

DOCKET NO. C-2018-3006116, et al.

Hearing Date: October 5, 2020

EXHIBITS

Thornbury

St. No. 1 –

(Direct testimony of
Jeffery Seagraves)

Thornbury

Ex. No. 1

(Attachment to
J. Seagraves testimony)

Range Resources

St. 1-R (Testimony

of Alan Engberg)
(Public and
Highly Confidential
version)

SPLP–N13

SPLP–N13C

(M. Gordon
rebuttal testimony)
(Public and Highly
Confidential version)

SPLP MG-1

(M. Gordon CV)

SPLP–N13–RJ

(M. Gordon rejoinder
outline)

SPLP MG 2–12

(M. Gordon exhibits)

SPLP–N12

(P. Angelides Rebuttal
testimony)

SPLP PA–1

(P. Angelides CV)

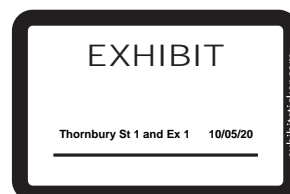
**BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION**

Megan Flynn, Rosemary Fuller,	:	Docket No. C-2018-3006116
Michael Walsh, Nancy Harkins,	:	Docket No. P-2018-3006117
Gerald McMullen, Caroline Hughes	:	
and Melissa Haines	:	
	:	
	:	
v.	:	
	:	
Sunoco Pipeline, L.P.	:	
a/k/a Energy Transfer Partners	:	
	:	

**DIRECT WRITTEN TESTIMONY OF
JEFF SEAGRAVES, TOWNSHIP MANAGER
THORNBURY TOWNSHIP, DELAWARE COUNTY**

Pursuant to 52 Pa. Code § 5.412, et seq. and the Commission's June 6, 2019 Procedural Order, Intervenor Thornbury Township, Delaware County, hereby submits the following written testimony of Township Manager, Jeff Seagraves in the above captioned consolidated proceedings.

SUBMITTED BY:
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James J. Byrne, Jr., Esquire
1223 N. Providence Road
Media, PA 19063
Ph. 610-565-4322
Counsel for Intervenor, Thornbury Township



Q: Please state your full name and business address.

A: Jeff Seagraves, Thornbury Township, Delaware County with a business address of 6 Township Drive, Cheyney, Pennsylvania 19319.

Q: What is your current position with Thornbury Township and how long have you been in your current position?

A: I serve as the Township Manager and Zoning Officer and have held those positions since January 2005.

Q: Can you describe Thornbury Township, Delaware County to the Commission?

A: Thornbury Township is a Second Class Pennsylvania Township of approximately 9 square miles in western Delaware County. The Township borders Westtown Township, Chester County, Edgmont Township, Delaware County, Middletown Township, Delaware.

Q: Are portions of Energy Transfer Partners' Mariner East pipelines located in Thornbury Township?

A: Yes.

Q: Can you please describe for the Commission the locations of the Mariner East pipelines in Thornbury Township?

A: The pipelines enter Thornbury Township at the intersection of State Routes 926 and 352, travel along Route 352 before turning easterly onto Slitting Mill Road.

Q: What is the length of the Mariner East pipelines located in the Township and can you please describe the uses on the properties which abut the Mariner East pipelines in the Township?

A: The existing pipeline and proposed pipelines run along State Route 352 in the Township and directly abut densely populated residential communities and commercial establishments.

1 Sunoco Overview Pipeline Plans are attached as Thornbury 1 to depict an overview of the ME1
2 & ME2 pipeline in Delaware County and then specifically within Thornbury Township.

3 **Q: Are you familiar with and have you reviewed the Township's Intervention Petition**
4 **in this matter?**

5 A: Yes.

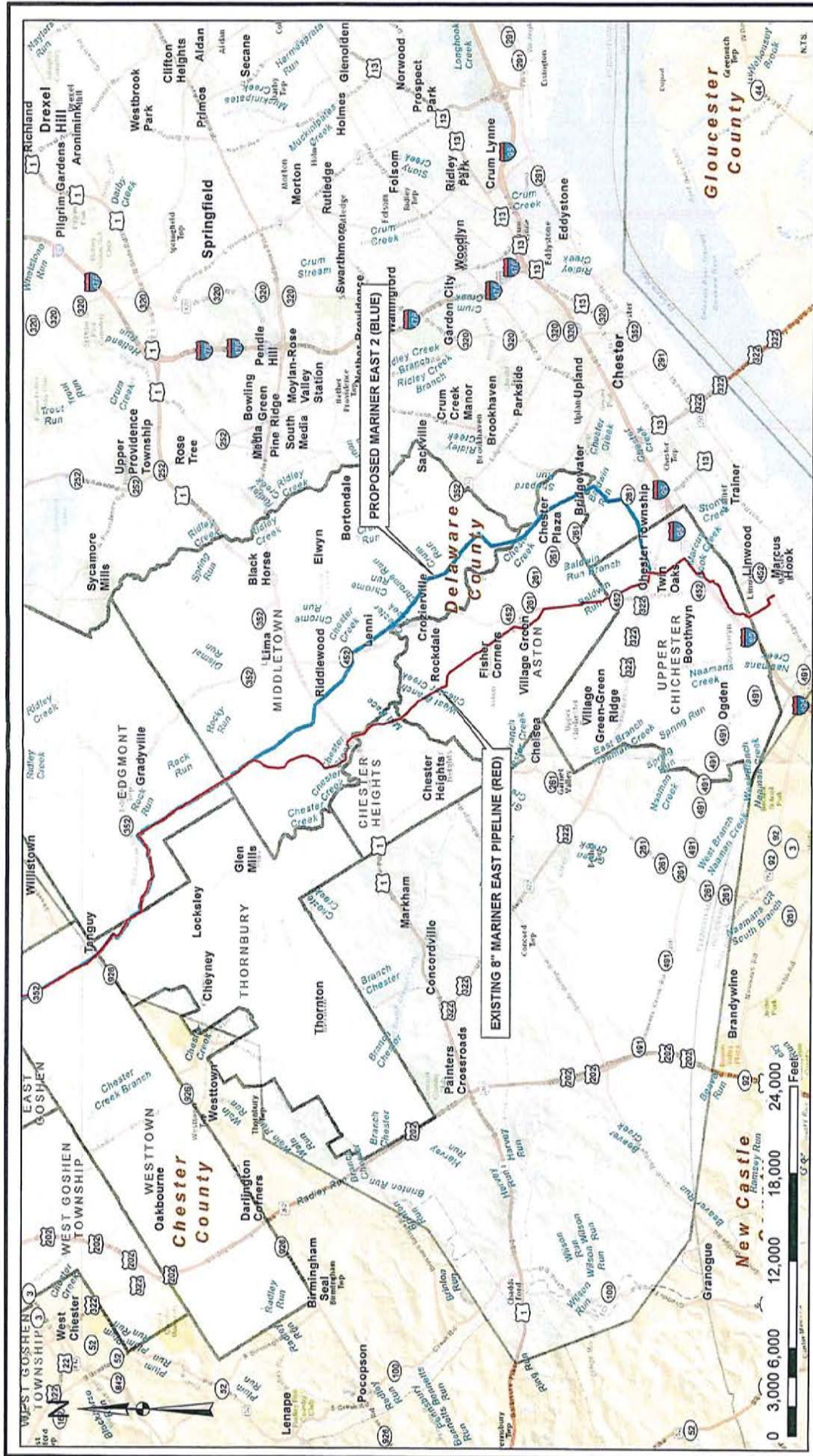
6 **Q: Can you please articulate for the Commission the relief Thornbury Township is**
7 **seeking in this matter as an Intervenor?**

8 A: The Township Administration and Supervisors are requesting the Commission (i) Order
9 Energy Transfer Partners to work with the appropriate emergency responders to develop an
10 appropriate and comprehensive pipeline-specific emergency response plan; (ii) Order Energy
11 Transfer Partners establish and submit testing and inspection protocols appropriate to ensure safe
12 operation and maintenance of all Energy Transfer pipelines throughout Thornbury Township;
13 (iii) Order Energy Transfer Partners to provide twenty-four (24) hours advanced notice of any
14 proposed pipeline work in Thornbury Township to the Township Administration and any
15 Township residents immediately adjacent to the pipelines; (iv) Order the Energy Transfer to
16 develop and install a mass early warning notification system for all potentially affected
17 properties located within Thornbury Township that would provide immediate notice of a leak,
18 release, potential explosion or other failure of the Energy Transfer pipeline system to the public;
19 (v) Order Energy Transfer to assist the Township officials in developing a specific
20 comprehensive public education and awareness plan designed to inform and educate the public
21 and Township officials and staff on proper and effective disaster prevention and response.

22 **Q: Does this conclude your direct written testimony on behalf of Intervenor Thornbury**
23 **Township, Delaware County?**

1 A: Yes, it does.

THORNBURY 1



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REVISIONS

REV	DATE	DESCRIPTION

ISSUED FOR REVIEW

DATE: 04/11/11

BY: [Signature]

FOR: [Signature]

LEGEND

PROPOSED MARINER EAST 2 (BLUE)

EXISTING 8" MARINER EAST PIPELINE (RED)

PROJECT INFORMATION

PENNSYLVANIA PIPELINE PROJECT

STATE: PENNSYLVANIA

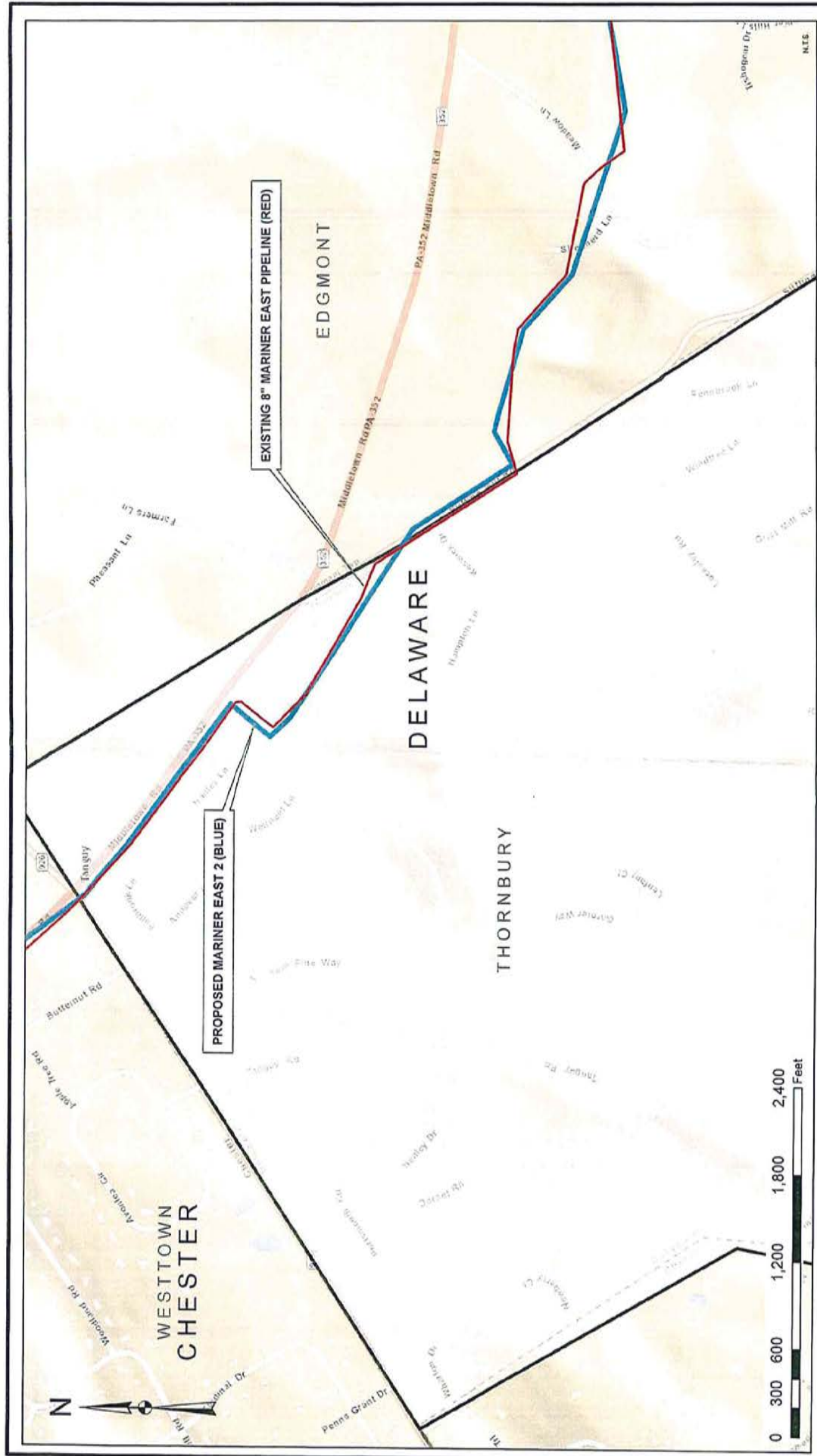
COUNTY: DELAWARE

CLIENT

AMERICAN PIPELINE

DATE

04/11/11



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REVISIONS

REV	DATE	DESCRIPTION

1. USED FOR REVIEW

2. USED FOR REVIEW

3. USED FOR REVIEW

4. USED FOR REVIEW

5. USED FOR REVIEW

6. USED FOR REVIEW

7. USED FOR REVIEW

8. USED FOR REVIEW

9. USED FOR REVIEW

10. USED FOR REVIEW

LEGEND

PROPOSED MARINER EAST 2 (BLUE)

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STATE: PENNSYLVANIA

COUNTY: DELAWARE

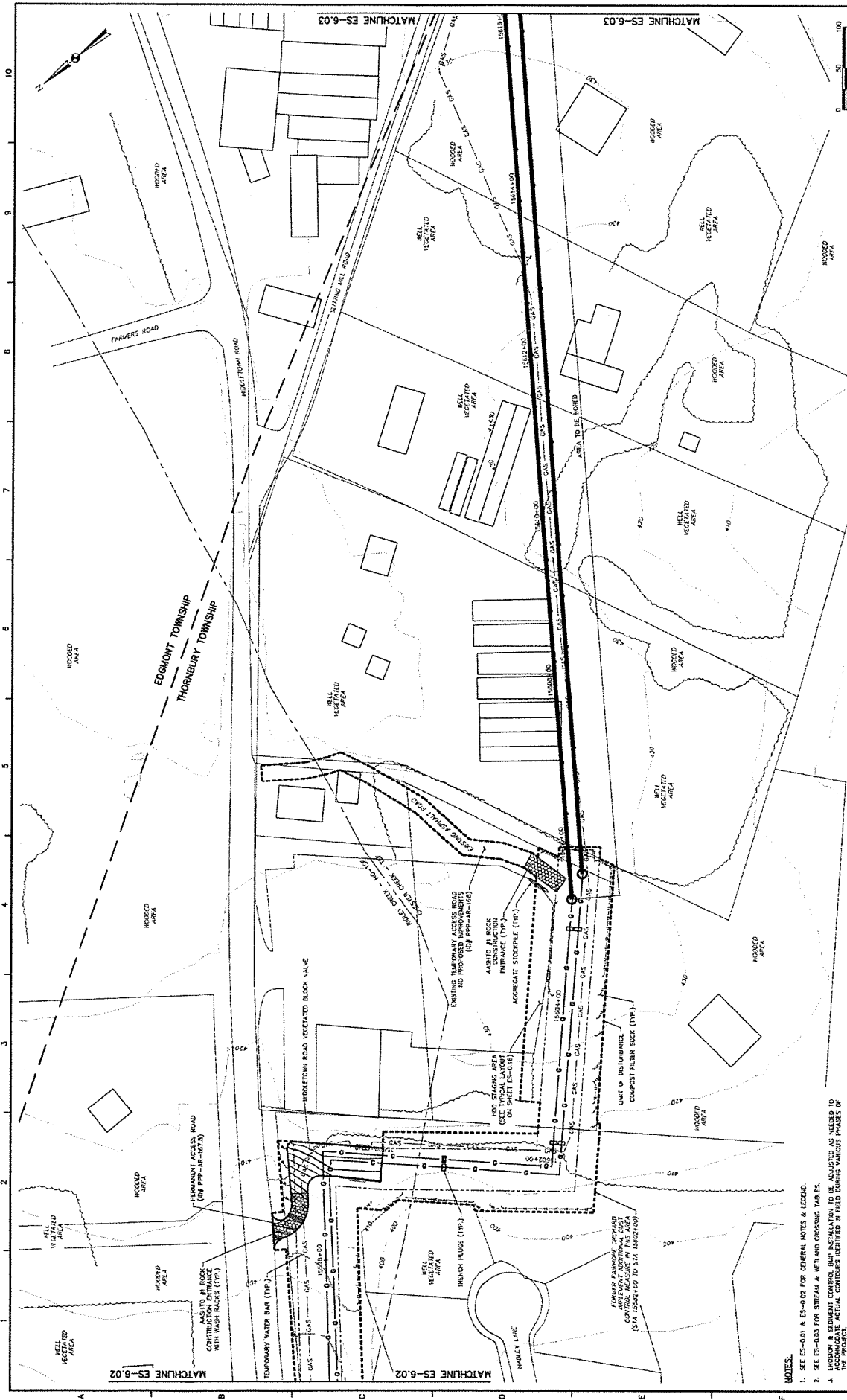
TOWNSHIP: THORNBURY

CLIENT

Sanco Pipeline L.P.

DATE

01/15/2020



- NOTES:
1. SEE ES-6.01 & ES-6.02 FOR GENERAL NOTES & LEGEND.
 2. SEE ES-6.03 FOR STREAM & WETLAND CROSSING TABLES.
 3. CONSTRUCTION SHALL BE ADJUSTED AS NEEDED TO ACCOMMODATE ACTUAL CONDITIONS IN FIELD DURING CONSTRUCTION OF THE PROJECT.

TETRA TECH

680 ANDERSON ROAD
PITTSBURGH, PA 15220
P: (412) 921-7000 | F: (412) 921-4040

SUNOCO PIPELINE L.P.
SINKING SPRING, PENNSYLVANIA
PENNSYLVANIA PIPELINE PROJECT
CONSTRUCTION SPREAD 6

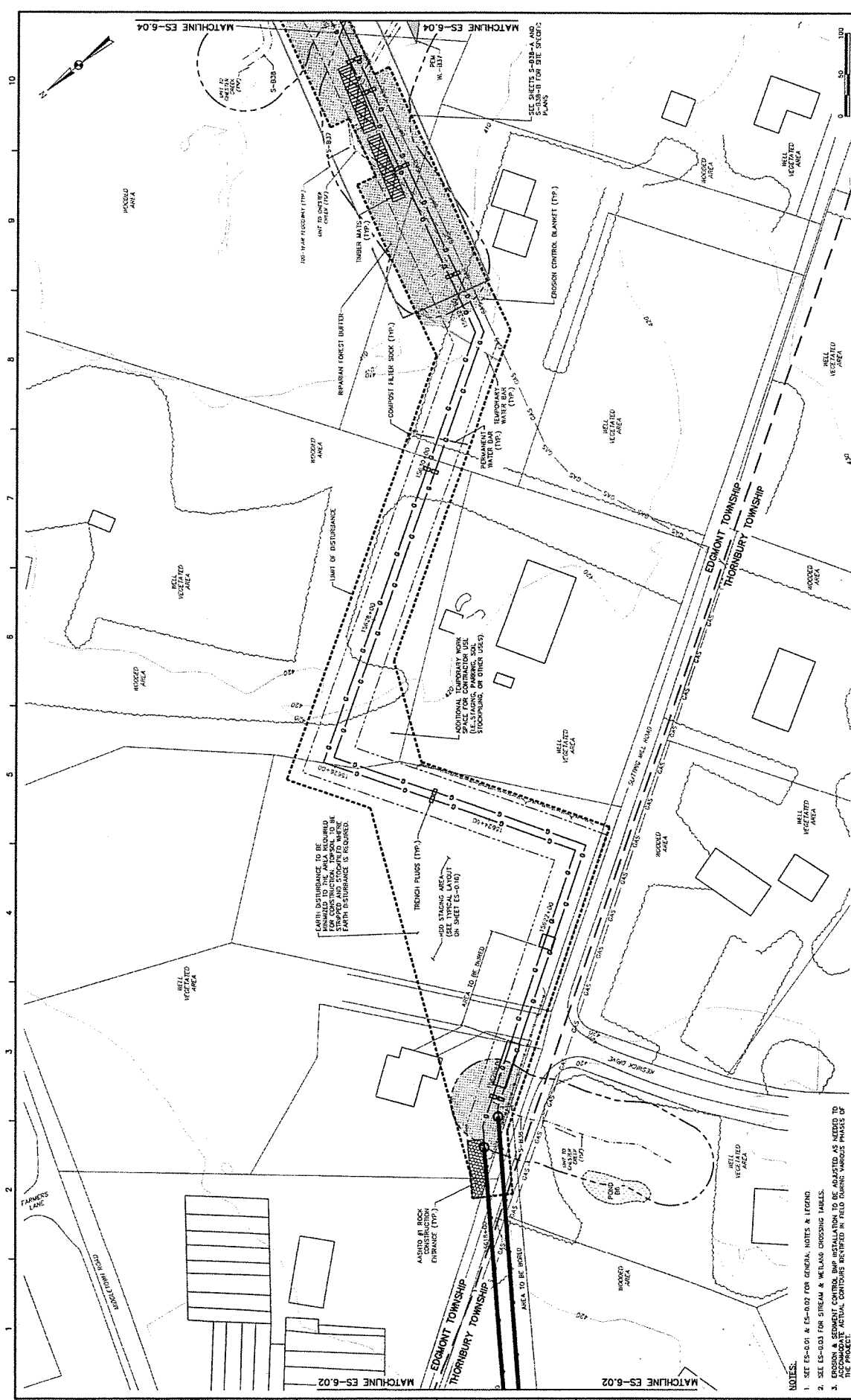
REVISIONS

NO.	BY	DATE	REMARKS


1-20" & 1-16" WELDED STEEL NATURAL GAS PIPELINES
DELAWARE COUNTY CONSERVATION DISTRICT
EROSION & SEDIMENT CONTROL &
SITE RESTORATION PLAN
ES-6.02
SHEET 2 OF 35

DATE: 12/07/20
PROJECT NO.: 17200000
DESIGNED BY: JH
DRAWN BY: JH
CHECKED BY: JH
EXPIRATION DATE: 12/31/2020
SHEET 6.02 OF 60

SCALE: 1" = 100'



- NOTES:
1. SEE ES-0.01 & ES-0.02 FOR GENERAL NOTES & LEGEND.
 2. SEE ES-0.03 FOR STREAM & WETLAND CROSSING TABLES.
 3. EROSION CONTROL BMP INSTALLATION TO BE ADJUSTED AS NEEDED TO ACCOMMODATE ACTUAL CONDITIONS ENCOUNTERED IN FIELD DURING CONSTRUCTION OF THE PROJECT.

		TETRA TECH	
6810 WILSON ROAD, SUITE 200, PLAZA 7 NITTSBURGH, PA 15208-1007 T: (412) 821-7990 F: (412) 921-4040		www.tetratech.com	
REVISIONS		REMARKS	
NO.	BY	DATE	
SUNOCO PIPELINE L.P. SINKING SPRING, PENNSYLVANIA PENNSYLVANIA PIPELINE PROJECT CONSTRUCTION SPREAD 6			
1-20" & 1-16" WELDED STEEL NATURAL GAS PIPELINES DELAWARE COUNTY CONSERVATION DISTRICT EROSION & SEDIMENT CONTROL & SITE RESTORATION PLAN ES-6.03 SHEET 3 OF 35			
DATE: 3/6/17 PROJECT NO.: 112020224 DESIGNED BY: BH DRAWN BY: BH CHECKED BY: BH CONSTRUCTION NO.: 112020224 SHEET NO.: 35		DATE: 3/6/17 PROJECT NO.: 112020224 DESIGNED BY: BH DRAWN BY: BH CHECKED BY: BH CONSTRUCTION NO.: 112020224 SHEET NO.: 35	



NOTE: SHOULD ANY STORMWATER ISSUES ARISE FROM THE NEWLY
 CONSTRUCTED STORMWATER MANAGEMENT PLAN, THE TOWNSHIP, TOWN OF
 THORNBURY, PENNSYLVANIA, WILL BE RESPONSIBLE FOR TENDING THE
 OUTFALL PIPES INTO THE NEARBY INLETS

TETRA TECH

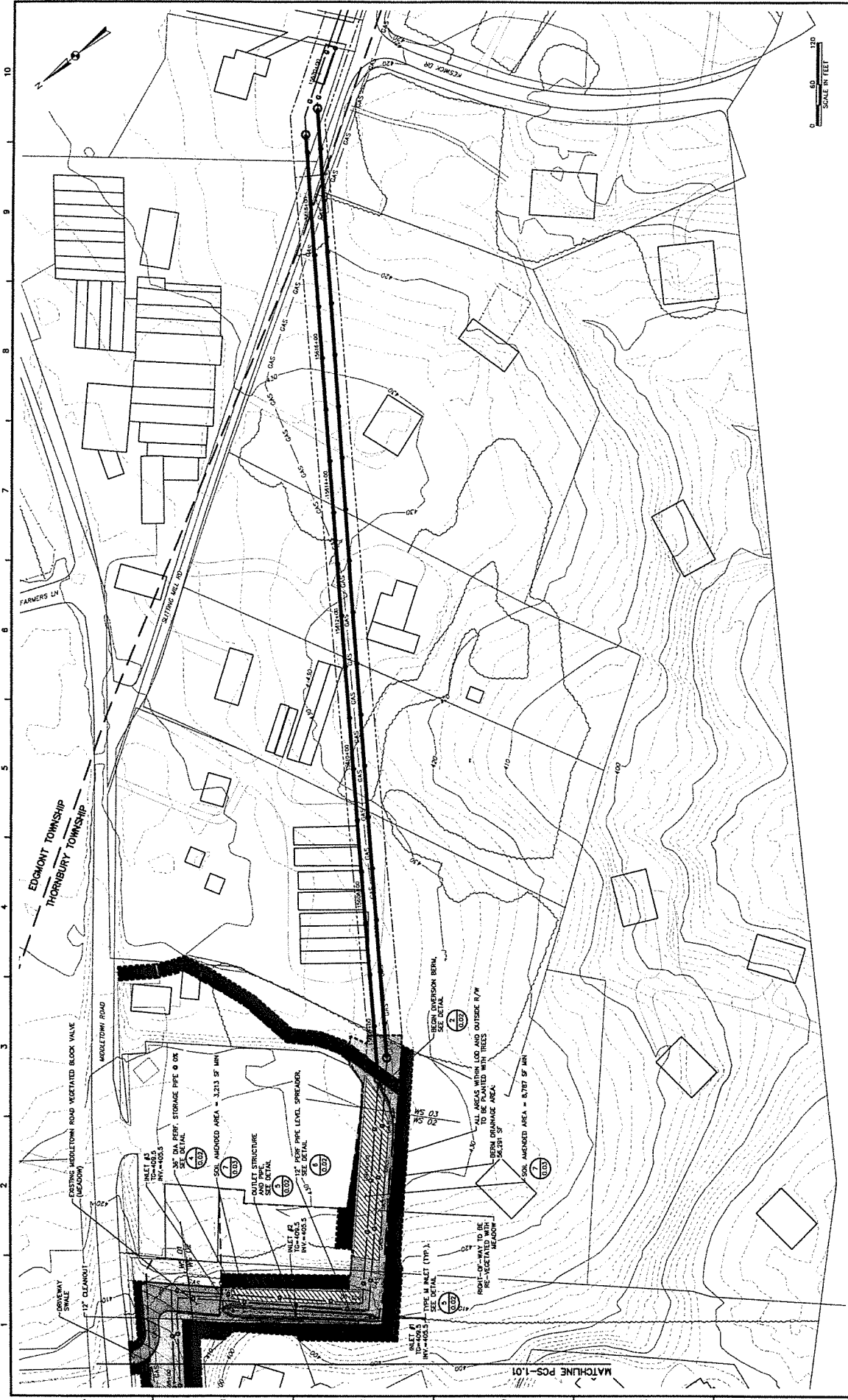
601 ANDERSON BLVD. SUITE 100
 PITTSBURGH, PA 15206
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SUNOCO PIPELINE L.P.
 SINKING SPRING, PENNSYLVANIA
 PENNSYLVANIA PIPELINE PROJECT
 THORNBURY TOWNSHIP

REVISIONS		REMARKS
NO.	DATE	
1	05/17/17	REVISIONS TO ADDRESS TOWNSHIP COMMENTS
2	06/07/17	REVISIONS TO ADDRESS TOWNSHIP COMMENTS

DATE: 5/27/17
 PROJECT NO.: 11202022
 DESIGNED BY: JH
 DRAWN BY: JH
 CHECKED BY: JH
 COPYRIGHT TETRA TECH, INC.
PCS-1.01
 SHEET 1.01 OF 3

1-20" & 1-16" PROPOSED WELDED STEEL NATURAL GAS PIPELINES
 WATERSHEDS WS01
 POST CONSTRUCTION STORMWATER MANAGEMENT PLAN



<div>TETRA TECH</div> <div>681 ANDERSON DRIVE • FORTIX PLAZA 7 PITTSBURGH, PA 15220 T: (412) 281-7900 F: (412) 281-4040 www.tetratech.com</div>				<table><tr><th>NO.</th><th>BY</th><th>DATE</th><th>REMARKS</th></tr><tr><td>1</td><td>BS</td><td>6/15/17</td><td>REVISIONS TO ADDRESS TOWNSHIP COMMENTS</td></tr><tr><td>2</td><td>BS</td><td>6/19/17</td><td>REVISIONS TO ADDRESS TOWNSHIP COMMENTS</td></tr><tr><td> </td><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td><td> </td></tr></table>				NO.	BY	DATE	REMARKS	1	BS	6/15/17	REVISIONS TO ADDRESS TOWNSHIP COMMENTS	2	BS	6/19/17	REVISIONS TO ADDRESS TOWNSHIP COMMENTS																									<div>SUNOCO PIPELINE L.P. SINKING SPRING, PENNSYLVANIA PENNSYLVANIA PIPELINE PROJECT THORNBURY TOWNSHIP</div>				<div>1-20" & 1-16" PROPOSED WELDED STEEL NATURAL GAS PIPELINES WATERSHEDS WS02 & WS03 POST CONSTRUCTION STORMWATER MANAGEMENT PLAN PCS-1.02</div> <div>DATE: 5/17/17 PROJECT NO.: 11702066A DESIGNED BY: BS DRAWN BY: BS CHECKED BY: BS COMPUTER FILE: 1071702066A SCALE: AS SHOWN</div>				<div>PCS-1.02 SHEET 1.02 OF 1</div>			
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CERTIFICATE OF SERVICE

I hereby certify that I have this day served a true copy of the foregoing document upon the persons listed below in accordance with the requirements of § 1.54 (relating to service by a party).

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/s/ James J. Byrne, Jr.

Dated: January 15, 2020

**BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION**

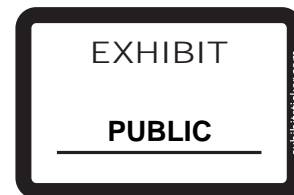
**Flynn, et al. v. Sunoco Pipeline, LP, Docket Nos. C-2018-3006116, P-2018-3006117
Andover Homeowners Association v. Sunoco, LP, Docket No. C-2018-3003605
DiBernardino v. Sunoco, LP, Docket No. C-2018-3005025
Britton v. Sunoco, LP, Docket No. C-2019-3006898
Obenski v. Sunoco, LP, Docket No. C-2019-3006905**

**Range Resources – Appalachia, LLC
Statement No. 1-R**

**Rebuttal Testimony of
Alan Engberg**

Topics Addressed: Economic Impacts of Mariner East Shutdown

Dated: June 15, 2020



I. INTRODUCTION AND QUALIFICATIONS

Q. Please state your full name, employer and business address.

A. My name is Alan Engberg. I am employed by Range Resources Corporation (“Range”) as Vice President of Liquids Marketing and have been with Range since 2016. Range Resources Corporation’s headquarters are located in Fort Worth, Texas. In addition, Range’s wholly-owned subsidiary, Range Resources – Appalachia, LLC, (“Range-Appalachia”) has a business address of 3000 Town Center Blvd. Canonsburg, PA 15317. I work out of both locations.

Q. What are your principal duties and responsibilities as Vice President of Liquids Marketing?

A. As Vice President of Liquids Marketing, I am responsible for the marketing of Range’s natural gas liquids and condensate. In this role, I ensure Range’s liquids production is effectively moved to markets that provide reliable long-term offtake, and optimal prices.

Q. Please describe your educational background and professional experience.

A. I have obtained a Chemical Engineering degree from McGill University and an MBA from the University of Texas. In addition, I have over 30 years of experience working in the Energy and Chemical industries, having worked primarily at Shell Chemical Co. and BP Energy Company before joining Range.

Q. Please describe the purpose of your testimony.

A. I am providing testimony on behalf of Range-Appalachia in response to the testimony of the complainants that argue that the Mariner Pipelines, specifically the Mariner East 1

1 Pipeline (“ME1”) and the Mariner East 2 Pipeline (“ME2”) owned and operated by Sunoco
2 Pipeline, L.P. (“SPLP”), should be shutdown. In my testimony, I will detail the economic
3 impacts of a shutdown of ME1 and ME2 on producers of natural gas liquids, such as Range-
4 Appalachia, who utilize the pipelines to transport this essential production. In particular, I
5 will explain the economic impacts of such a shutdown on Range-Appalachia.

6
7 **Q. When you refer to natural gas liquids or “NGLs” to what specific substances are you**
8 **referring?**

9 A. I am specifically referring to ethane, propane, normal butane, isobutane and pentanes.

10
11 **Q. Have you previously testified before the Pennsylvania Public Utility Commission**
12 **(“Commission”) regarding the economic impacts of a shutdown of ME1 on producers**
13 **of NGLs such as Range-Appalachia?**

14 A. Yes. I previously provided testimony on this topic at the November 30, 2018 hearing on
15 the Complainants’ Petition for Interim Emergency Relief in these proceedings. In addition,
16 I previously provided testimony at the hearings regarding the Petition for Interim
17 Emergency Relief that occurred on May 9-10, 2018, in *Pennsylvania State Senator Andrew*
18 *E. Dinniman v. Sunoco Pipeline, L.P.*, Docket No. P-2018-3001453.

19
20 **Q. Why was your testimony in each of these prior proceedings focused on the economic**
21 **impacts of a shutdown of ME1 and not ME2.**

1 A. At the time of each of these prior hearings, only ME1 was in operation. ME2 construction
2 had not yet been completed and, therefore, Range-Appalachia was not transporting NGLs
3 on this pipeline.

4
5 **Q. What are Range's primary business operations?**

6 A. Range is an independent natural gas exploration and production company that has been
7 operating in Pennsylvania for more than 25 years. The majority of our operations today
8 are located in Washington County, Pennsylvania where we focus on development of the
9 Marcellus Shale. A portion of the production produced in Washington County from the
10 Marcellus Shale is rich with NGLs. Once produced, these NGLs are separated from the
11 natural gas and are used and sold as separate products. Range relies upon ME1 and ME2
12 to transport these products to various markets for distribution and consumption. For
13 context, in 2019 Range's NGL sales represented 30% of the company's net revenues while
14 condensate was 8% and natural gas made up the remaining 62% of Range's revenues.

15
16 **Q. Please describe Range-Appalachia's presence in Pennsylvania.**

17 A. Range-Appalachia pioneered the Marcellus Shale in 2004 when it drilled the Renz #1 well
18 in Mount Pleasant Township, Washington County, Pennsylvania. Range-Appalachia has
19 acquired approximately 833,000 net acres across Pennsylvania. The majority of Range-
20 Appalachia's leasehold is in Washington County where the Company's core acreage is rich
21 NGLs. Range is a top 10 natural gas producer and a top 5 NGL producer in the country.
22 Since 2004, Range has invested well over \$7 billion of capital in the Commonwealth. Since
23 2015, Range-Appalachia has paid Pennsylvania royalty owners over \$1.115 billion. The

1 Mariner Pipelines provided the effective transport of these NGLs and outlets for
2 distribution, sale and consumption which benefited Range and its Pennsylvania royalty
3 owners. Range has also contributed to the economic vitality of the Commonwealth through
4 paying a variety of taxes, such as the drilling tax/impact fee. All in all, Range has paid
5 \$216 million for this tax alone.

6
7 **Q. Have the Complainants in this proceeding argued that ME1 and ME2 should be shut**
8 **down and that construction of ME2 should be stopped?**

9 A. Yes. In the initial Complaint and Petition for Interim Emergency Relief filed in this
10 proceeding, the Complainants requested that the Commission enjoin the operation of ME1
11 and further argued that construction of ME2 and the Mariner East 2X Pipeline (“ME2X”)
12 should be halted. Since the initial Complaint was filed, ME2 went into partial service and
13 specifically provides service to Range-Appalachia as discussed in more detail below.
14 However, ME2X construction is not yet operational.

15 On December 11, 2018, the Administrative Law Judge Elizabeth H. Barnes (the
16 “ALJ”) issued an Order denying the Complainants’ request for interim emergency relief,
17 including the request to shutdown ME1. In addition, it is my understanding that, although
18 the Commission imposed conditions upon the additional construction activities associated
19 with ME2, SPLP satisfied those conditions and ME2 was placed into partial service.

20 On December 27, 2018, the Complainants repeated their request for relief in the
21 form of an injunction of both ME1 and ME2 operations in their Amended Complaint (*see*,
22 *e.g.*, Amended Compl., pp. 24, 26, 28). The Commission affirmed the ALJ’s Order
23 denying the Complainants’ request for interim emergency relief by Order entered February

1 1, 2019. The Complainants have repeated this request for relief in their direct testimony in
2 this proceeding (*see, e.g.*, Direct Testimony of Dr. Mehrooz Zamanzadeh, pp. 41-42).

3
4 **Q. Do Range-Appalachia products flow on any SPLP owned pipelines other than ME1**
5 **and ME2?**

6 A. Yes. In addition to ME1 and ME2, certain of Range-Appalachia's customers utilize the
7 Mariner West Pipeline to transport ethane.

8
9 **Q. What is the volume of NGLs that Range-Appalachia transports on ME1 and ME2?**

10 A. Range-Appalachia currently transports 20,000 BPD of ethane on ME1. Range-Appalachia
11 also transports 30,000 BPD of propane and 10,000 BPD of normal butane on the ME2
12 pipeline. Additionally, Range-Appalachia sells 10,000 BPD of a combination of propane
13 and normal butane to a third party that transports this product on ME2. In total, Range-
14 Appalachia directly and indirectly transports 70,000 BPD of natural gas liquids on ME1
15 and ME2. This represents approximately 32% of our typical ethane and 100% of our
16 current propane and normal butane production.

17
18 **Q. Are natural gas extraction and pipeline transportation deemed to be "life-sustaining"**
19 **businesses?**

20 A. Yes. In response to the emergence of the COVID-19 pandemic, Pennsylvania Governor
21 Tom Wolf issued a 90-Day Declaration of Disaster Emergency on March 4, 2020.
22 Thereafter, he ordered the closure of all non-life-sustaining businesses on March 21, 2020.
23 Natural gas extraction and pipeline transportation companies, which provide critical

1 supplies of energy to Pennsylvania residents and businesses, were deemed life-sustaining
2 businesses.

3
4 **Q. Are Range-Appalachia products necessary for fighting the COVID-19 pandemic?**

5 A. Yes. Chemicals and polymers made from ethane, propane and butane feedstocks are
6 critical, for example, for the manufacturing of detergents, hygiene products, face masks,
7 medical gowns and medical devices.

8
9 **Q. Why is it important to recognize that Range is considered a life sustaining business?**

10 A. On June 4, 2020, Governor Wolf extended his original Declaration of Disaster Emergency
11 for another ninety days. While the duration of the COVID-19 pandemic and its effects
12 upon Pennsylvania businesses remain unclear, it is essential that Pennsylvania-based
13 energy producers continue to have access to safe and reliable means of transporting
14 essential, locally produced products to end users across the state. The Complainants
15 request would eliminate the primary means by which NGL producers such as Range-
16 Appalachia transport these products in and across Pennsylvania. This would result in the
17 substantial economic harms I detail below and could exacerbate the economic impacts of
18 COVID-19 on the Commonwealth at a time when access to less-expensive, locally
19 produced energy products is critical.

20
21 **Q. How necessary are the Mariner East Pipelines to Range-Appalachia's business?**

1 A. Both of these pipelines are essential to Range-Appalachia's business and, as mentioned
2 here, the Commonwealth. Pipeline transportation provides the safest and most reliable
3 means of transportation of natural gas and natural gas liquids.
4

5 **Q. Why are the Mariner East pipelines essential to Range-Appalachia's business?**

6 A. In Washington County, Pennsylvania, where the majority of Range-Appalachia's
7 operations take place, the natural gas produced is rich with NGLs. In order for wells with
8 NGL-rich production to be safely used by downstream consumers, the NGLs must first be
9 removed from the gas stream and then transported to distributors, manufacturers and other
10 downstream users. In addition to the COVID 19 related products described above, ethane,
11 propane, butanes and pentane, are used in a wide variety of day-to-day products that run
12 your grill, heat your home, fuel your cars and serve as the building blocks for many
13 products across a wide-range of industries, including the healthcare industry. Pipelines are
14 essential for the transportation and distribution of these NGLs.

15 The Mariner East Pipelines provide Range-Appalachia with a safe and reliable
16 source of takeaway capacity for its NGLs and alleviates congestion and over-supply in the
17 local Appalachian market.
18

19 **Q. Please further explain why it is essential to transport NGLs by pipeline as opposed to**
20 **other forms of transportation.**

21 A. Ethane, like all of Range-Appalachia's NGLs, is a valuable product derived from its natural
22 gas production. Ethane, however, is similar to natural gas in that large volumes can only
23 be effectively transported by pipeline. Its boiling point is -127 degrees Fahrenheit and the

1 cost to chill and/or compress it to a liquid makes large scale bulk truck or rail uneconomic.
2 In the absence of ethane pipeline transport, ethane can be “rejected” or blended back into
3 the natural gas stream. However, ethane rejection is limited to relatively small volumes
4 (14% on a gas volume basis) due to gas quality heat content specifications. In the absence
5 of pipeline capacity, the natural gas producer is forced to limit, or possibly shut-in, its
6 production after it reaches the maximum level of ethane in the gas stream.

7 Pipelines are also critical for transporting propane and butane. However, since
8 these are heavier molecules—*i.e.*, in the case of propane 3 carbon molecules instead of 2
9 carbons in ethane or just 1 carbon in natural gas—its boiling point is much higher (at a
10 balmy -44 degrees Fahrenheit) they can more easily be chilled and/or compressed for
11 transport on railcars and trucks.

12 While railcars and trucks are an alternative to pipeline transportation, pipeline
13 transportation is superior in safety and efficiency. Indeed, one month’s worth of Range-
14 Appalachia’s propane and butane shipments on the Mariner East Pipelines equates to 2,130
15 railcars or 7,600 trucks. This is a significant quantity to be moving on local rails and roads.
16 It should also be noted the total volumes of Appalachian-produced propane and normal
17 butane flowing on the Mariner East Pipelines today (estimated at a maximum of 200,000
18 barrels/day) exceed the available railcar and truck loading capacity in Appalachia.
19 Consequently, Appalachian well shut-ins would be required in the event of a shutdown of
20 the Mariner East Pipelines.

21
22 **Q. How are you aware of the limitation on trucks and railcars?**

PUBLIC VERSION - HIGHLY CONFIDENTIAL MATERIALS REDACTED

1 A. In addition to its shipments on ME1, Range-Appalachia was moving approximately 30 to
2 40 railcars per day of propane and butane in 2019. This production volume now flows on
3 ME2.

4 Regarding the limitations associated with this method of transportation, at times of
5 peak seasonal demand for propane and butane there is often severe congestion on the
6 railroads. Furthermore, the rail loading facilities operated by our midstream service
7 provider do not have the capacity to accommodate today's NGL flows on the Mariner East
8 Pipelines (226,000 barrels/day of NGLs in 1Q20) if they were diverted away from these
9 pipelines. As such, a diversion away from the Mariner East Pipelines would likely result
10 in well shut-ins in the Appalachian Basin and would certainly impact Range-Appalachia's
11 production volumes.

12 With regards to trucks, similar to rail, there is not enough truck loading capacity
13 available to replace the Mariner East Pipeline at today's flow rates.

14
15 **Q. If ME1 and ME2 were shut down, what would happen to Range-Appalachia's NGLs**
16 **and natural gas production?**

17 A. Range-Appalachia, along with other operators, would likely be forced to shut-in
18 production, resulting in significant losses to natural gas, NGL and condensate production,
19 and losses to capital investment, jobs, and revenue for the entire supply chain. There would
20 also be losses to landowners in the form of reduced or non-existent royalty payments.
21 Significantly, as discussed above, with ME2 now being in partial service (as of December
22 2018), Range-Appalachia, and other producers in the Appalachian Basin, rely more heavily
23 on the Mariner East Pipelines to transport these critical and life-sustaining products. At

1 this time, the Mariner East Pipelines are one of only two pipeline systems transporting
2 propane from production in western Pennsylvania, Ohio and West Virginia. The other
3 pipeline is Enterprise's TEPPCO pipeline which has approximately 12.5% of ME2's
4 capacity for reaching the Marcus Hook storage, distribution and export terminal. Also at
5 this time, there is no other pipeline alternative for transporting normal butane out of western
6 Pennsylvania. Therefore, if western Pennsylvania production is prohibited from flowing
7 on the Mariner East Pipelines, and the TEPPCO pipeline is already subscribed, the
8 remainder of this Pennsylvania-based production would be forced to flow on available rail
9 and truck loading capacity which would be quickly overwhelmed resulting in well-pad
10 shut-ins followed by the attendant consequences described above.

11
12 **Q. You are aware that the ME1 pipeline was enjoined for approximately 8 weeks starting**
13 **back on March 7, 2018, through May 3, 2018, and then shutdown again for another**
14 **approximate 3 weeks beginning on May 24, 2018 through June 15, 2018, correct?**

15 A. Yes. I will refer to the period between March 7, 2018, through May 3, 2018, as the "First
16 Shutdown" and the period between May 24, 2018 through June 15, 2018, as the "Second
17 Shutdown."

18
19 **Q. Did Range-Appalachia suffer any harm from the injunction that led to the First**
20 **Shutdown and the Second Shutdown?**

21 A. Yes.

22
23 **Q. What types of harm?**

1 A. While Range-Appalachia made every effort to identify and secure alternate markets and
2 means of transport for its products, a significant portion of Range-Appalachia's ethane that
3 normally flows on ME1 was rejected to the gas stream resulting in significant financial
4 losses to Range-Appalachia, its royalty owners, and the Commonwealth as mentioned
5 earlier.

6 In the case of propane, the vast majority of our ME1 pipeline flows were shifted to
7 railcars, where and when available.
8

9 **Q. Could you please quantify that harm?**

10 A. Yes. [BEGIN HIGHLY CONFIDENTIAL] [REDACTED]
11 [REDACTED]

12 [END HIGHLY CONFIDENTIAL] This consisted of increased transportation costs
13 (truck and rail) and sales losses due to ethane rejection to natural gas and due to the need
14 to move propane railcars to less desirable markets.
15

16 **Q. Are you aware of the shutdown of ME1 that occurred between January 21, 2019 and**
17 **April 22, 2019?**

18 A. Yes. I will refer to the period between January 21, 2019 and April 22, 2019, as the "Third
19 Shutdown."
20

21 **Q. Did Range-Appalachia suffer any harm from the Third Shutdown?**

22 A. Yes.
23

1 **Q. What types of harm?**

2 A. The majority of Range-Appalachia's ethane that normally flows on ME1 was sold into an
3 alternative, less desirable market, resulting in financial loss to Range-Appalachia, its
4 royalty owners, and the Commonwealth. Fortunately, because ME2 was in service, Range-
5 Appalachia was able to shift propane to the ME2 pipeline in order to access the same
6 market as ME1, so no loss resulted with respect to propane.

7
8 **Q. Could you please quantify that harm?**

9 A. [BEGIN HIGHLY CONFIDENTIAL] [REDACTED]
10 [REDACTED] [END HIGHLY
11 CONFIDENTIAL] This consisted of increased transportation costs in order to gain entry
12 to an alternative market plus lower ethane pricing in that market relative to the market
13 Range-Appalachia would have accessed via ME1.

14
15 **Q. If ME1 and ME2 were enjoined from operating, what harms would Range-**
16 **Appalachia and the public experience?**

17 A. With respect to the direct harms to Range-Appalachia, Range-Appalachia's ethane that
18 normally flows on ME1 would either be sold into an alternate market or be rejected into
19 the gas stream resulting in significant financial losses to Range-Appalachia, its royalty
20 owners, and the Commonwealth. Should Range-Appalachia be able to identify an
21 alternative market, along with a number of other producers also trying to do the same,
22 estimated annual costs incurred as a result of another shutdown of ME1 would be
23 approximately [BEGIN HIGHLY CONFIDENTIAL] [REDACTED] [END HIGHLY

1 **CONFIDENTIAL]** per year. This consists of increased transportation costs, plus an
2 alternative market that is priced below the market Range-Appalachia would have accessed
3 via ME1. Moreover, **[BEGIN HIGHLY CONFIDENTIAL]** [REDACTED]

4 [REDACTED]

5 [REDACTED]

6 [REDACTED]

7 [REDACTED]

8 [REDACTED] **[END HIGHLY**
9 **CONFIDENTIAL]**

10 If the ME2 system were shut-down, Range-Appalachia would need to find alternate
11 markets and modes of transport for 50,000 barrels per day of propane and normal butane.
12 In a scenario where both railcars and railcar loading facilities were available in adequate
13 quantities for moving 50,000 barrels per day of Range-Appalachia's production and
14 alternate rail markets were available to Range-Appalachia, it is estimated that Range-
15 Appalachia's costs (increased logistics fees and lower priced markets) would amount to
16 approximately **[BEGIN HIGHLY CONFIDENTIAL]** [REDACTED] **[END HIGHLY**
17 **CONFIDENTIAL]** per year. A more likely measure, however, has Range-Appalachia
18 being able to access rail cars and railcar loading capacity for the equivalent of 19,000
19 barrels/day of propane and butane (note that truck loading is not available for Range's NGL
20 production). This would leave 31,000 barrels per day of Range-Appalachia propane and
21 butane without access to rail or pipe loading **[BEGIN HIGHLY CONFIDENTIAL]**

22 [REDACTED]

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[REDACTED]

[REDACTED] [END HIGHLY CONFIDENTIAL]

Q. What harms to Range-Appalachia’s royalty owners would you expect to result from another shutdown of ME1 and ME2?

A. In the case where only ME1 ethane is affected and Range-Appalachia’s ethane production was not able to access alternate ethane markets and ethane rejection was not available,

[BEGIN HIGHLY CONFIDENTIAL] [REDACTED]

[REDACTED]

[REDACTED] [END HIGHLY CONFIDENTIAL]

Furthermore, if ME2 was shut-down and Range-Appalachia could only access railcars and railcar loading capacity for 38% of its 50,000 barrel/day of ME2 flows,

[BEGIN HIGHLY CONFIDENTIAL] [REDACTED]

[REDACTED]

[REDACTED] [END HIGHLY CONFIDENTIAL]

Q. What harms to natural gas and propane consumers in the Northeastern United States would you expect to result from another shutdown of ME1 and/or a shutdown of ME2?

A. A decrease in ethane, propane, butane and natural gas supply resulting from a shut-in of ME1 and ME2 would very likely increase the price of NGLs and natural gas to consumers in Pennsylvania. Demand for both propane and natural gas is highest during the winter when people use these key products to heat their homes in the region. It is estimated that

1 the shut-down of these pipelines would result in the shut-in of approximately one third of
2 Appalachian NGL production and 8% of Appalachian natural gas production. This would
3 likely leave the region short of supply to meet winter demand and require high cost imports
4 to the region by rail, pipeline and from overseas. Accordingly, decreasing supply could
5 result in severe price inflation for consumers during the critical winter months. If we
6 assumed a 10% increase in Northeastern winter propane and natural gas prices as a result
7 of this lost supply, the EIA's October 2019 Winter Fuels Outlook report suggests that
8 Northeastern natural gas consumers would pay an extra \$72/household during the winter
9 while Northeastern propane consumers would pay an extra \$189/household.

10
11 **Q. Please describe and quantify the harms Pennsylvania-based jobs associated with**
12 **natural gas and natural gas liquids production that you would expect to result from**
13 **another shutdown of ME1 and/or a shutdown of ME2.**

14 A. Range-Appalachia has 457 employees in Pennsylvania. In the event that Range were
15 forced to shut-in production due to a shutdown of ME1 and/or ME2, Range would also be
16 forced to lay off employees, contractors and subcontractors. These impacts would
17 reverberate down the supply chain that either directly or indirectly supports Range's
18 operations.

19
20 **Q. You mentioned earlier that Range-Appalachia pays drilling impact fees to the**
21 **Commonwealth. How much has the Commonwealth received in drilling impact fees?**

22 A. Yes. Since its inception in 2012, Pennsylvania's drilling tax/impact fee has generated
23 nearly \$1.67 billion in new revenue for communities in all 67 counties across the

1 Commonwealth. As noted above, Range alone has paid approximately \$216 million in
2 drilling impacts fees.

3
4 **Q. Will a shutdown of ME1 and/or ME2 affect the drilling negatively impact fees paid**
5 **to the Commonwealth?**

6 A. Yes. Drilling impact fees are based on production. Assuming only the proportion of
7 Range-Appalachia's production transported on ME1 and ME2 were impacted, the
8 Commonwealth would lose out on approximately \$8.7 million per year—based on 2019
9 payments of \$29 million—in impact fees. Importantly, this is for Range-Appalachia alone;
10 the collective impact, which would account for other shippers on ME1 and ME2, would be
11 far greater.

12
13 **Q. Does this conclude your direct testimony?**

14 A. Yes, it does.

**BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION**

MEGHAN FLYNN et al.	:	Docket Nos.	C-2018-3006116 (consolidated)
	:		P-2018-3006117
MELISSA DIBERNARDINO	:	Docket No.	C-2018-3005025 (consolidated)
REBECCA BRITTON	:	Docket No.	C-2019-3006898 (consolidated)
LAURA OBENSKI	:	Docket No.	C-2019-3006905 (consolidated)
ANDOVER HOMEOWNER'S ASSOCIATION, INC.	:	Docket No.	C-2018-3003605 (consolidated)

v.

SUNOCO PIPELINE L.P.

**REBUTTAL TESTIMONY
OF MATTHEW GORDON
ON BEHALF OF SUNOCO PIPELINE, L.P.**

Date: June 15, 2020

**SPLP
N13**

1 **Q: What is your full and current occupation?**

2 A: My name is Matthew Gordon. Since April 2018, I have been Senior Director of Liquid
3 Pipeline Operations for Energy Transfer Partners (formerly Sunoco Logistics). Immediately
4 prior to that, from April 2017 to April 2018, I was Director of Special Projects and from October
5 2012 to April 2017, I was principal engineer and project manager for the Mariner East 2 (ME2)
6 pipeline project for Sunoco Pipeline (SPLP).

7

8 **Q: What did you do in your capacity as project manager?**

9 A: I oversaw the design, permitting, land acquisition and construction of ME2 in accordance
10 with federal, state and local law and company policies and procedures. I was also project
11 director for the Mariner East 1 pipeline project.

12

13 **Q: What did you do in your capacity as Director, Special Projects?**

14 A: I managed a team of 13 project managers on multi-year, large capital projects consisting
15 of new pipelines, pump stations, meter sites and valve stations.

16

17 **Q: What do you do in your current capacity as Senior Director of Liquid Pipeline**
18 **Operations?**

19 A: I manage a team of directors and managers executing operations, maintenance and
20 compliance of liquid pipeline assets across eight states in the eastern United States. I drive a
21 safety first culture that ensures reliable operations while complying with strict federal, state and
22 local regulations.

1 **Q: What is your educational background?**

2 A: I hold a Bachelor of Science in Mechanical Engineering from North Carolina State
3 University.

4
5 **Q: Is Exhibit SPLP MG-1 your curriculum vitae?**

6 A: Yes.

7
8 **Q: Can you please briefly describe ME2?**

9 A: ME2 consists of two parallel pipelines, one 16” and one 20” in the same right-of-way
10 from Houston, Washington County, Pennsylvania to SPLP’s Marcus Hook facility in Delaware
11 County, Pennsylvania: Approximately 80% of the route state-wide is co-located adjacent to
12 existing utility corridors, including approximately 230 miles of pipeline co-located in the
13 existing SPLP Mariner East pipeline system (ME1). ME2 will transport propane, butane and
14 ethane. It runs through approximately 85 municipalities in Pennsylvania.

15
16 **Q: You mentioned driving a safety first culture. What are the safety measures SPLP**
17 **has taken and continues to take concerning ME2?**

18 A: The overall safety of our pipeline is exceptional. SPLP not only follows all applicable
19 federal and state safety and construction regulations, but goes well above and beyond these
20 requirements concerning the most important aspects as to safety of ME2. For example:

- 21 • ME2 will have a minimum cover from the top of the pipe up to ground level in
22 industrial, commercial and residential areas of 48 inches instead of the 49 C.F.R.

1 Part 195 required minimum 36 inches to enhance protection from potential third-
2 party damage.

- 3 • For the pipe grade purchased on ME2, the minimum pipeline thickness is .38
4 inches with a .6 factor which exceeds the minimum 49 C.F.R. Part 195 required
5 .316 thickness and .72 design factor to increase resistance to third-party damage,
6 ground movement, shipping damage, and overall pipe body cleanliness and
7 weldability.

- 8 • ME2 pipe is specified to the American Petroleum Institute's (API) 5L's
9 (incorporated into 49 C.F.R. Part 195) more stringent PSL-2 standard, which has
10 stricter requirements for metallurgy, testing frequencies, factory inspections and
11 record retention. SPLP voluntarily meeting these higher quality standards
12 increases the resistance to third-party damage, ground movement, shipping
13 damage, and overall pipe body cleanliness and weldability.

- 14 • ME2 will be hydrostatically pressure tested for at least 8 hours to a pressure equal
15 to 125% Maximum Operating Pressure (MOP), exceeding 49 C.F.R. Part 195
16 regulation requirements of testing for four hours at 125% of MOP and 4 hours at
17 110% of MOP, which will confirm there are no leaks, deleterious material, or
18 construction flaws.

- 19 • The ME2 right-of-way will be inspected once every 7 days, not to exceed 10 days,
20 weather permitting, exceeding 49 C.F.R. Part 195's required inspection of 26
21 times per year, not to exceed 3 weeks between inspection, which provides
22 heightened awareness of activities taking place along the pipeline route.

1 These safety measures and others are described in Mariner East 2, Pipeline Project Safety
2 Practices and Design, attached to my testimony as Exhibit SPLP MG-2.

3
4 **Q: Why do you say these are the most important aspects as to safety?**

5 A: These items discussed above are measures that prevent a release in the first place,
6 whereas other equipment and procedures SPLP uses and implements react to a release or event
7 once it has already occurred to isolate and minimize this impact.

8
9 **Q: Why does SPLP take extra safety measures when it is not required to do so?**

10 A: Safety is a core value of our corporation. We are required to comply with the law but
11 voluntarily go above and beyond the law's requirements when appropriate from an engineering
12 and managerial perspective because we have determined it is the right thing to do.

13
14 **Q: Does the Commission inspect the ME2 line during construction?**

15 A: Yes. In 2017 to 2020, the Commission's Pipeline Safety Section spent 150 days
16 inspecting the Mariner East project. The inspectors continue this rigorous inspection program
17 through construction on at least a weekly basis. They also inspect the line once it is in operation.

18
19 **Q: Does SPLP have protocols and standard operating procedures for construction**
20 **safety?**

21 A: Yes.

1 **Q: Are Exhibits SPLP MG-3-10 those procedures?**

2 A: Yes.

3

4 **Q: Complainants have raised a number of specific issues or incidents regarding ME2**
5 **and I'd like to go through them with you. What is the maximum operating pressure for**
6 **ME2.**

7 A: 1480 PSI

8

9 **Q: Are you aware of a leak from a refined product line at Tunbridge Apartments on**
10 **November 11, 2019?**

11 A: Yes.

12

13 **Q: Can you describe the incident?**

14 A: Yes. There was a valve on a gasoline line at that location. The valve had tubing that was
15 not properly installed by the manufacturer. As a result there was a small leak. It was not an
16 HVL leak.

17

18 **Q: Did Sunoco become aware of the leak?**

19 A: Yes. There was an alarm at the control center that identified a potential leak. The control
20 center called field personnel to respond to confirm whether there was a release.

21

1 **Q: So to be clear, even with this small release, the control center was able to determine**
2 **that further investigation was necessary.**

3 A: Yes.

4

5 **Q: Did SPLP field personnel go to the site?**

6 A: Yes.

7

8 **Q: Was the pipeline shut down and the release isolated?**

9 A: Yes, remotely at the control center.

10

11 **Q: Who was present when the field personnel arrived?**

12 A: The Fire Department and Delaware County Emergency Services. A neighbor had already
13 called 911.

14

15 **Q: Were there combustible vapors outside of the fence line of the valve site?**

16 A: No.

17

18 **Q: Was there any threat to the residents?**

19 A: No.

20

21 **Q: Let's turn to another site. Are you aware of Sunoco lowering a portion of the 12"**
22 **pipe that was in operation in Middletown Township.**

1 A: Yes.

2

3 **Q: Can you describe what happened there?**

4 A: Yes. The section of pipe was to be lowered because due to a stormwater washout the
5 pipe did not have the necessary depth of cover. SPLP evaluated alternatives to remedy the
6 situation including (i) lowering the pipe pursuant to 49 C.F.R. § 195.424(b) requirements with
7 product in the pipe, or (ii) purging the pipe and replacing that section of the pipe. In its
8 evaluation, SPLP looked at schedule, elevation, length of line exposure, inspection requirements,
9 reinforcement of girth welds, potential impacts to property owners and the public and extent of
10 flaring. Based on this evaluation SPLP selected the pipe lowering methodology that was
11 authorized by 40 C.F.R. § 195.424(b), and was to reduce pressure in the line section to lower
12 than 50%.

13

14 **Q: Was there a requirement to evacuate this during the pipe lowering?**

15 A: No. The closet structure was 150' from the work location, but the closest inhabited
16 structure was 300' from the work zone.

17

18 **Q: Does SPLP have a standard operating procedure for moving or lowering pipes with**
19 **product in it?**

20 A: Yes. Hazardous Liquids Pipeline Shut Down and Startup. Exhibit SPLP MG-11. And
21 SPLP intended to follow that procedure.

1 **Q: If those procedures are followed, do you believe there was a risk in lowering the pipe**
2 **section?**

3 A: No
4

5 **Q: Why did SPLP not initially decide to purge the pipe and replace it?**

6 A: SPLP believed that purging and flaring of the HVL in the pipe segment, rather than
7 lowering it, was more disruptive to the public. The purge distance is four times the length of
8 pipe section to be moved, requires three flaring locations with two separate purges and refill
9 operations and the nitrogen venting duration will be extended.
10

11 **Q: Then why did you decide to purge and flare rather than lower the pipe?**

12 A: The Township asked SPLP to and SPLP agreed.
13

14 **Q: Are you aware of SPLP's decision to change from an HDD (no. 381) at Swedesford**
15 **Road to an open cut?**

16 A: Yes.
17

18 **Q: Was that done through a permit modification approved by the Pennsylvania**
19 **Department of Environmental Protection ("DEP")?**

20 A: Yes.
21
22

1 **Q: Why did you seek the permit modification?**

2 A: Aqua had a public well in the area and they were concerned that the HDD could impact
3 their well. We evaluated different drill depths and configurations and decided that it was safer to
4 do an open cut then risk impacting Aqua's well.

5

6 **Q: Did Sunoco make that change voluntarily without being ordered to do so by DEP?**

7 A: Yes.

8

9 **Q: And did Aqua concur in that decision?**

10 A: Yes.

11

12 **Q: Are you aware of an incident where a resident identified what they believed to be an**
13 **operating section of ME1 in a stream?**

14 A: Yes.

15

16 **Q: Was that an operating section of ME1?**

17 A: No. It had been abandoned for some time.

18

19 **Q: Was there a second pipeline visible in that stream?**

20 A: Yes. That was an 8 inch refined product pipeline that had been replaced.

21

22

1 **Q: How are exposures of the Mariner East pipelines addressed by Sunoco Pipeline?**

2 **A:** The company has a standard operating procedure (“SOP”) for the Management of Depth
3 of Cover and Evaluation called SOP HLI.24. Exposures of pipeline are addressed in accordance
4 with that SOP.

5
6 **Q: Is Exhibit SPLP MG-12 a copy of SOP HLI.24 dealing with Management of Depth of**
7 **Cover and Evaluation?**

8 **A:** Yes it is.

9
10 **Q: Does Sunoco Pipeline follow this SOP for the Mariner East pipelines?**

11 **A:** Yes it does.

12
13 **Q: Briefly describe how Sunoco Pipeline implements this SOP to identify and address**
14 **areas of the Mariner East pipelines that may become exposed, whether from natural erosion**
15 **or some other cause?**

16 **A:** Generally, pipeliners walk the entire length of the pipeline in their designated areas to
17 inspect the pipelines and to identify areas where a pipeline has become exposed. We then make
18 an engineering and operations assessment and evaluation of each exposure utilizing a variety of
19 factors as set forth in the SOP to determine whether the exposure requires any immediate
20 remediation. Those that do are promptly addressed. The others are documented and monitored.
21 Pipeline exposures or partial exposures are quite common, and the overwhelming majority of
22 them create no issue with respect to the integrity of the pipeline or other safety issue.

1 **Q: Are you aware of the complaint by Mr. McMullen about a cathodic protection unit**
2 **on his property?**

3 A: Yes

4

5 **Q: Was that unit operable?**

6 A: Yes.

7

8 **Q: Did it present any risk, including a risk of electric shock?**

9 A: No, it was not pleasing looking aesthetically, but it was operational and there was no risk
10 of shock. The voltage difference between the ground and the wire contact is 1.5 volts, about the
11 same as holding an AA battery.

12

13 **Q: What did you do?**

14 A: We replaced it.

15

16 **Q: Mr. McMullen also claimed that the pipeline marker on his property was misplaced.**
17 **Can you explain?**

18 A: There was both a cathodic protection test station and a line marker on the property. We
19 installed a new cathodic protection test station that had the line marker sticker on it instead of
20 putting a second marker back in place.

21

1 **Q: Are you aware of an incident involving a loud noise that occurred during a flare**
2 **testing at a valve station located at the Boot Road Pump Station.**

3 A: Yes.
4

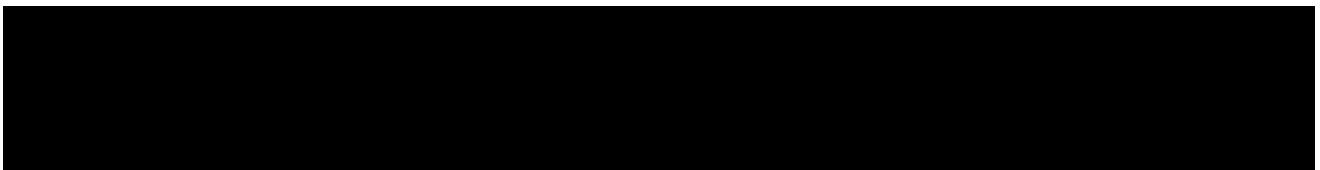
5 **Q: Can you explain that?**

6 A: Workers were performing maintenance at the site which required isolating the station
7 from the main line, flaring down the residual vapors in the piping, and purging any residual
8 vapors with nitrogen. During the nitrogen sweep the pilot on the flare briefly went out. The
9 automatic re-light sequence relit the pilot a short time after. A small pocket of vapor was present
10 when it relit resulting in an audible sound. During the re-light employees on the side could be
11 seen turning their heads to look at it but immediately resuming their work tasks. One employee
12 walked over towards the flare to inspect it and it was operating properly.

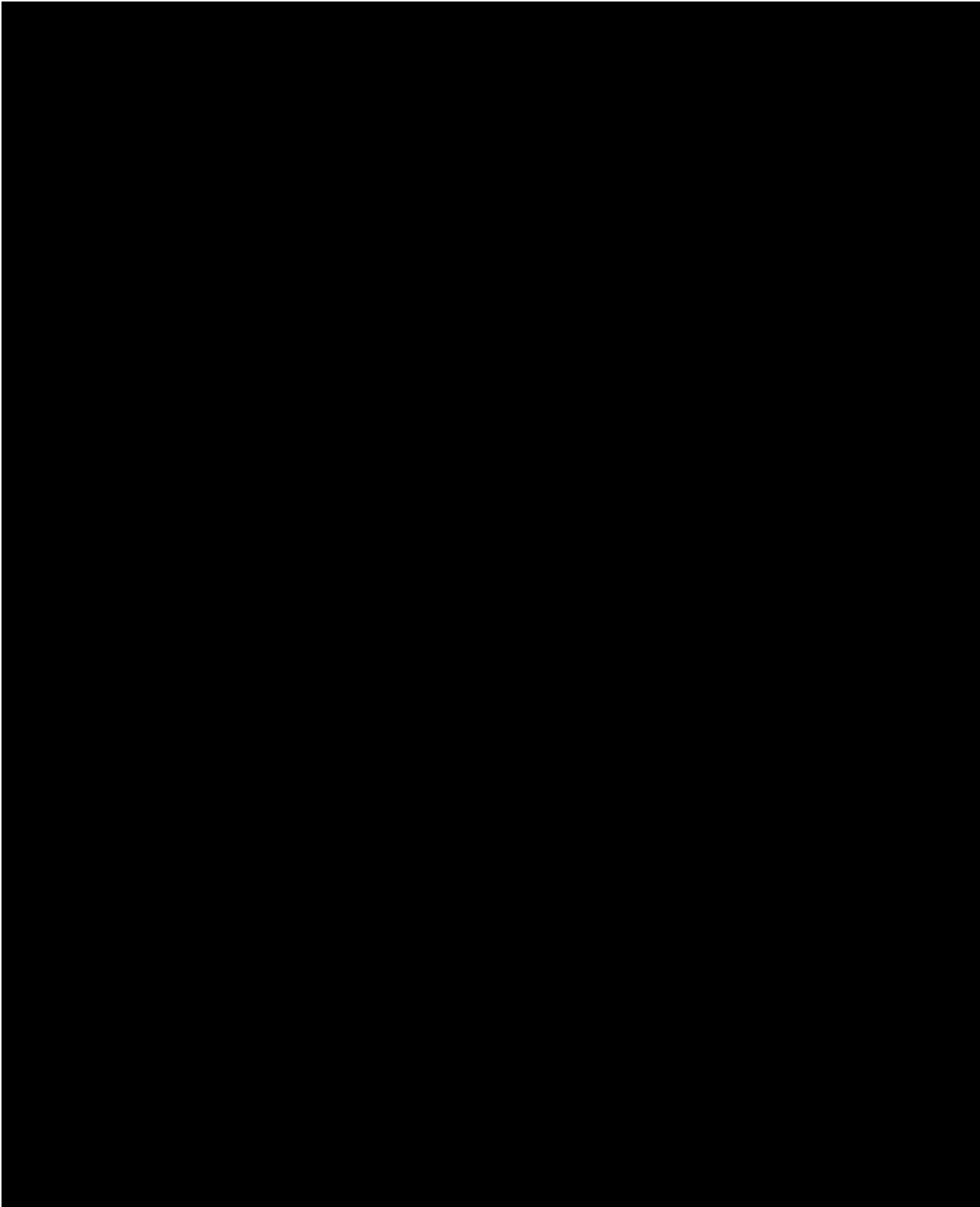
13
14 **Q: Can you explain the safety protections you have around valve stations in Chester**
15 **and Delaware County?**

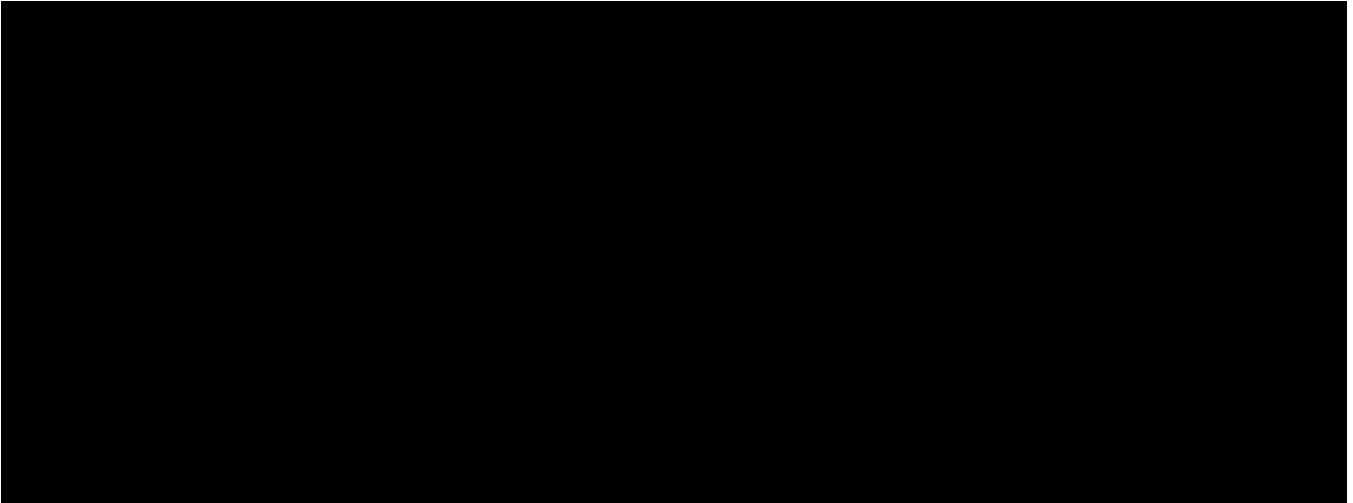
16 A: The valve sites are fenced in. All equipment is physically locked. Any sites that are
17 proximate to a road way have safety bollards or jersey barriers installed. The sites are monitored
18 remotely. All sites provide pressure, temperature and wind direction feedback.

19
20 **[BEGIN HIGHLY CONFIDENTIAL, CONFIDENTIAL SECURITY INFORMATION]**



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[END HIGHLY CONFIDENTIAL, CONFIDENTIAL SECURITY INFORMATION]

Q: Complainants assert that the integrity of the Amtrak rail lines near the Lisa Drive HDD (no. 400) may have been impacted by the subsidences in that area: Is that accurate?

A: No.

Q: Why not?

A: Amtrak inspected the tracks in that area daily and never communicated any safety concerns relating to those tracks.

Q: Last incident to discuss. A Complainant asserted that on February 18, 2020, while working near the Chester County line, SPLP's contractor, Michel's, struck a PECO natural gas line causing a leak. Is that accurate?

A: No.

1 **Q: What actually happened?**

2 A: There was no line strike. Michel's was using hydro-excavation which is a form of soft
3 digging. It jets water into the ground to loosen soil and then extracts mud with a vacuum. It is a
4 safe way to expose underground utilities without damaging them. When Michel's completed the
5 hydro-excavation a gas distribution line pulled apart on its own. Michel's did not touch it. The
6 reason it pulled apart was because there was a coupled fitting on one side and no corresponding
7 fitting on the other side for it to be joined together. It was literally held together with tape.

8

9 **Q: Do you wish to offer anything else?**

10 A: I reserve the right to supplement my testimony based on the sur-rebuttal testimony by

11 Complainants and Complainant Aligned Intervenors

**BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION**

MEGHAN FLYNN et al.	:	Docket Nos.	C-2018-3006116 (consolidated)
	:		P-2018-3006117
MELISSA DIBERNARDINO	:	Docket No.	C-2018-3005025 (consolidated)
REBECCA BRITTON	:	Docket No.	C-2019-3006898 (consolidated)
LAURA OBENSKI	:	Docket No.	C-2019-3006905 (consolidated)
ANDOVER HOMEOWNER'S ASSOCIATION, INC.	:	Docket No.	C-2018-3003605 (consolidated)

v.

SUNOCO PIPELINE L.P.

**REBUTTAL TESTIMONY
OF MATTHEW GORDON
ON BEHALF OF SUNOCO PIPELINE, L.P.**

**CONTAINS HIGHLY CONFIDENTIAL, CONFIDENTIAL
SECURITY INFORMATION**

Date: June 15, 2020

**SPLP
N13-C**

1 **Q: What is your full and current occupation?**

2 A: My name is Matthew Gordon. Since April 2018, I have been Senior Director of Liquid
3 Pipeline Operations for Energy Transfer Partners (formerly Sunoco Logistics). Immediately
4 prior to that, from April 2017 to April 2018, I was Director of Special Projects and from October
5 2012 to April 2017, I was principal engineer and project manager for the Mariner East 2 (ME2)
6 pipeline project for Sunoco Pipeline (SPLP).

7

8 **Q: What did you do in your capacity as project manager?**

9 A: I oversaw the design, permitting, land acquisition and construction of ME2 in accordance
10 with federal, state and local law and company policies and procedures. I was also project
11 director for the Mariner East 1 pipeline project.

12

13 **Q: What did you do in your capacity as Director, Special Projects?**

14 A: I managed a team of 13 project managers on multi-year, large capital projects consisting
15 of new pipelines, pump stations, meter sites and valve stations.

16

17 **Q: What do you do in your current capacity as Senior Director of Liquid Pipeline**
18 **Operations?**

19 A: I manage a team of directors and managers executing operations, maintenance and
20 compliance of liquid pipeline assets across eight states in the eastern United States. I drive a
21 safety first culture that ensures reliable operations while complying with strict federal, state and
22 local regulations.

1 **Q: What is your educational background?**

2 A: I hold a Bachelor of Science in Mechanical Engineering from North Carolina State
3 University.

4
5 **Q: Is Exhibit SPLP MG-1 your curriculum vitae?**

6 A: Yes.

7
8 **Q: Can you please briefly describe ME2?**

9 A: ME2 consists of two parallel pipelines, one 16” and one 20” in the same right-of-way
10 from Houston, Washington County, Pennsylvania to SPLP’s Marcus Hook facility in Delaware
11 County, Pennsylvania: Approximately 80% of the route state-wide is co-located adjacent to
12 existing utility corridors, including approximately 230 miles of pipeline co-located in the
13 existing SPLP Mariner East pipeline system (ME1). ME2 will transport propane, butane and
14 ethane. It runs through approximately 85 municipalities in Pennsylvania.

15
16 **Q: You mentioned driving a safety first culture. What are the safety measures SPLP**
17 **has taken and continues to take concerning ME2?**

18 A: The overall safety of our pipeline is exceptional. SPLP not only follows all applicable
19 federal and state safety and construction regulations, but goes well above and beyond these
20 requirements concerning the most important aspects as to safety of ME2. For example:

- 21 • ME2 will have a minimum cover from the top of the pipe up to ground level in
22 industrial, commercial and residential areas of 48 inches instead of the 49 C.F.R.

1 Part 195 required minimum 36 inches to enhance protection from potential third-
2 party damage.

- 3 • For the pipe grade purchased on ME2, the minimum pipeline thickness is .38
4 inches with a .6 factor which exceeds the minimum 49 C.F.R. Part 195 required
5 .316 thickness and .72 design factor to increase resistance to third-party damage,
6 ground movement, shipping damage, and overall pipe body cleanliness and
7 weldability.

- 8 • ME2 pipe is specified to the American Petroleum Institute's (API) 5L's
9 (incorporated into 49 C.F.R. Part 195) more stringent PSL-2 standard, which has
10 stricter requirements for metallurgy, testing frequencies, factory inspections and
11 record retention. SPLP voluntarily meeting these higher quality standards
12 increases the resistance to third-party damage, ground movement, shipping
13 damage, and overall pipe body cleanliness and weldability.

- 14 • ME2 will be hydrostatically pressure tested for at least 8 hours to a pressure equal
15 to 125% Maximum Operating Pressure (MOP), exceeding 49 C.F.R. Part 195
16 regulation requirements of testing for four hours at 125% of MOP and 4 hours at
17 110% of MOP, which will confirm there are no leaks, deleterious material, or
18 construction flaws.

- 19 • The ME2 right-of-way will be inspected once every 7 days, not to exceed 10 days,
20 weather permitting, exceeding 49 C.F.R. Part 195's required inspection of 26
21 times per year, not to exceed 3 weeks between inspection, which provides
22 heightened awareness of activities taking place along the pipeline route.

1 These safety measures and others are described in Mariner East 2, Pipeline Project Safety
2 Practices and Design, attached to my testimony as Exhibit SPLP MG-2.

3
4 **Q: Why do you say these are the most important aspects as to safety?**

5 A: These items discussed above are measures that prevent a release in the first place,
6 whereas other equipment and procedures SPLP uses and implements react to a release or event
7 once it has already occurred to isolate and minimize this impact.

8
9 **Q: Why does SPLP take extra safety measures when it is not required to do so?**

10 A: Safety is a core value of our corporation. We are required to comply with the law but
11 voluntarily go above and beyond the law's requirements when appropriate from an engineering
12 and managerial perspective because we have determined it is the right thing to do.

13
14 **Q: Does the Commission inspect the ME2 line during construction?**

15 A: Yes. In 2017 to 2020, the Commission's Pipeline Safety Section spent 150 days
16 inspecting the Mariner East project. The inspectors continue this rigorous inspection program
17 through construction on at least a weekly basis. They also inspect the line once it is in operation.

18
19 **Q: Does SPLP have protocols and standard operating procedures for construction**
20 **safety?**

21 A: Yes.

1 **Q: Are Exhibits SPLP MG-3-10 those procedures?**

2 A: Yes.

3

4 **Q: Complainants have raised a number of specific issues or incidents regarding ME2**
5 **and I'd like to go through them with you. What is the maximum operating pressure for**
6 **ME2.**

7 A: 1480 PSI

8

9 **Q: Are you aware of a leak from a refined product line at Tunbridge Apartments on**
10 **November 11, 2019?**

11 A: Yes.

12

13 **Q: Can you describe the incident?**

14 A: Yes. There was a valve on a gasoline line at that location. The valve had tubing that was
15 not properly installed by the manufacturer. As a result there was a small leak. It was not an
16 HVL leak.

17

18 **Q: Did Sunoco become aware of the leak?**

19 A: Yes. There was an alarm at the control center that identified a potential leak. The control
20 center called field personnel to respond to confirm whether there was a release.

21

1 **Q: So to be clear, even with this small release, the control center was able to determine**
2 **that further investigation was necessary.**

3 A: Yes.

4

5 **Q: Did SPLP field personnel go to the site?**

6 A: Yes.

7

8 **Q: Was the pipeline shut down and the release isolated?**

9 A: Yes, remotely at the control center.

10

11 **Q: Who was present when the field personnel arrived?**

12 A: The Fire Department and Delaware County Emergency Services. A neighbor had already
13 called 911.

14

15 **Q: Were there combustible vapors outside of the fence line of the valve site?**

16 A: No.

17

18 **Q: Was there any threat to the residents?**

19 A: No.

20

21 **Q: Let's turn to another site. Are you aware of Sunoco lowering a portion of the 12"**
22 **pipe that was in operation in Middletown Township.**

1 A: Yes.

2

3 **Q: Can you describe what happened there?**

4 A: Yes. The section of pipe was to be lowered because due to a stormwater washout the
5 pipe did not have the necessary depth of cover. SPLP evaluated alternatives to remedy the
6 situation including (i) lowering the pipe pursuant to 49 C.F.R. § 195.424(b) requirements with
7 product in the pipe, or (ii) purging the pipe and replacing that section of the pipe. In its
8 evaluation, SPLP looked at schedule, elevation, length of line exposure, inspection requirements,
9 reinforcement of girth welds, potential impacts to property owners and the public and extent of
10 flaring. Based on this evaluation SPLP selected the pipe lowering methodology that was
11 authorized by 40 C.F.R. § 195.424(b), and was to reduce pressure in the line section to lower
12 than 50%.

13

14 **Q: Was there a requirement to evacuate this during the pipe lowering?**

15 A: No. The closet structure was 150' from the work location, but the closest inhabited
16 structure was 300' from the work zone.

17

18 **Q: Does SPLP have a standard operating procedure for moving or lowering pipes with**
19 **product in it?**

20 A: Yes. Hazardous Liquids Pipeline Shut Down and Startup. Exhibit SPLP MG-11. And
21 SPLP intended to follow that procedure.

1 **Q: If those procedures are followed, do you believe there was a risk in lowering the pipe**
2 **section?**

3 A: No
4

5 **Q: Why did SPLP not initially decide to purge the pipe and replace it?**

6 A: SPLP believed that purging and flaring of the HVL in the pipe segment, rather than
7 lowering it, was more disruptive to the public. The purge distance is four times the length of
8 pipe section to be moved, requires three flaring locations with two separate purges and refill
9 operations and the nitrogen venting duration will be extended.
10

11 **Q: Then why did you decide to purge and flare rather than lower the pipe?**

12 A: The Township asked SPLP to and SPLP agreed.
13

14 **Q: Are you aware of SPLP's decision to change from an HDD (no. 381) at Swedesford**
15 **Road to an open cut?**

16 A: Yes.
17

18 **Q: Was that done through a permit modification approved by the Pennsylvania**
19 **Department of Environmental Protection ("DEP")?**

20 A: Yes.
21
22

1 **Q: Why did you seek the permit modification?**

2 A: Aqua had a public well in the area and they were concerned that the HDD could impact
3 their well. We evaluated different drill depths and configurations and decided that it was safer to
4 do an open cut then risk impacting Aqua's well.

5

6 **Q: Did Sunoco make that change voluntarily without being ordered to do so by DEP?**

7 A: Yes.

8

9 **Q: And did Aqua concur in that decision?**

10 A: Yes.

11

12 **Q: Are you aware of an incident where a resident identified what they believed to be an**
13 **operating section of ME1 in a stream?**

14 A: Yes.

15

16 **Q: Was that an operating section of ME1?**

17 A: No. It had been abandoned for some time.

18

19 **Q: Was there a second pipeline visible in that stream?**

20 A: Yes. That was an 8 inch refined product pipeline that had been replaced.

21

22

1 **Q: How are exposures of the Mariner East pipelines addressed by Sunoco Pipeline?**

2 **A:** The company has a standard operating procedure (“SOP”) for the Management of Depth
3 of Cover and Evaluation called SOP HLI.24. Exposures of pipeline are addressed in accordance
4 with that SOP.

5

6 **Q: Is Exhibit SPLP MG-12 a copy of SOP HLI.24 dealing with Management of Depth of**
7 **Cover and Evaluation?**

8 **A:** Yes it is.

9

10 **Q: Does Sunoco Pipeline follow this SOP for the Mariner East pipelines?**

11 **A:** Yes it does.

12

13 **Q: Briefly describe how Sunoco Pipeline implements this SOP to identify and address**
14 **areas of the Mariner East pipelines that may become exposed, whether from natural erosion**
15 **or some other cause?**

16 **A:** Generally, pipeliners walk the entire length of the pipeline in their designated areas to
17 inspect the pipelines and to identify areas where a pipeline has become exposed. We then make
18 an engineering and operations assessment and evaluation of each exposure utilizing a variety of
19 factors as set forth in the SOP to determine whether the exposure requires any immediate
20 remediation. Those that do are promptly addressed. The others are documented and monitored.
21 Pipeline exposures or partial exposures are quite common, and the overwhelming majority of
22 them create no issue with respect to the integrity of the pipeline or other safety issue.

1 **Q: Are you aware of the complaint by Mr. McMullen about a cathodic protection unit**
2 **on his property?**

3 A: Yes

4

5 **Q: Was that unit operable?**

6 A: Yes.

7

8 **Q: Did it present any risk, including a risk of electric shock?**

9 A: No, it was not pleasing looking aesthetically, but it was operational and there was no risk
10 of shock. The voltage difference between the ground and the wire contact is 1.5 volts, about the
11 same as holding an AA battery.

12

13 **Q: What did you do?**

14 A: We replaced it.

15

16 **Q: Mr. McMullen also claimed that the pipeline marker on his property was misplaced.**
17 **Can you explain?**

18 A: There was both a cathodic protection test station and a line marker on the property. We
19 installed a new cathodic protection test station that had the line marker sticker on it instead of
20 putting a second marker back in place.

21

1 **Q: Are you aware of an incident involving a loud noise that occurred during a flare**
2 **testing at a valve station located at the Boot Road Pump Station.**

3 A: Yes.
4

5 **Q: Can you explain that?**

6 A: Workers were performing maintenance at the site which required isolating the station
7 from the main line, flaring down the residual vapors in the piping, and purging any residual
8 vapors with nitrogen. During the nitrogen sweep the pilot on the flare briefly went out. The
9 automatic re-light sequence relit the pilot a short time after. A small pocket of vapor was present
10 when it relit resulting in an audible sound. During the re-light employees on the side could be
11 seen turning their heads to look at it but immediately resuming their work tasks. One employee
12 walked over towards the flare to inspect it and it was operating properly.
13

14 **Q: Can you explain the safety protections you have around valve stations in Chester**
15 **and Delaware County?**

16 A: The valve sites are fenced in. All equipment is physically locked. Any sites that are
17 proximate to a road way have safety bollards or jersey barriers installed. The sites are monitored
18 remotely. All sites provide pressure, temperature and wind direction feedback.
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20 **[BEGIN HIGHLY CONFIDENTIAL, CONFIDENTIAL SECURITY INFORMATION]**
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A: No.

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3 digging. It jets water into the ground to loosen soil and then extracts mud with a vacuum. It is a
4 safe way to expose underground utilities without damaging them. When Michel's completed the
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9 **Q: Do you wish to offer anything else?**

10 A: I reserve the right to supplement my testimony based on the sur-rebuttal testimony by

11 Complainants and Complainant Aligned Intervenors

SPLP Exhibit MG-1-RJ

-----Original Message-----

From: Michele Truitt <mtruitt@eastgoshen.org>

Sent: Wednesday, August 5, 2020 5:07 PM

To: Massaro, Joseph P <JOSEPH.MASSARO@energytransfer.com>; Gordon, Matthew L <MATTHEW.GORDON@energytransfer.com>

Cc: John Hertzog <jhertzog@eastgoshen.org>; Bloom, Ronald G <RONALD.BLOOM@energytransfer.com>; Jon Altshul <jaltshul@eastgoshen.org>

Subject: Pump station & Pipeline site tour

Gentlemen,

Please accept our gratitude for everything you had to do to set up the tours for John & I today. Ron, your thorough explanation of the operations side of the project was impressive! In fact, ALL of you are very knowledgeable & professional in how you explained everything to us.

The main reason John & I were so interested in touring the pump station & an active site, was all about the safety. The redundancies that are built into the system are many, & gives both of us reassurance that SET is a first class operation with safety foremost in mind.

While you answered so many of our questions today, we may have some follow ups. Personally, I need a little time to digest the information before deciding if I need any clarification. If I have anything, I will probably reach out to Matt.

Matt, the Eagle site is tremendous! And you have to know already, that Quita, Rahn, Ron, & Joe all represented SET exceptionally well. Jamie (Michel's) was very thorough & clear with his explanations of the active site, & seems to genuinely love his job & care that what he is doing is so important from the safety perspective as well. And I was happy to hear that so many of the people on site are from PA.

Thanks again for a terrific site tour, the thorough explanations, answering our questions, & being gracious hosts.

With Appreciation,
Michele

Private and confidential as detailed [here](#). If you cannot access hyperlink, please e-mail sender.

Exhibit SPLP MG-1

SPLP
MG-1

PROJECT MANAGEMENT • OPERATIONS • ENGINEERING

A results-focused, senior level Operations and Project Manager, with a technical background and extensive experience in the oil & energy midstream sector to include pipeline construction, storage facilities, operations and maintenance. Experienced in multi-facility management, and supervision of operations, technical and non-technical staff in both union and non-union environments. Strong leadership in safety, operations, project management, and regulatory compliance including DOT/PHMSA, FMCSA, DEP, and EPA. A highly effective communicator and collaborator with a strong customer orientation, who builds win-win relationships, champions improved processes and practices, and leads and operates with the highest integrity. A critical thinker who utilizes project management best practices, anticipates problems and develops contingency plans.

NOTABLE ACHIEVEMENTS

- Successfully negotiated contract bid awards in excess of \$100MM
- Managed multi-year, multi-billion-dollar capital projects ranging from \$2MM to \$2.5B, from design through construction and completion, on schedule and within budget
- Led the integration of a \$100MM marine terminal acquisition

PROFESSIONAL EXPERIENCE**Energy Transfer Partners (formerly Sunoco Logistics)****Jan 2006 – Present****Senior Director, Liquid Pipeline Operations | April 2018 - Present**

- Manage a team of directors and managers, executing operations, maintenance, and compliance of liquid pipeline assets across 8 states in the eastern U.S.
- Drive a safety first culture that ensures reliable operation while complying with strict federal, state, and local regulations.
- Represent the company in public meetings and often in confrontational circumstances.
- Meet with elected officials and regulators to review compliance / exceedance of regulatory requirements. Liaison with government entities for compliance and emergency response planning.
- Testify on behalf of the company in hearings and in court.

Director, Special Projects | April 2017 – April 2018

- Manage a team of 13 project managers, executing multi-year, multi-billion-dollar capital projects consisting of hundreds of miles of new pipeline, pump stations, meter sites, and valve stations.
- Establish project protocols and procedures in accordance with all federal, state, and local regulations while implementing company standards and specifications.
- Drive a results focused culture that both anticipates project challenges and overcomes them in a timely fashion to maintain cost and schedule.
- Represent the company and the projects in public meetings often in confrontational circumstances.
- Meet with elected officials to review projects and compliance/ exceedance of regulatory requirements.
- Testify on behalf of the company in hearings and in court.
- Liaison with government entities including but not limited to US Army Corps of Engineers, US Fish and Wildlife Service, Department of Environmental Protection, Environmental Protection Agency, Pipeline Hazardous Material Safety Administration (under US Department of Transportation), Pennsylvania Historic Museum Commission, and other federal, state and local entities.

Principal Engineer/Project Manager | October 2012 - April 2017

Mariner East Pipeline - Reported directly to Senior Director of Capital Projects and the Senior Management Team as required, and managed all aspects of two NGL pipeline construction projects across PA, WV, and OH. Scope includes construction of 50 miles of 12" pipeline, 350 miles of 20" pipeline, 220 miles of 16" pipeline, 21 pump stations, 9 custody transfer metering sites, and over 90 valve stations. Combined project budget over \$2.5B.

- Guided and oversaw staff through the design of the project, permitting of the construction, acquisition of the land, construction of the assets, and compliance with all federal, state, and local regulations where applicable.
- Liaised with government entities for permitting, compliance, audits, inspections and speaking at public informational meetings.
- Managed a multi-discipline contract staff of environmental engineers, archaeologists, biologists, civil engineers, mechanical engineers, electrical engineers, inspectors, land agents and construction personnel.

Area Manager | August 2012 – October 2012

Reported directly to the Pipeline Operations Director, and managed all aspects of pipeline operations and breakout storage in PA and NY. Responsibilities:

- Led and developed five supervisors, one engineer, and 100 union field personnel to ensure safe, reliable operations and product quality.
- Settled labor disputes, represented the company for labor related hearings and arbitrations
- Budgeted, planned and executed all CAPEX and OPEX in the area
- Planned and budgeted future capital improvements / upgrades / expansion for reliability and organic growth
- Managed capital projects; due diligence team member for new acquisitions
- Safety committee chair; Corporate Incident Management Team Incident Commander; Emergency Response – NIMS 700 level trained I.C.
- Ensured regulatory compliance and led audits by PHMSA, DEP, and EPA
- Liaised with customers, government agencies, and the public

Operations Manager | Jan 2010 – July 2012

Reported directly to the Area Manager, and managed all aspects of four pipeline breakout storage facilities and two marine terminals.

- Led two operations supervisors and 100 union personnel
- Safety committee chairperson
- Ensured regulatory compliance and lead audits by USCG, PHMSA, DEP, EPA, and FDA
- Served as Area Manager for NJ & SE PA assets for (2) six-month temporary assignments, leading four supervisors, two engineers and forty-four new union employees in addition to the 102 employees in the existing Operations Manager organization.
- Scheduling and inventory accounting oversight for dock, tank farm and pipeline assets
- Root cause analysis team leadership for post incident investigation
- Facility Security Officer in charge of all security staff and compliance at three MARSEC facilities
- Settled labor disputes, and represented the company for labor related hearings and arbitrations

Technical Supervisor | July 2007 – January 2010

Reported directly to Area Manager, and was responsible for overall mechanical and electrical preventative maintenance for PA and NY area pipeline and terminals.

- Supervised union pipeline mechanics and electricians
- Supervised annual calibrations, testing, qualifications and documentation. Audited records for accuracy and content.
- Federal/State/Local compliance and audit team member Subject Matter Expert for annual calibrations and testing
- Hot work supervision and welding inspection

- Maintained OQ compliance of employees and contractors
- Program Administrator for MP2 and SKF Vibration
- Hydro-testing supervisor
- Area FMCSA compliance coordinator
- Emergency Responder

*Earlier career includes **Pipeline Field Engineer** at **Sunoco Logistics** (2006 – 2007), **Product Engineer**, and **Product Design Engineer** for **SFS intec, Inc.** (2003 – 2006).*

EDUCATION

Bachelor of Science, Mechanical Engineering
North Carolina State University, Raleigh, NC

Exhibit SPLP MG-2

SPLP
MG-2

Mariner East 2

PIPELINE PROJECT SAFETY PRACTICES AND DESIGN

At Energy Transfer and Sunoco Pipeline, safety is our top priority. Our goal is to provide safe and reliable transportation of natural gas liquids (NGLs) for our customers. Using advanced technology and a proven safety design, Mariner East 2 has added features that exceed federal requirements and will minimize the impact to the environment and local communities along the route.

Energy Transfer and Sunoco Pipeline are committed to the long-term integrity and safe operation of the Mariner East 2 Pipeline. Once in operation, there are many safety precautions we will employ for the protection of the pipeline and the safety of the communities along the route.

The U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) Office of Pipeline Safety (OPS) is the federal safety authority for ensuring the safe, reliable and environmentally sound operations of our nation's pipeline transportation system. PHMSA's "Transportation of Hazardous Liquids by Pipeline" regulation (49 CFR 195), incorporates by reference 48 industry standards and specifications that have been developed by organizations such as the American Petroleum Institute (API), National Fire Protection Association (NFPA) and ASME International.

Some of these safety measures include, but are not limited to:

- A SCADA (Supervisory Control And Data Acquisition) system will be installed that provides real-time data acquisition, monitoring and control of key operating points such as pressures, temperatures, flows and equipment status, including alarming of any conditions outside established parameters. The system can shut itself down safely without human intervention, but it is monitored by a live operator at all times.
- We also use a subsystem of SCADA, known as the Computational Pipeline Monitoring System ("CPM"), which analyzes deviations in the flow of liquids using computational algorithms, thus improving the operator's ability to identify abnormal operating conditions.
- Sunoco Pipeline will maintain a robust and continuously updated Facility Response Plan for effective and timely response to abnormal operating conditions. The Facility Response Plan is used as a basis for emergency response training and drills with local, regional, state and federal agencies.
- Sunoco Pipeline has teamed with local emergency responders along the route to provide information and training on emergency pipeline response. Strategic contracts will also be executed with private response organizations in the area.
- Sunoco Pipeline provides biennial neighbor stakeholder outreach and implementation of a Public Awareness Program.

ABOVE AND BEYOND EXTRA ATTENTION TO SAFETY

DOT CFR 195 Requirements	Mariner East 2 Standard	Benefit of Exceeding Requirement
Pipeline Coverage and Separation Distances for New Construction		
The minimum required coverage in rural areas (excluding certain water bodies, drainage ditches, public roads and railroad crossings) is 30 inches.	Mariner East 2 will have a minimum cover (from the top of the pipe to ground level) of 48 inches for all conventional lays.	The additional coverage enhances protection from potential third-party damage.
The minimum required coverage in industrial, commercial and residential areas that are not within 50 feet of any private dwelling, industrial building or places of public assembly areas is 36 inches.	Mariner East 2 will have a minimum cover (from the top of the pipe to ground level) of 48 inches through these industrial, commercial and residential areas.	
The minimum required coverage for crossings of inland waterbodies that are less than 100 feet wide is 30 inches and in some cases 36 inches.	Mariner East 2 will have a minimum cover of 60 inches at these inland waterbody crossings.	The additional coverage enhances protection from potential third-party damage and from other outside forces, such as flooding, scouring and washouts.
Horizontal Directional Drills (HDDs) underneath waterbody crossings that are wider than 100 feet must be at least 48 inches under the natural bottom of the waterbody.	Sunoco Pipeline starts HDDs at a minimum of 48 inches and drills to a minimum of 60 inches below the natural bottom of these waterbodies.	The additional depth of the HDD will improve the safety and protection of the pipeline and the environment.

PIPELINE PROJECT SAFETY PRACTICES AND DESIGN

DOT CFR 195 Requirements	Mariner East 2 Standard	Benefit of Exceeding Requirement
Pipeline Strength		
The required design factor for inland pipelines not on a platform in navigable waters is .72. The minimum thickness for this design factor is .316 inches.	The minimum pipe thickness utilized is .38 inches with a .6 design factor. This means that the system will never exceed 60 percent of the pipe's minimum yield strength.	The higher quality of pipe standards increases the resistance to third-party damage, ground movement, shipping damage, and overall pipe body cleanliness and weldability.
	Mariner East 2 will employ heavier pipe wall thickness (.456 inches and 0.5 design factor) for horizontal directional drills (HDDs) under certain waterbodies, roads and sensitive areas.	
Line pipe must be fit-for-purpose per the API 5L Specification for Line Pipe.	Mariner East 2 pipe is specified to the API 5L's more stringent PSL-2 standard, which has stricter requirements for metallurgy, testing frequencies, factory inspections and record retention.	The higher quality of pipe standards increases the resistance to third-party damage, ground movement, shipping damage, and overall pipe body cleanliness and weldability.
	The longitudinal seam of all pipe has been 100% examined by Nondestructive Testing (NDT). Qualified third-party inspection is required during pipe production to monitor product quality and processing.	By placing qualified third-party NDT inspection personnel full-time at this production station, it provides an added level of verification that the NDT was completed per requirements.
Manufacturers are not required by API to be certified by ISO or have Q1 certification.	All pipe mills were inspected for their quality assurance and quality testing programs prior to being allowed to bid as a contractor for the project. We require all manufacturers to be certified to ISO 9001, ISO/TS 29001 or an equivalent such as API Q1, so that they comply with all (not just a few) requirements of API 5L.	Pipe manufacturers are subjected to frequent audits verifying their capabilities and adherence to API 5L requirements. This provides added assurance that pipe produced exceeds quality standards including but not limited to visual, mechanical and dimensional properties.
Line pipe inspection is only required at the job site during installation.	For Mariner East 2, inspectors were placed in each pipe mill while the pipe was being produced, and inspection was carried out all the way through installation.	This extra inspection provides an additional measure of compliance with quality control measures and additional safety and serviceability.
Pipeline Valves		
Regulation defers to the operator to determine placement of mainline isolation valves, some of which are remotely controlled.	The Mariner East 2 pipeline will have strategically placed automated valves that will enable pipeline segments to be quickly isolated. These valves are programmed to automatically close along with other programming that safely shuts down and isolates the pipeline if certain parameters meet a predefined level.	The automated valves reduce response time allowing a given pipeline segment to be quickly isolated should the need arise.
Pipeline Integrity Testing		
Regulation requires that we perform Nondestructive Testing (NDT), by either radiographic or ultrasonic methods, for 10% of the girth welds made by each welder each day.	100% of all mainline girth welds will be subjected to NDT inspection.	This provides a higher level of the integrity and strength of the welds.
Prior to being placed into service, regulation requires that the line must be hydrostatically pressure tested for 4 hours at 125% of the Maximum Operation Pressure (MOP), and an additional 4 hours at 110% or more of MOP.	Mariner East 2 will be hydrostatically pressure tested for at least 8 hours to a pressure equal to 125% MOP.	This additional time at 125% of MOP confirms there are no leaks, deleterious material or construction flaws.
The code references ASME B31.4 which states that "testing for buckles, dents and other diameter restrictions shall be performed after installation." The code does not require use of an Internal Line Inspection (ILI) deformation tool run through the entire pipeline prior to start-up.	Mariner East 2 will run an Internal Line Inspection deformation tool through the entire pipeline prior to start-up to identify and address any potential defects.	This will help to validate the pipeline's integrity by identifying any previously unrecognized construction damage and providing a baseline for future inspections.
Regulation requires that the pipeline Cathodic Protection System must be activated within 1 year after the pipeline is ready for operation.	Mariner East 2 will tie into an active preexisting Cathodic Protection System once the pipeline is backfilled and completed. The system will be activated in stages along the route as the pipeline is backfilled and completed.	This system helps to prevent corrosion and prevent the pipeline from reacting to other elements in the environment.
Operations		
Regulation requires inspection of the right-of-way 26 times per year, not to exceed 3 weeks between inspections.	Mariner East 2 right-of-way will be inspected once every 7 days, weather permitting.	The increased inspections of the right-of-way provide heightened awareness of activities taking place along the pipeline route.

Exhibit SPLP MG-3

SPLP
MG-3

**CONSTRUCTION AGREEMENT
NO.: 4600000976**



BETWEEN

**Sunoco Marketing Partners & Terminals, LP
and/or
Sunoco Pipeline, LP**

AND

**Otis Eastern Services, LLC
Vendor Number 1000005142**

EFFECTIVE DATE: July 15, 2015

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THIS CONSTRUCTION AGREEMENT (this "Agreement") is made as of the 15th day of July, 2015, by and between **SUNOCO PARTNERS MARKETING & TERMINALS, LP and/or SUNOCO PIPELINE L.P.**, ("Sunoco"), a Delaware Limited Partnership, and **Otis Eastern Services, LLC.** ("Contractor"), a Limited Liability Corporation, with its principal place of business located at 2971 route 417 P.O. Box 330, Wellsville, NY 14895.

BACKGROUND

WHEREAS, Contractor has expertise in providing Construction services; and

WHEREAS, Sunoco desires that Contractor render Construction services to Sunoco, in accordance with the provisions of the Agreement Documents as defined herein.

NOW, THEREFORE, in consideration of the mutual obligations set forth herein, and intending to be legally bound, Sunoco and Contractor covenant and agree as follows:

ARTICLE I: GENERAL TERMS

1.1 Incorporation of Background: The Background Section, above, is incorporated by reference herein.

1.2 Definitions: Capitalized terms shall have the following meanings:

Agreement Documents. "Agreement Documents" means this Agreement, any and all other documents or exhibits attached hereto, incorporated herein or by reference, and any and all subsequent Amendments to any of these documents.

Amendment. "Amendment" means a written modification or change to any Agreement Document signed by both Parties.

Applicable Law. "Applicable Law" means all applicable present and future court orders, injunctions and decrees, laws, ordinances, executive orders, rules, regulations, interpretations and requirements (including, without limitation, those relating to the environment, and the specific laws set forth in Article XIII (Specific Laws) herein, as amended from time to time), of any federal, state or local court, administrative agency or governmental body, and the United States.

Completion Date. "Completion Date" means the date that entire project is In-Service AND all additional requirements under the Project are complete, including but not limited to, fulfillment of all regulatory requirements, testing, operational capacity if fully met, site and installations are cleaned, and all release of liens are executed and submitted.

Event of Default. "Event of Default" means those events defined and identified in Section 10.1 (Events of Default) of this Agreement.

Event of Insolvency. "Event of Insolvency" means (a) the filing of a voluntary petition by Contractor under the Federal Bankruptcy Code or any similar state or federal law; or (b) the

filing of an involuntary petition against Contractor under the Federal Bankruptcy Code or any similar state or federal law which remains undismissed for a period of forty-five (45) days; or (c) Contractor's making of an assignment for the benefit of creditors; or (d) the appointment of a receiver for Contractor or for the property or assets of Contractor, if such appointment is not vacated within forty-five (45) days thereafter; or (e) any other proceeding under any bankruptcy or insolvency law or liquidated law, voluntary or otherwise.

In – Service Date. “In-Service Date” means the date the Project is in service, achieving the specified objective with respect to operations and capacity as required under the scope of work set forth in the Purchase Order

Materials. “Materials” means any and all memoranda, reports, records, documents, documentation, information, supplies, plans, original drawings, specifications, computations, sketches, renderings, arrangements, videos, pamphlets, advertisements, statistics, and other data, computer tapes, computer software, and other tangible work product or materials prepared or developed by the Contractor or for the Contractor by a Subcontractor and supplied to Sunoco by Contractor or a Subcontractor in performance of this Agreement.

Party or Parties. “Party” means either Sunoco or Contractor. “Parties” means Sunoco and Contractor.

Project Manager. “Project Manager” means the Sunoco representative charged with managing the Project.

Purchase Order. “Purchase Order” means a document authorizing work on a Project under the Terms & Conditions of this Agreement, which sets forth the cost structure, the Scope of Work and any additional information required for project authorization.

Schedule of Values. “Schedule of Values” means a breakdown of the scope of work using the work breakdown structure (wbs) in a hierarchal layout containing scope of work activities, unit of measurement, unit cost, work hours and cumulative values for both direct and indirect costs.

Sunoco Contact. “Sunoco Contact” means Sunoco's procurement representative.

Scope of Work. “Scope of Work” means the work or services set out in the document(s) attached as *Exhibit A* to this Agreement, or Purchase Order referencing this Agreement, provided by Sunoco, which set(s) forth the Services to be rendered and Materials to be provided under this Agreement, the time frames within which the Services are to be rendered and the Materials are to be provided and other requirements Contractor must satisfy in rendering the Services and providing the Materials.

Services. “Services” means the work to be performed under this Agreement as specified in *Exhibit A* or Purchase Orders referencing this Agreement.

Subcontract. “Subcontract” means a contract made between the Contractor and a Subcontractor.

Sunoco Representative. "Sunoco Representative" means the Project Manager or designated point of contact for the Project as named by Sunoco.

Subcontractor. "Subcontractor" means an individual or entity who/that has contracted with the Contractor for the performance of all or a part of the work or Services which the Contractor has contracted to perform under this Agreement.

Termination Notice. "Termination Notice" means a written notice from Sunoco to Contractor that informs Contractor of Sunoco's intent to terminate this Agreement.

1.3 Exhibits: The following Exhibits are attached hereto or to a Purchase Order issued hereunder, and incorporated by reference:

Exhibit A – Scope of Work
Exhibit B – Compensation
Exhibit C– Sunoco Health & Safety Requirements
Exhibit D – Lump Sum Acknowledgement
Exhibit E – Standard Release of Liens
Exhibit F – Contractor's Completion Affidavit

1.4 Term: This Agreement shall commence on July 15, 2015 (Effective Date). The term of this Agreement shall be:

(Check One)

☐ continue for a primary term of (1) year from its effective date, and shall extend from month to month thereafter, unless and until terminated by either party giving at least thirty (30) days prior written notice to the other party. Contractor may not terminate this Agreement as to any particular project upon which work has commenced.

☐ be for a fixed term of three years from its effective date.

ARTICLE II: THE WORK

2.1. Scope of Work: Contractor shall furnish and pay for all labor, supervision, tools, technical capability, transportation, materials and supplies (except those materials and supplies which Sunoco hereinafter agrees to furnish) and all other items or accessories necessary for Contractor to perform and accomplish the Work described in Exhibit "A" or set forth in a Purchase Order or Change Orders issued by Sunoco. All work performed for and materials purchased on behalf of Sunoco shall meet the most current specifications provided to Contractor by Sunoco.

Contractor shall complete the Work by the In Service Date, as set forth here, or in dates as set forth in Purchase Orders provided.

2.2 Prior Work Performed: If Sunoco has permitted Contractor to begin any Work before this Contract has been issued and executed by Contractor, and that work is within the definition of "Work", Contractor agrees that said work shall be governed by, and shall be deemed to have been carried out in accordance with, the terms and conditions of this Contract.

2.3 Contractor Prequalification: Contractor has met all prequalification requirements as required by Sunoco, set forth in Exhibit C, and shall maintain such qualifications at all times during the term of this Agreement, or during the time that any work is being performed in accordance with a Purchase Order issued by Sunoco and accepted by Contractor. Should Contractor's qualifications fail to meet the Sunoco standards as set forth and required, Sunoco maintains the right to terminate this Agreement and any work in progress at the time. Contractor must notify Sunoco if they, for any reason, fail to meet these ongoing required qualifications.

2.4 Conflict of Interest. For purposes of Conflict of Interests, Contractor shall disclose to Sunoco all Owners, Senior Executives, Principals, Partners, General Partners, Parent Companies who own at least 25% of Contractor, or in any event, a controlling interest in Contractor.

2.5 Public Relations. Contractor shall exert all reasonable efforts to maintain good will for the benefit of Sunoco with the landowners, tenants, and lessees along the right-of-way, and with the general public.

ARTICLE III: SUBCONTRACTORS

3.1 Subcontractor Usage: Prior to the subcontractor's start of work on Sunoco's project, Contractor shall provide Sunoco with a list of all subcontractors used to carry out all, or portions of, the Work. Sunoco maintains the right to reject any subcontractor or individual employees of a proposed subcontractor. This right may be exercised at any point during the execution of the Work. Contractor is responsible to ensure that all subcontractors and their agents and employees are and remain qualified for the Work.

3.2 Responsibility for Subcontractors: In the event that Contractor subcontracts any of the Work, Contractor shall be solely responsible for the engagement and management of its subcontractors in the performance of the Work in accordance with the terms of this Contract, for the performance of the Work by its subcontractors and for all acts or omissions of subcontractors. Contractor shall ensure that subcontractor and all sub-subcontractors meets all governmental agency regulations as well as Sunoco and local requirements under this Agreement and that all Work furnished or performed by its subcontractors conforms to the requirements of this Contract. No contract or agreement with any subcontractor shall bind, or purport to bind, Sunoco, or give the subcontractor a right to seek compensation or damages from Sunoco. Contractor shall remain responsible for all Work performed by its subcontractors.

ARTICLE IV: SCHEDULE

4.1 In-Service Date: Contractor shall commence the work after receipt of a written authorization in the form of a Purchase Order from Sunoco to Commence Work, and shall perform the Work at such a rate of progress as necessary to achieve the In Service Date of set forth in the Purchase Order provided at the inception of the Project. Any approved changes to the In-Service Date will be reflected in a subsequent Change Order issued by Sunoco. Should no such order be issued by Sunoco, the In-Service Date remains unchanged.

4.2 Completion Date: Contractor shall have the Project fully complete by the date set forth in the project specific Purchase Order.

4.3 Time: Time being of the essence in performance of this Agreement and all Purchase Orders and Change Orders issued by Sunoco, Contractor agrees to prosecute the work regularly and diligently and uninterruptedly at such a rate of progress as will be sufficient to achieve the In Service Date set forth in this agreement, section 4.1 and any milestones set forth or contemplated under this Agreement. Contractor acknowledges that the time requirement herein is both reasonable and realistic.

4.4. Delays – Damages: Notwithstanding anything contained herein to the contrary, contractor expressly agrees that its sole remedy for delay of any type (including any delay by Sunoco in authorizing contractor to mobilize, lack of material, or lack of the right-of-way or permits) or nature in the performance of the Work under this Agreement or applicable Purchase Order under this Agreement shall be an extension of time (to the In-Service Date and, if applicable, the dates for calculating any Incentive Bonus or Liquidated Damages Under this Agreement) in an amount equal to the time period of such delay and that Contractor shall make no demand to Sunoco for damages or extended overhead as a result of Such delay. For any such claimed delay, Contractor shall not be afforded an extension of time of any kind unless Contractor can show unequivocally that such claimed delay will affect the critical path of the work and directly delay the In-Service Date. Contractor shall not be entitled to payment or compensation of any kind from Sunoco for, including but not limited to, direct, indirect, or impact damages, due to hindrance of delay from any cause whatsoever, unless the parties agree that the delay is caused in whole by Sunoco.

4.5 Liquidated Damages: Contractor shall be entitled to a grace period of two (2) weeks past the agreed Sunoco In-Service Date set forth in the Purchase Order and/or Subsequent Change Orders, during which period no liquidated damages will be assessed. If the Contractor fails to meet the requirements the Agreement and any subsequent Purchase Orders and/or Change Orders, after such grace period, then the Contractor shall, as the sole monetary remedy for delay, pay to Sunoco by way of liquidated damages and not as a penalty for a failure to achieve timely completion, 1 percent (1 %) of the Agreement price per week (or part of a week) subject to an overall liability cap equal to a percentage of the Agreement price as agreed to between the parties and set forth in the Purchase Order terms. The Parties agree that the levels of liquidated damages agreed to represent a reasonable pre-estimate of the losses likely to be suffered by Sunoco in the event that each applicable time for completion is not met and are not in the nature of a penalty. These amounts are agreed upon and fixed because of the difficulty of ascertaining the exact amount of loss that Sunoco would suffer in such circumstances and shall be applicable regardless of the actual loss that Sunoco sustains.

ARTICLE V: PRICE AND PAYMENT

5.1 Price: As total consideration for this Work to be performed hereunder, Sunoco shall pay contractor pursuant to Exhibit C – Compensation, as and to the extent modified by Purchase Orders and subsequent Change Orders; such payment to be paid in accordance with the payment provisions included herein. Contractor shall submit its schedule of rates on an annual basis, but not more than one time in any twelve month period. If Contractor submits a schedule of rates during any twelve month period that contains a rate increase from the previous twelve month period, Sunoco shall not be obligated to compensate contractor for such rate increase unless approved by Sunoco in writing by way of an Amendment to the Agreement duly executed by the parties. If the Project is bid as a Lump Sum, in whole in or in part, upon submission of the

executed Purchase Order, Contractor shall execute and submit a Lump Sum Acknowledgement, a copy of which is attached hereto as Exhibit D.

5.2 Lump Sum Breakdown: If the Project set forth in a Purchase Order is a Lump Sum, in total, or in part, Contractor shall provide a Lump Sum Breakdown of the Lump Sum cost, including costs for mechanical labor, civil labor, equipment, materials, etc. This breakdown does not constitute Unit Prices, but will be used for progress payments or development of estimates for requested changes that will be lump sum in nature.

5.3 Invoicing: Subject to all terms and conditions contained herein, for projects without agreed upon milestone payments, Subcontractor shall submit an Invoice to Sunoco once a month for work completed during the preceding month. All invoices must contain the correct and appropriate Purchase Order number and must be approved by Sunoco's representative. Ninety percent (90%) of the Work satisfactorily completed is payable in accordance with Section 5.4. Final payment of ten (10%) retention will be due after Contractor has met all requirements under this Agreement, and all releases are received to the effect that the work has been performed and there are no unsatisfied or undischarged claims, demands, losses, liens, attachment or encumbrances arising out of the agreement. Payment by Sunoco does not constitute a waiver of any of Sunoco's rights under this Agreement, nor constitute or imply acceptance by Sunoco of any portion of the work. Acceptance of final payment by Contractor shall constitute a release and waiver by Contractor of all claims Subcontractor has or may have against Sunoco.

5.3.1 All invoices submitted by Contractor shall be based on the most recent schedule of values submitted by Contractor and approved by Sunoco in accordance with the Contract Documents. The Schedule of Values, which is to have been provided with the Contractor's bid package, shall allocate the entire Contract Price among the various portions of the Work and be prepared in such form and supported by such data to substantiate its accuracy as Sunoco may require. In some instances bid sheets are incorporated in the bid packages and the Schedule of Values is based on them in development in the Scope of Work. This schedule of values, if approved by Sunoco, shall be used as the basis for reviewing Contractors invoices. Invoices submitted shall indicate the percentage of completion of each portion of the work as of the end of the period covered by the invoice. The estimated percentage of completion of each portion of the percentage of each portion of the work in the schedule of values is to be determined by Sunoco. Sunoco's determination is final and binding on Contractor. Sunoco and any other party whose approval is required by Contract documents shall have the right of inspection and verification of the invoice. Contractor shall also provide partial lien waivers from its subcontractors and suppliers when required by Sunoco.

5.3.2 Progress payments to be calculated as follows:

- (i) Take that portion of the Contract price properly allocable to completed work as determined by multiplying the percentage completed of each portion of the Work by the share of the total contract price allocated to that portion of the work in the Schedule of Values, less that percentage actually retained, if any, from payment to the Sunoco on account of the Work of Contractor.
- (ii) Add that portion of the contract Price properly allocable to materials and equipment delivered and suitably stored at the site by Contractor for subsequent incorporation into the Work, or, if approved in advance by Sunoco,

suitably stored off site at a location agreed upon in writing, less the percentage of retainage as set forth above.

- (iii) Subtract the aggregate of previous payments made by Sunoco; and
 - (iv) Subtract amounts, if any, which are related to Work of Contractor for which Sunoco has withheld or nullified, in whole or in part, for a cause which is the fault of Contractor.
- 5.3.3 Invoices submitted by Contractor shall have the attached Waiver of Lien form properly completed and signed by an officer or duly authorized individual on behalf of Contractor. Final Invoice will also be supported by the Final release form identified as Exhibit E. Any Invoice submitted by Contractor without the completed Waiver of Lien form and/or Final Release for will be rejected. Both the Waiver of Lien and Final Release must be signed by an owner, principal, partner, authorized officer or duly authorized individual of Contractor and must be notarized by a licensed Notary Public.
- 5.3.4 Contractor agrees to accept the specified compensation as full compensation for doing all work and furnishing all material contemplated by and embraced in the Contract for all loss or damage arising out of the nature of the Work or from the action of the elements from any unforeseen or unknown difficulties or obstructions which may arise or be encountered in the prosecution of the Work until its acceptance for all risks of every description connected with the Work.

5.4 Payment Terms: Sunoco shall make payment of all sums due and owing to Contractor, Net 60 days or 2% Net 30 upon receipt of a invoice which contains a valid Purchase Order Number.

5.5 Materials Payment: Sunoco will not pay for materials purchased and stored for use in the Work, but not yet incorporated into the Work, unless Sunoco has expressly agreed to such payments, in writing, and then only on the following conditions: (1) Contractor shows that payment is being requested only for a reasonable amount of material, necessary to support its prompt performance of the Work; (2) the material has been properly stored on the Project site or other property approved by Sunoco; (3) Contractor certifies that it has inspected the material and that it is not subject to any defect or non-conformity that could reasonably be discovered by careful inspection; and (4) upon Sunoco's request, Contractor will execute documentation to confirm that good title to Sunoco will pass upon payment.

5.6 Acceptance: Neither progress payments, milestone payments, partial nor entire use or occupancy of the Work by Sunoco, shall constitute an acceptance or approval of any of Contractor's Work that is defective or otherwise is not in accordance with the Contract, or constitute a waiver of any claim or right that Sunoco may then or thereafter have against Contractor.

5.6 Retainage: Sunoco shall withhold ten percent (10%) of the amount of all invoices as retention.

5.5.1 Upon notice that subcontractors are unpaid, or a lien notice has been received, Sunoco reserves the right, upon notice to contractor and a reasonable time to cure, to pay subcontractor out of the retainage held in accordance with section 5.5 above.

5.52 If Contractor fails to complete all work required to reach the Completion Date in on time, Sunoco maintains the right to take over the work and reduce the retainage to cover the uncompleted work, including any increased costs incurred by Sunoco in doing so.

5.7 Taxes and Fees: Unless otherwise required by law, Contractor has exclusive liability for sales, use, excise and other taxes, charges or contributions with respect to or imposed on any material or equipment supplied or Work performed by Contractor, including such taxes or contributions imposed on the wages, salaries or other payments to persons employed by Contractor or its subcontractors in the performance of this Contract. Contractor shall pay all such taxes, charges, or contributions before delinquency or discount date and shall indemnify and hold Sunoco harmless from any liability and expense by reason of Contractor's failure to pay such taxes, charges or contributions. Upon request made by Contractor, Sunoco will provide Contractor with a tax exempt certificate for any Projects that are deemed tax exempt.

Sunoco shall not be responsible for the direct payment of any withholding taxes, social security payments, payment under workers' compensation or other insurance premiums, or other charges of any kind or nature, except as specifically outlined herein. Contractor hereby certifies that he will deduct and pay over to the proper governmental authority any withholding taxes or similar assessment which an employer is required to deduct and pay over. Contractor accepts exclusive liability for any payroll taxes or contributions imposed by any federal, state or other governmental authority, covering its agents or employees.

Contractor assumes full responsibility for and agrees to pay for, and agrees that the price to be paid by Company as set forth herein shall be fully inclusive of all labor, including overtime as legally required, all overhead, and all contributions and taxes payable under federal and state social security acts, old age pension, worker's compensation laws, unemployment compensation laws, and income tax laws and any other applicable laws as to all of its employees and agents engaged in the performance of the work hereunder; and Contractor hereby agrees to indemnify and save Company harmless against the consequences of any failure by Contractor or any of its subcontractors to pay or withhold taxes, charges, or compensation due on behalf of its employees or agents involved in the work.

5.8 Final Acceptance: After Sunoco has acknowledged final acceptance of the Work, Contractor shall submit to Sunoco its invoice for final payment. As a condition precedent to final payment, Contractor shall deliver (1) a full release of liens in such form as Sunoco may require; (2) all warranty and guarantee documents required by this Contract; (3) any instruction or operation manuals or instructions required by this Contract; and (4) all other documents delivery of which is required by provisions elsewhere in the Contract Documents. If any liens have been threatened or asserted against Sunoco or its property as a result of the Work and have not been removed by Contractor, Contractor may be required to post a bond, or other form of security acceptable to Sunoco, covering liability and costs (including attorneys' fees) arising from the lien claim as a condition of receiving final payment.

5.9 Final Payment: Acceptance of final payment shall constitute a waiver of all of Contractor's claims and liens relating to or arising from the Work or this Contract.

Final payment to Contractor (including the remaining ten percent (10%)) shall be made by Sunoco only after presentation of Contractor's final adjusted invoice (initialed and dated by Sunoco's Representative), accompanied by an executed Contractor's Completion Affidavit (when required by Sunoco) attached hereto as Exhibit "F", and properly supported by evidence (including, if requested by Sunoco, releases or waivers of all liens, form of which is attached hereto as Exhibit "E", or claims for property damage and proof of payment of all taxes and other obligations assumed hereunder, arising out of or in connection with the Work by all persons, firms, corporations, or agencies of government on whose behalf such liens or claims could be or have been filed) satisfactory to Sunoco, that all charges for labor and material incorporated in the Work and all other damages or indebtedness connected with the Work for which such liens or claims could be filed have been paid and that the Work is free of all liens, claims and encumbrances. Such payment shall be made by Sunoco pursuant to Contractor's final adjusted invoice following Sunoco's receipt of evidence of payment of obligations and receipt of such invoice and final inspection report from Sunoco's representative advising that the Work has been satisfactorily completed. Sunoco's payment of this invoice shall constitute its acceptance of the Work. Acceptance by Contractor of such final payment shall constitute a waiver by it of all claims against Sunoco related to or arising out of this Agreement. Such final acceptance and payment by either party hereto shall not, however, release Contractor and its surety from any unperformed obligations hereunder.

5.10 Payment withholding: Sunoco may withhold payments if any of the following occurs: (1) the Work is defective and the defects have not been remedied; (2) Contractor fails to perform the Work in accordance with this Contract; (3) Contractor has failed to pay subcontractors or suppliers promptly, or has made false or inaccurate certifications that payments to subcontractors or suppliers are due or have been made; (4) any construction lien or mechanic's lien claim has been filed against Sunoco, the Project site or any portion thereof or interest therein, or any improvements on the Project site in violation of the terms of this Contract, and Contractor, upon notice, has failed to remove the lien, by bonding it off or otherwise, within the time allowed by this Contract; or (5) Sunoco has reasonably determined that Contractor's progress has fallen behind the Project Schedule, and Contractor fails, within five business days of Sunoco's written demand, to provide Sunoco with a realistic and acceptable plan to recover the delays or to accelerate the Work as directed, (6) Damage to another Contractor attributable to the actions or inactions of Contractor; (7) Damage to Sunoco's property attributable to the actions or inactions of Contractor; or (8) Damage to the property of others attributable to the actions or inactions of Contractor.

5.11 Disputed Invoices: In the event Sunoco disputes the amount or content of any invoice, Sunoco shall not be responsible for payment of such invoice or portion of such invoice that is in dispute until such time as the disputed portion is resolved. Notwithstanding disputes concerning any invoices, Contractor shall continue to diligently prosecute the work.

5.12 Offset: Sunoco shall be entitled to offset from any sum due Contractor hereunder against any obligations Contractor may owe to Sunoco under this or any other contract with Contractor.

VI. REPRESENTATION, WARRANTIES AND RESPONSIBILITIES

6.1 Representations: Contractor represents and warrants that Contractor is engaged in the business of, and has developed the requisite expertise for performing the Work. Contractor and its agents, employees, and subcontractors have the capability, experience, expertise and means required to perform the Work and the Work will be performed using personnel, equipment, and

materials qualified and/or suitable to do the work requested. Contractor acknowledges that Sunoco is relying on the Contractor's expertise and knowledge in performance of the Work. Contractor shall perform the Work:

(1) with due diligence and in a safe, workmanlike, and competent manner, in accordance with sound construction practices and standards and Sunoco's approved practices and standards;

(2) in compliance with all applicable laws, codes, regulations or other standards applied by any governmental entity having jurisdiction over the Work and shall secure, at its expense, all necessary permits and licenses, including but not limited to applicable state contractor licenses, for the performance and completion of the Work, including by not limited to the operation, hauling and transportation of all materials and/or equipment needed, used or supplied in and for the Work, and Contractor shall pay in connection therewith, without reimbursement from Sunoco, all valid and applicable fees, assessments or taxes levied by units of government with jurisdiction imposed by law on Contractor or Sunoco as a result of Work performed by Contractor, its subcontractors, vendors, agents or representatives,

(3) in accordance with all applicable manufacturer's requirements;

(4) in accordance with all applicable standards and codes; and

(5) in accordance with the provisions of this Contract.

6.2 Warranties. Contractor's warranty for services provided shall extend for twenty-four (24) months from final Completion Date by Sunoco. If the Contract requires warranty terms that are of longer duration or require a higher standard of performance than is set forth in this Section, the more stringent or extensive warranty requirements shall apply. This warranty shall be in addition to, and shall not limit, any warranty of materials provided by any manufacturer or supplier of equipment or materials incorporated in the Work, and any other remedies Sunoco may have pursuant to applicable law. The warranty shall not be deemed to establish a period of limitation or prescription within which such other rights or remedies must be asserted.

6.3 Project Examination: Contractor represents that, before executing this Contract, it has, acting as a skilled and experienced contractor, conducted a careful investigation and examination of the Project site to ascertain the nature and location of the site and other reasonably discoverable conditions that may affect its Work, including topographical features, water on or near the site, roads, the size and shape and topography of the site and its ability to accommodate the various trades and any required storage, features affecting transportation, vegetation or physical barriers, rocks, rubble, or existing structures or impediments to construction, and the like. Contractor also represents that it has, before executing this Contract, carefully examined all information provided by Sunoco concerning soils or subsurface conditions, as-built conditions, location of existing underground utilities and services at the site, and any other information concerning the site or structures on it, and has independently verified the location of all utilities.

6.4 Site Review: It shall be the responsibility of the Contractor to examine, and Contractor specifically represents that it has carefully examined the sites and routes of the Work, and is acquainted thoroughly with all conditions likely to be encountered in performing the Work. In relation to the project site, Contractor has taken into account all facets of the job, including, but not limited to, the items listed below as they relate to the specifications and the conditions which

may be encountered in performing the Work, and Contractor's price reflects consideration of all of them, to wit:

1. Low areas, which could be wet during construction
2. Normal and abnormal weather conditions other than Force Majeure event;
3. Completion of project in order to meet the In-Service Date;
4. Labor conditions and availability;
5. Rail locations;
6. Material type and size, fuel costs, and equipment availability;
7. Road load limits;
8. Special taxes, assessments, or use fee;
9. Availability and disposal of clean, non-alkaline water for hydrostatic testing;
10. Crossing of Sunoco or third party pipelines;
11. Equal Opportunity/Affirmative Action/Drug Testing responsibilities
12. Applicable federal, state and local laws, ordinances, statutes, rules, regulations, permits and orders;
13. Applicable federal, state and local environmental and safety standards;
14. All rock removal and disposal;
15. All underground structures and subsurface conditions, including, but not limited to underground utilities
16. Crop irrigation systems;
17. Utilities or Rights of Way;
18. Water crossings of any kind;
19. All surface and subsurface conditions including, but not limited to timber, crop fields, or berms;
20. The existence of any federal or state classified threatened and or endangered species and/or birds covered under the Migratory Bird Treaty Act;
21. Access and limitations to work area due to physical structures or operational policies that are communicated by a Sunoco Representative; and
22. The likelihood or existence errors or omissions in plans, specifications, or drawings provided to Contractor. If Contractor is aware, or notes any errors or omissions in plans specifications, or drawings provided, they will notify Sunoco of same. Costs incurred for work and rework resulting from work performed with failure to notify, shall be borne by Contractor.

6.5 Scope Impact Notification: With respect to sections 6.3 and 6.4 above, Contractor shall advise Sunoco of any and all potential changes to the scope as described herein, schedule, or cost prior to any work beginning.

6.6 Payment to Materialmen: Contractor will make timely payments to all materialmen, subcontractors and suppliers for materials and services furnished by them for the Work, and failure of the Contractor to so perform shall be deemed a breach hereof.

6.7 Warranty of Title: Contractor warrants good title to all Work and warrants and guarantees that title, when it passes to and vests in Sunoco, will be free and clear of any liens, claims, charges, security interests, encumbrances and rights of any type or kind.

6.8 Material Warranty: If Contractor is supplying materials or equipment under this Contract, Contractor shall obtain standard commercial warranties from all material or equipment manufacturers. If Sunoco so requests, Contractor shall also provide reasonable assistance in determining whether superior warranty terms are available from a vendor and in obtaining such terms for Sunoco. If warranty terms are available, but only at increased cost, and Sunoco elects to obtain such terms, Sunoco shall pay the additional cost, over and above the Contract sum. Such guarantees shall run directly to Sunoco and its affiliates and Contractor shall render all reasonable assistance to Sunoco in enforcing such warranties. If a vendor or subcontractor fails to provide such guarantees and warranties or is unable or unwilling to guarantee the material and equipment to be free of faulty design, workmanship and materials by reason of the vendor or subcontractor is relying upon contractor's process or mechanical calculations, in the design and manufacture of the materials and equipment, the Contractor shall guarantee to Sunoco and its successors and assigns that such materials and equipment will be free of faulty design, materials and workmanship for a period of twenty-four (24) months from Sunoco's final acceptance of the work. Contractor guarantees the Work for a period of twenty-four (24) months from the Sunoco's final acceptance.

6.9 Repair/Replacement: Within five (5) days after being notified in writing by Sunoco of any breach of Contractor's warranties or any non-conformity to the Agreement or drawings and specifications, Contractor shall commence, and thereafter complete as rapidly as reasonably possible, repair or replacement of the defective or non-conforming Work, at Contractor's sole expense. In addition, Contractor shall, at its sole expense, repair or replace any portions of the Work (or work of other contractors) damaged by the non-conforming Work or which becomes damaged in the course of repairing or replacing defective Work. For any Work so corrected, Contractor's obligation hereunder to correct defective Work shall be reinstated for longer of (1) the remainder of the original warranty period or (2) six (6) months from the date on which the corrected Work is accepted. Final payment by Sunoco or final acceptance of the Work shall not relieve Contractor from its responsibilities under this Section. **In the event the Work performed by Contractor for Sunoco is incorrect, defective or otherwise in error, the Contractor shall indemnify and hold Sunoco, its parent and affiliated companies and limited partnerships in which Sunoco, its parent and/or affiliated companies act as general partner, and their officers, directors, employees and agents harmless from and against all damages, losses, costs and expenses (including attorney's fees) which Sunoco may incur by reason of Contractor's error**

6.10 Sunoco's Right to Repair: Alternatively, if in the sole discretion of Sunoco, the defective or non-conforming Work creates an immediate risk to person or property or is critical to Sunoco's operations, Sunoco may undertake the repair or replacement of the defective or non-conforming Work and back charge Contractor for all reasonable costs associated with the repair or replacement of the defective or non-conforming Work. In no event, will any work undertaken pursuant to this Section limit, impair or void any warranties provided by Contractor.

6.11 Effects on Rights and Remedies: The warranties set forth herein shall not affect or limit any of Sunoco's other rights or remedies provided by the Contract or applicable law and shall not

be deemed to establish a period of limitation or prescription within which such other rights or remedies must be asserted.

VII. EXTRA WORK- CHANGE

7.1 Extra Work: Sunoco may require Contractor to perform Work or furnish materials or equipment or the use thereof, in connection with the Work which arises outside and is independent or not otherwise included in this Agreement or its scope (hereinafter referred to as "Extra Work"). Extra work may be occasioned by major change in design or specification requiring work of both a materially different nature and cost from that contemplated at the time of execution of this Agreement, or the performance of other additional Work incident to the completion of the Project or facilities here involved, but not in contemplation of the parties at the time of execution of this Agreement. Contractor shall not perform any Extra Work without having first secured written authorization from Sunoco (by Change Order). Such authorization will describe the Extra Work to be performed and specify the schedule to complete the changes, the impact of this change upon the base work with respect to cost, scope or schedule, price to be paid therefore, or the basis on which such price will be calculated. In the event that there is a change agreed to between the parties, Contractor shall provide a basis for the cost change, which shall include (1) unit price (2) lump sum breakdown and/or (3) competitive bid estimates. At a minimum a change order request shall provide work to be performed, work hours planned, materials and equipment to be used and the cost of each; such information shall be provided whether the project is a lump sum, time and material, unit price, or cost reimbursable. Should Contractor perform Extra Work without advance written authorization from Sunoco Representative, such Extra Work will be at Contractor's expense.

7.2 Cost Change Estimates: All change estimates shall be inclusive of all costs. Notwithstanding anything contained herein to the contrary, Sunoco shall not be responsible for any costs which are not submitted for approval, including but not limited to: stacking of trades; crew productivity and inefficiency; concurrent operations; dilution of supervision; logistics; ripple effects; overtime, weekends and holidays worked.

VIII. INSPECTION AND TESTING; RECORDS AND AUDIT

8.1 Inspection and Testing: Sunoco Representative may, at its option, visit the Work site at intervals appropriate, to keep familiar with the progress and quality of the Work, as well as to determine if the Work is proceeding in accordance with the Agreement. However, the Sunoco Representative will not be required to make exhaustive or continuous on-site inspections to check the quality of the Work

Except as required by law, Sunoco Representative will not be responsible for and will not have control or charge of the means methods techniques sequences or procedures or for safety precautions and programs in connection with the Work and the Sunoco Representative will not be responsible for Contractor's failure to carry out the Work in accordance with the Agreement. The Sunoco representative will not be responsible for or have control or charge over the acts or omission of Contractor, its subcontractors, or any of their agents or employees, or any other persons performing the work.

Sunoco Representative shall at all times have access to the Work wherever it is in preparation or progress and to any other location where equipment or material for the Work, if any, is being

fabricated or stored by Contractor or its subcontractors. All Work shall be performed in a Workmanlike manner and shall meet with the approval of Sunoco's Representative; provided, however, that no inspection or suggestion by Sunoco's Representative or Sunoco's employees or agents shall operate to control the method of performance of the Work hereunder, the manner and method of performing the same being under the sole control and direction of Contractor, Sunoco having interest only in the results obtained, and Contractor shall perform all Work hereunder as an independent contractor.

8.2 RECORDS AND AUDIT. Contractor shall keep accurate daily records of account for all Work performed, and shall provide copies to Sunoco (except Work for which a fixed price has been quoted), which itemize the names of employees, the hours worked by each, the type of work performed, the wages paid, equipment and materials used and any other item of cost for which Sunoco is required to reimburse Contractor. Sunoco, its agents or assigns, shall have the right, at all reasonable times during regular business hours, to inspect and audit such records. Contractor shall preserve such records for 36 months after completion, cancellation or termination of this Contract.

If the audit discloses that either party owes money to the other, any sums due will be paid within thirty (30) days after the sum due is agreed upon by the parties or determined by a court or other dispute resolution tribunal. In any event, Contractor's right to recover any alleged underpayment shall be waived, unless a claim in writing with full support documents is received by Sunoco within 180 days after the end of the particular contract year, or the contract term, if less than a year.

IX. RISK OF LOSS PASSAGE OF TITLE

9.1 Risk of Loss and Passage of Title: (a) Contractor shall be responsible for all materials, equipment and/or work until acceptance thereof by Sunoco and shall be required to repair, to the satisfaction of Sunoco, or pay for any loss, injury or damages which said materials, equipment and/or Work may sustain from any source or cause whatsoever before acceptance of the Work. Contractor, at its sole cost, shall be responsible for and obligated to replace, repair, or reconstruct the Work and any material, equipment, or supplies furnished for the Work which is lost, damaged, or destroyed prior to acceptance of the Work by Sunoco however, such loss shall occur. Contractor shall be responsible for repair and replacement of any of the Sunoco's other property, other than the Work covered by this Contract, or the property of third parties which is lost, damaged, or destroyed by the act or omission of the Contractor, its employees, agents and subcontractors. (b) Sunoco shall have title to all Work completed or in progress and to all machinery, equipment, materials and supplies, the cost of which has been paid to Contractor. All studies, specifications, test results, reports, in whatever state of completion prepared by Contractor in exchange for consideration hereunder shall be the property of Sunoco upon completion or termination of this Contract. Sunoco shall have the right to use same for any purpose whatsoever without right on the part of Contractor to any additional compensation therefore.

9.2 Contractor warrants that title to all work covered by an invoice shall pass to Sunoco at the earlier of the incorporation into the project or the time of payment. Contractor also warrants that, upon submittal of an invoice, all Work for which payments have been received from Sunoco, will be free and clear of liens, claims, security interests, or encumbrances in favor of Contractor or any other person or entity performing construction at the Project site or furnishing materials or

equipment relating to the Work, and all necessary documentation, such as Release of Liens, shall be provided.

X. RIGHT-OF-WAY; INGRESS AND EGRESS

10.1 Contractor Duty to Remain Within Right-Of-Way or Project Limits: Contractor acknowledges that it must perform its work within the right-of-way area or project limits as described in the plans, specifications, and this Agreement or any related part thereto. Contractor further acknowledges that in the event Contractor, its agents, subcontractors, vendors or representatives deviate from the right of way area, Contractor may incur, amongst other things, trespass damages. Contractor shall not deviate from the right-of-way area, unless directed or approved by Sunoco in writing. **CONTRACTOR SHALL INDEMNIFY SUNOCO AND HOLD SUNOCO HARMLESS FOR ANY AND ALL COSTS, EXPENSES, AND LIABILITIES OF SUNOCO AS A RESULT OF ANY DEVIATION FROM THE PROPOSED RIGHT-OF-WAY BY CONTRACTOR, ITS AGENTS, SUBCONTRACTORS, VENDORS OR REPRESENTATIVES, EXCLUDING HOWEVER, ANY AND ALL COSTS, EXPENSES AND LIABILITIES RESULTING FROM A DEVIATION DIRECTED BY SUNOCO OR ITS REPRESENTATIVE IN WRITING.**

10.2 Right Of Ingress And Egress: To the extent necessary, Sunoco will furnish all rights-of-way and rights of ingress and egress necessary for the prosecution of the Work. Contractor shall not enter upon private property until all rights-of-way and rights of ingress and egress have been secured and verbal and/or written notification of such has been given to Contractor by the Sunoco Representative. Contractor shall comply fully with any and all terms and conditions contained in such rights-of-way and rights of ingress and egress and shall fully indemnify Sunoco, its parent and affiliated companies, in the same manner as set forth herein, for any costs and expenses incurred by Sunoco, its parent and affiliated companies, as a result of any non-compliance therewith by Contractor.

XI. INDEMNITY, INFRINGEMENT, INSURANCE AND BONDING.

11.1 Indemnity: TO THE FULLEST EXTENT PERMITTED BY LAW, CONTRACTOR AGREES TO INDEMNIFY, DEFEND, RELEASE AND HOLD HARMLESS SUNOCO, ITS PARENT AND AFFILIATE COMPANIES, PARTNERS, LIMITED PARTNERSHIPS IN WHICH SUNOCO, ITS PARENT AND/OR AFFILIATED COMPANIES ACT AS GENERAL PARTNER, SUCCESSORS, ASSIGNS, LEGAL REPRESENTATIVES, OFFICERS, DIRECTORS, SHAREHOLDERS, INSURERS, AGENTS AND EMPLOYEES (COLLECTIVELY "SUNOCO INDEMNITIEES") FROM AND AGAINST ANY AND ALL CLAIMS, DEMANDS LOSSES, DAMAGES, CAUSES OF ACTION, SUITS AND LIABILITIES OF EVERY KIND, INCLUDING ALL EXPENSES OF LITIGATION, COURT COSTS, AND ATTORNEY'S FEES FOR INJURY TO OR DEATH OF ANY PERSON, OR FOR LOSS OF DAMAGES (EXCLUDING PUNITIVE AND EXEMPLARY) TO ANY PROPERTY (INCLUDING WITHOUT LIMITATION, CLAIMS FOR POLLUTION AND ENVIRONMENTAL DAMAGE), PRODUCT LIABILITY AND STRICT LIABILITY AND CIVIL OR CRIMINAL FINES OR PENALTIES, DISCOVERED OR UNDISCOVERED,

DIRECTLY OR INDIRECTLY ARISING OR ALLEGED TO ARISE OUT OF OR IN ANY WAY INCIDENTAL TO (I) ANY BREACH OR NON-COMPLIANCE WITH ANY TERM OR PROVISION OF THIS AGREEMENT, BY THE CONTRACTOR, ITS EMPLOYEES, SUBCONTRACTORS, VENDORS, AGENTS REPRESENTATIVES, ASSIGNS, SUCCESSORS, AFFILIATED COMPANIES, OR ANY OTHER PERSON FOR WHOM THE CONTRACTOR IS RESPONSIBLE IN THE LAW, RELATED TO THIS AGREEMENT OR THE PERFORMANCE OF NON-PERFORMANCE OF THE WORK HEREUNDER (COLLECTIVELY "CONTRACTOR'S LIABILITIES"). THIS INDEMNITY INCLUDES CONTRACTORS AGREEMENT TO PAY ALL COSTS AND EXPENSES OF DEFENSE, INCLUDING WITHOUT LIMITATION REASONABLE ATTORNEY'S FEES INCURRED BY ANY SUNOCO INDEMNITTEE. THIS INDEMNITY SHALL APPLY WITHOUT LIMITATION TO ANY "CONTRACTOR LIABILITY" IMPOSED ON ANY PARTY INDEMNIFIED HEREUNDER AS A RESULT OF ANY STATUTE, RULE, REGULATION OR THEORY OF STRICT LIABILITY INCLUDING BUT NOT LIMITED TO STRICT PRODUCTS LIABILITY OR STRICT STATUTORY LIABILITY. CONTRACTOR EXPRESSLY ASSUMES, TO THE EXTENT OF ITS RELATIVE FAULT, ANY AND ALL "CONTRACTOR LIABILITIES" ARISING IN FAVOR OF ANY THIRD PARTY OR GOVERNMENTAL AGENCY OR ENTITY, THE PARTIES HERETO, THEIR EMPLOYEES AND THEIR EMPLOYEES' REPRESENTATIVES AND BENEFICIARIES. THIS INDEMNIFICATION SHALL NOT BE LIMITED TO DAMAGES, COMPENSATION, OR BENEFITS PAYABLE UNDER INSURANCE POLICIES, WORKERS' COMPENSATION ACTS, DISABILITY BENEFITS ACTS OR OTHER EMPLOYEES' BENEFITS ACTS. ALTHOUGH CONTRACTOR HAS CAUSED THE INDEMNITIEES TO BE NAMED AS ADDITIONAL INSURED UNDER THE CONTRACTOR'S POLICIES OF INSURANCE, CONTRACTOR'S LIABILITY UNDER THIS INDEMNIFICATION SHALL NOT BE LIMITED TO THE LIABILITIES LIMITS SET FORTH IN SUCH POLICIES. If this Contract relates to Work of any kind performed in Ohio, **CONTRACTOR EXPRESSLY AND SPECIFICALLY WAIVES ITS STATUTORY AND CONSTITUTIONAL WORKERS' COMPENSATION IMMUNITY UNDER OHIO LAW AND INCLUDING ANY AMENDMENTS TO THIS CONTRACT.** This Section shall survive termination or cancellation of this Contract. CONTRACTOR FURTHER AGREES, EXCEPT AS MAY BE OTHERWISE SPECIFICALLY PROVIDED HEREIN, THAT THE OBLIGATIONS OF INDEMNIFICATION HEREUNDER SHALL INCLUDE, BUT NOT BE LIMITED TO THE FOLLOWING:

- a. LIENS BY THIRD PERSONS AGAINST THE SUNOCO, ITS PARENT AND AFFILIATED COMPANIES AND THEIR PROPERTY, BECAUSE OF LABOR, SERVICES, MATERIALS, OR ANY OTHER TYPE OF LIEN, FURNISHED TO THE CONTRACTOR, ITS ASSIGNS OR SUBCONTRACTORS, IN CONNECTION WITH THE WORK PERFORMED BY CONTRACTOR HEREUNDER AND CONTRACTOR SHALL REQUIRE ALL SUBCONTRACTORS OR VENDORS PROVIDING LABOR, SERVICES OR MATERIALS IN CONNECTION WITH THE WORK TO EXECUTE A LIEN WAIVER PRIOR TO CONTRACTOR'S PAYMENT TO SAID SUBCONTRACTOR OR VENDOR. SAID LIEN WAIVER SHALL EXPLICITLY SET FORTH THE SUBCONTRACTOR'S RELEASE AND WAIVER OF ANY AND ALL MECHANIC'S LIEN OR RIGHT OF LIEN WHICH ACCRUES OR

MAY ACCRUE TO SAID SUBCONTRACTOR OR VENDOR AND PROPERLY SETTING FORTH SUNOCO AS THE OWNER OF THE WORK. CONTRACTOR SHALL PROVIDE SUNOCO COPIES OF ALL EXECUTED SUBCONTRACTOR OR VENDOR LIEN WAIVERS.

- b. EXPENSES, CLAIMS, FINES, AND PENALTIES OR OTHER ENFORCEMENT CHARGES, RESULTING FROM THE FAILURE OF CONTRACTOR TO ABIDE BY ANY AND ALL VALID APPLICABLE LAWS, RULES OR REGULATIONS OF ANY GOVERNMENTAL OR REGULATORY AUTHORITY WITH JURISDICTION.

CONTRACTOR SHALL WAIVE AND RELEASE AND DOES HEREBY WAIVE AND RELEASE ANY AND EVERY MECHANIC'S LIEN OR RIGHT OF LIEN WHICH ACCRUES TO IT AT ANY TIME UPON ANY REAL ESTATE, BUILDINGS, OR STRUCTURE OF THE SUNOCO, ITS PARENT OR AFFILIATED COMPANIES OR IF WORK IS TO BE PERFORMED ON PROPERTY OF THIRD PARTIES, EVERY MECHANIC'S LIEN OR RIGHT OF LIEN WHICH ACCRUES TO IT UPON ANY REAL ESTATE BUILDING OR STRUCTURE OF SUCH THIRD PARTIES, AS A RESULT OF THE PERFORMANCE OF THE WORK.

CONTRACTOR SHALL ASSUME ALL RESPONSIBILITY FOR, INCLUDING CONTROL AND REMOVAL OF, AND PROTECT, DEFEND, AND SAVE HARMLESS SUNOCO FROM AND AGAINST ALL CLAIMS CAUSED BY CONTRACTOR OR CONTRACTOR'S EMPLOYEES, AGENTS REPRESENTATIVES, INVITEES OR SUBCONTRACTORS, ARISING FROM POLLUTION OR CONTAMINATION, WHICH MAY BE IMPOSED UPON OR INCURRED BY OR ASSERTED AGAINST SUNOCO BY ANY OTHER PARTY OR PARTIES (INCLUDING GOVERNMENTAL ENTITIES), IN CONNECTION WITH ANY ENVIRONMENTAL CONDITIONS INCLUDING ANY ALLEGED EXPOSURE OF ANY PERSON TO ENVIRONMENTAL CONDITIONS) OR THE REMEDIATION OF ANY ENVIRONMENTAL CONDITIONS (WHETHER NOW KNOWN OR HEREAFTER DISCOVERED) OR ANY ENVIRONMENTAL NONCOMPLIANCE ARISING OUT OF, RESULTING FROM OR ATTRIBUTABLE TO THE PERFORMANCE OF OR FAILURE TO PERFORM THE WORK OR THE PROVISIONS OF THIS CONTRACT.

SUNOCO DOES NOT GIVE CONTRACTOR ANY INDEMNITY OF ANY KIND IN CONNECTION WITH THIS CONTRACT OR THE WORK, AND NO SUCH INDEMNITY SHALL BE IMPLIED BY THE TERMS OF THIS AGREEMENT, THE CONDUCT OF THE PARTIES, THE RELATIONSHIP OF THE PARTIES, OR OTHERWISE.

Sunoco shall notify Contractor of any claim that has given or could give rise to a right of indemnification hereunder or that may be presented to it by any party. Contractor shall, at its sole cost and expense, investigate, handle, respond to, and provide defense for any claim for which it gives indemnity herein; provided that Sunoco shall have the right and opportunity to participate in any such investigation and defense. At Sunoco's sole discretion and option, exercisable at any time, Sunoco may itself undertake the defense, litigation, settlement or satisfaction of any such claim, reserving the right to seek indemnification against Contractor until after the claim is resolved, or Sunoco may direct Contractor to contest, defend, litigate, settle or satisfy any claim

made against Sunoco provided that Contractor shall not settle any claim without Sunoco's prior written consent, such consent not to be unreasonably withheld. In the event the Contractor, after receipt of notice of a Claim, fails to furnish a defense and indemnity as provided for under this provision, the Sunoco shall be entitled to receive from the Contractor its attorney's fees, costs, expenses and any amounts paid in the enforcement of this Agreement.

Sunoco shall include its members, affiliated companies, partners, co-owners, joint ventures, and each of its and their respective directors, officers, employees, agents, servants, representatives, affiliates, including Sunoco's joint interest owners and the surface fee owner(s) of the real property on which the Work is being performed or to which Contractor may have access hereunder.

In the event Contractor engages a subcontractor to perform any portion of the Work, Contractor agrees that it will obtain from each such subcontractor indemnity provisions for the benefit of Sunoco that are at least as extensive as those provided by Contractor to Sunoco. If Contractor fails to obtain an indemnity provision from any of its subcontractors, Contractor agrees to protect, defend, indemnify and hold harmless, Sunoco in the same extend as provided above, as if contractor were its subcontractors and shall carry contractual indemnity insurance therefore. Contractor's subcontractors shall carry insurance policies substantially similar to those policies as required of Contractor hereunder.

IN NO EVENT SHALL SUNOCO, OR ANY AFFILITE OR ANY LIMITED PARTNERSHIPS IN WHICH SUNOCO, ITS PARENT AND/OR AFFILIATED COMPANIES ACT AS GENERAL PARTNER BE LIABLE TO CONTRACTOR FOR ANY LOST OR PROSPECTIVE PROFITS OR ANY OTHER SPECIAL, PUNITIVE, EXEMPLARY, CONSEQUENTIAL, INCIDENTAL OR INDIRECT LOSSES OR DAMAGES (IN TORT, CONTRACT, OR OTHERWISE) UNDER OR IN RESPECT OF THIS AGREEMENT OR FOR ANY FAILURE OF PERFORMANCE RELATED HERETO HOWSOEVER CAUSED, WHETHER OR NOT ARISING FROM SUNOCO'S OR AFFILIATES' SOLE, JOINT, OR CONCURRENT NEGLIGENCE.

11.2 Infringement: Contractor warrants that neither the Work nor use thereof by Sunoco will infringe any U.S. or foreign patent, copyright, trade secret, trade mark or any other property right. Contractor shall (1) defend, indemnify and hold Sunoco harmless from any claim, suit, action or proceeding for infringement or misappropriation of trade secrets in which Sunoco, its parents and/or its respective subsidiaries and/or affiliates, is made a defendant whether for an alleged infringement of any U.S. or foreign patent, trademark or copyright or other property right arising out of the Work or use of the Work, and (2) either (a) procure for Sunoco the right to continue to use the Work, (b) replace the Work with an equivalent non-infringing product; or (c) with the approval of Sunoco, remove the Work and refund all payments made by Sunoco for the Work. Contractor also shall pay and discharge any and all judgments or decrees which may be rendered in any such suit, action or proceeding against Sunoco, its parents or their respective subsidiaries and affiliates including reasonable attorneys' fees.

11.3 Insurance: Contractor shall procure and maintain with reputable insurers with AM Best Sunoco's of not less than "A-:VII" policies of insurance written on an occurrence basis or on claims made basis (in which event insurance shall be maintained during the term of this Contract and for a period of two years following expiration or earlier termination of this Contract), or self-

insurance acceptable to Sunoco, with limits not less than those indicated for the respective items as follows:

- 11.3.1** Statutory Workers' Compensation and Occupational Disease Insurance, including Employer's Liability Insurance and, if applicable, coverage under the Longshoremen and Harbor Workers' Compensation Act, the Jones Act or other Maritime Employer's Liability, complying with laws of each jurisdiction in which any work is to be performed or elsewhere as may be required. Employer's Liability Insurance (and Maritime Employer's Liability, if applicable) shall be provided with a limit not less than: **\$2,000,000** each occurrence;
 - 11.3.2** Commercial Liability Insurance, including but not limited to all Premises and Operations, Contractual Liability, Products-Completed Operations Liability, Fire Legal Liability, Explosion, Collapse and Underground Damage Liability, Broad Form Property Damage Liability, and if applicable, Watercraft and Aircraft Liability, as well as coverage on all Contractor's mobile equipment (other than motor vehicles licensed for highway use) owned, hired or used in the performance of this Contract with limits not less than: **\$5,000,000** Bodily Injury, Personal Injury & Property Damage combined each occurrence and aggregate;
 - 11.3.3** Commercial Automobile Liability Insurance, including Contractual Liability, covering all motor vehicles licensed for highway use and employed in the performance of this Contract, with limits not less than: **\$5,000,000** Bodily Injury, Personal Injury & Property Damage combined each occurrence and aggregate.
 - 11.3.4** Contractor shall provide to the Contract Specialist certificates of insurance acceptable to Sunoco prior to commencement of performance hereunder. All insurance shall (i) provide that coverage shall not be suspended, voided, canceled, non-renewed, reduced in scope or limits except after thirty (30) days' prior written notice has been given to Sunoco; and (ii) apply separately to each insured and additional insured against whom a claim is made or suit is brought, except with respect to the limits of the insurer's liability.
 - 11.3.5** The Commercial General Liability and Automobile Liability policies shall be endorsed to add, or shall have an existing blanket endorsement so as to add, Sunoco as an additional insured; provided, however, that Sunoco shall be named as an additional insured only with respect to any claims arising out of or related to this Contract and/or Contractor's obligations hereunder; and shall provide that the coverage afforded to Sunoco as an additional insured will be primary to any other coverage available to it, and that no act or omission of Sunoco shall invalidate the coverage.
 - 11.3.6** The insurance requirement set forth herein shall not in any way limit Contractor's liability arising out of this Contract, or otherwise, and shall survive the termination/cancellation of this Contract.
- 11.4 BONDS:** If requested by Sunoco, Contractor shall furnish performance and payment bonds covering the faithful performance of this Contract. Such bonds shall be in a form and amount and with a surety satisfactory to Sunoco. The cost of such bonds, without mark-up, shall be paid by Sunoco.

XII. TERMINATION, CANCELLATION SUSPENSION AND FORCE MAJEURE

12.1 Termination for Cause: Sunoco may terminate this Contract, in whole or in part, for default if Contractor fails materially to perform any of its duties or obligations under this Contract. In particular, but without limitation, Sunoco may terminate this Contract if: (1) Contractor fails to prosecute the Work diligently, in accordance with the Project Schedule, achieve milestones set out or to make such progress in the Work as Sunoco reasonably believes is necessary to complete the Work within the time required by this Contract; or (2) Contractor fails to perform the Work in accordance with the Required Standard of Care or (3) Contractor fails to perform the Work in a good and workmanlike manner, or fails to correct defects in the Work promptly upon notice by Sunoco; or (4) Sunoco reasonably determines that Contractor has abandoned the Work, or has failed to pay any subcontractors, suppliers, or laborers when payment is due; or (5) Contractor becomes insolvent, makes a general assignment for the benefit of creditors, files a voluntary petition under any chapter of the Bankruptcy Code, has an involuntary petition filed against it, has a receiver appointed, or files for dissolution or otherwise is dissolved; or (6) Contractor fails to pay its debts in a timely manner, or (7) Sunoco has reasonably determined that Contractor does not have the financial ability to carry out its obligations under this Contract and Contractor fails to give Sunoco prompt and reasonable assurances of its ability to perform.

12.2 Notice for Termination: Except as provided in this Section, Sunoco will provide Contractor with written notice of its intent to terminate this Contract, under Section 12.1, five (5) days before actually putting the termination into effect. If Contractor has begun its curative action and has made progress satisfactory to Sunoco within the five (5) days, Sunoco may so notify Contractor and the termination will not take effect. Otherwise, the termination shall take effect after five (5) days without further notice or opportunity to cure. If Sunoco terminates this Contract for default, no further payment shall be due to Contractor and Sunoco will have the right to take over the Work, to take and use all tools, equipment and supplies then being used in connection with the Work, and to finish the Work by whatever method it deems expedient, including accepting assignment of any or all outstanding purchase orders or subcontracts. Sunoco may terminate this Contract without prior notice or an opportunity for Contractor to cure the default, if the default involves risk of personal injury or property damage, violation of Sunoco's Safety and Security Requirements, environmental issues or violations of any applicable laws, codes, regulations or other standards applied by any governmental entity having jurisdiction over the Work.

12.3 Termination for Convenience: Sunoco may, upon five (5) days' written notice to Contractor, terminate this Contract for its convenience in whole or in part at any time without cause for such termination. After issuance of said written notice, Contractor shall terminate the Work as instructed by Sunoco. If Sunoco terminates this Contract for convenience, Contractor shall receive, as its sole and exclusive remedy, payment for the Work performed up to the date of the termination and all reasonable documented wind-up costs, including, without limitation, the costs of canceling open purchase orders and demobilizing from the project site. Contractor shall use reasonable efforts to mitigate wind-up costs. Contractor shall not be entitled to recover any amounts for unabsorbed overhead, anticipated profits on the unperformed portion of the Work, or lost opportunity. After receiving a notice of termination for convenience, Contractor shall place no further orders for material or equipment, issue no further subcontracts, and shall stop Work on the date given in the notice. Contractor shall consult with Sunoco regarding the disposition of

existing orders and subcontracts, and use its best efforts to terminate them on terms favorable to Sunoco. Contractor shall likewise consult with Sunoco to decide what actions should be taken to protect Work in place and equipment or materials that have been delivered and not yet installed, and to render the project site safe.

12.3.1 If this Contract is terminated for cause, and it is later determined by the final order or judgment of a court of competent jurisdiction, arbitration entity or administrative proceeding of any type that Contractor was not in default, the parties agree that the termination shall then be considered a termination for convenience and Contractor shall receive, as its sole and exclusive remedy, those costs as set forth in Section 12.3.

12.4 Suspension of Work: Sunoco reserves the right to suspend the Work of Contractor at any time in Sunoco's sole discretion. Sunoco shall give Contractor written notice of such suspension of Work. Sunoco agrees to pay Contractor for Work performed and obligations incurred prior to the suspension and for costs that Contractor directly incurs in suspending the Work, provided that Sunoco has authorized such payments in advance. In no event shall Sunoco be liable for any costs, claims, damages or liabilities whatsoever of Contractor or its subcontractors including, without limitation, consequential, special or indirect damages, loss of anticipated profit or reimbursement, relating to unperformed Work.

12.5 Payment upon Termination: In no event shall the amount owed to Contractor, if anything, upon termination of this agreement, exceed the total Agreement price, nor shall Contractor be entitled to loss of anticipated profit or overhead with regard to terminated work.

12.6 Force Majeure: If, because of force majeure, either party hereto is unable to carry out any of the obligations under this Contract, other than the obligations to pay money due hereunder, and if such party promptly gives to the other party hereto written notice of such force majeure, then the obligations of the party giving such notice shall be suspended to the extent made necessary by such force majeure and during its continuance, provided that the party giving such notice shall use its best efforts to remedy such force majeure insofar as possible with all reasonable dispatch. The term "force majeure" as used herein shall mean acts of God; acts of public enemy; insurrections; riots; strikes; lockouts; labor disputes; fires; explosions; floods; breakdowns or damage to plants, equipment or facilities; embargoes; orders; or acts of civil or military authority; or other causes of a similar nature which are beyond the reasonable control of the party affected thereby. Any event such as fire; explosion; flood, breakdown or damage to equipment or facilities caused by Contractor's, or a subcontractors', actions or inactions shall not be deemed to be a force majeure event for the purposes of this Agreement. Upon the cessation of the force majeure event, the party that had given original notice shall again promptly give notice to the other party of such cessation.

XIII. REGULATORY, COMPLAINT WITH LAWS GOVERNMENTAL AGENCIES

13.1 Health and Safety Requirements: Contractor shall comply with all applicable local and federal safety and health requirements, including OSHA. Contractor shall also comply with Sunoco's Safety Requirements, Attached hereto as Exhibit C, or any safety directions or rules reasonably issued by Sunoco to prevent injury or assure compliance with applicable law, whether or not Contractor agrees that those directions or rules are actually required in order to comply with applicable law, and do so without demanding further compensation from Sunoco for such compliance. Sunoco, at its sole option and without liability to Sunoco, may require Contractor to remove from its property any and all personnel of Contractor or its subcontractors who violate such practices and requirements.

13.2 Compliance with Laws: Contractor shall comply with all local, state and federal rules, regulations, orders, directives and statutes applicable to wage and employment practices and shall act in the best interest of Sunoco on matters which affect area labor practices and might lead to or set precedent. Contractor agrees all work performed incident to this Contract and all goods furnished under this Contract shall conform with all applicable federal, state and local laws. In performing this Contract, Contractor shall not discriminate or permit discrimination against any person because of race, color, religion, national origin, sex, disability, covered veteran status and/or sexual orientation. Specifically, Contractor agrees to comply with the regulations set forth in the Equal Opportunity Clause at 41 CFR 60-250.5(a), 41 CFR 60-741.5(a), 41 CFR 60-1.4, Executive Order 13201 and Section 202 of the Executive Order 11246, and all amendments thereto, unless specifically exempt. In the event of such discrimination, Sunoco may, in addition to any other rights or remedies available under this Contract, at law or equity, terminate this Contract forthwith. If this contract involves work being performed in the state of New Jersey, such conformance shall include compliance by Contractor with the New Jersey Domestic Security Preparedness Act, N.J. Stat. Ann. § C.App.A:9-64 *et seq.* Contractor warrants and agrees that it has used and will continue to use due diligence to ensure that during the performance of this Contract, no officer, employee, agent or other representative of Contractor has made or will make any payment in violation of any applicable federal, state, or local law or regulation, and all amendments therein. Contractor shall supply such evidence of compliance as Sunoco may require.

13.3 Governmental Agencies: Contractor shall not have any contact with government agencies, including any taxing authorities, with regard to Sunoco Projects, without the prior notice and approval of Sunoco, unless required to do so by law. Contractor shall notify Sunoco of any and all interaction with government entities with regard to the prosecution of the work. Notice shall be provide in advance of any discussion with such entities when advance notice is possible, and immediate notice shall be provided when advance notice is not possible. Contractor shall provide copies of all documentation between Contractor and any government agencies with regard to the Project.

13.4 Governmental Clearances. Where required by law, and/or by Sunoco site procedures, Contractor and all employees, agents, subcontractors and representatives will have the appropriate Transportation Worker Identification Card (TWIC) prior to being permitted access to the facility and shall maintain a current TWIC card during the time.

13.5 Safety Data Sheet Requirements: Contractor shall contact Sunoco's Safety and Health or Risk Management Departments or other Sunoco's authorized representative to request access to Safety Data Sheets (SDS) for areas where Work is to be performed prior to commencing any Work. Contractor shall review the SDS and ensure that its employees are advised of the location and accessibility of this hazard information. Contractor shall furnish copies of SDS to Sunoco for all substances to be used while performing Work at Sunoco's facility prior to use of such substances. Contractor shall maintain duplicate copies of said SDS in its field office at the Work site. Contractor shall not specify for use in the project any hazardous materials, including, without limitation, asbestos or PCBs, unless expressly authorized to do so in a writing signed by Sunoco.

IVX. LEGAL

14.1. Liens: To the full extent allowed by law, Contractor hereby waives its right to assert any

Mechanics' lien or similar lien claim against Sunoco, the project site, or improvements thereon. Upon completion of the Work and as a condition precedent to final payment, Contractor shall deliver a full release of liens in such form as Sunoco may require. Contractor agrees that it shall defend, indemnify and hold Sunoco harmless from all resulting costs and attorneys' fees from all such claims or any mechanic's lien claim that is brought by any person supplying labor or materials for the Work. If any mechanic's lien is placed upon any portion of, or interest in, Sunoco, its facilities or any improvements thereon arising out of or relating to the Work, Contractor will promptly take all action to remove the lien, upon receiving notice from Sunoco or, failing that, will be liable for Sunoco's costs and attorneys' fees for doing so. Contractor agrees to insert a similar clause in all of its subcontract and supply agreements. In addition to any rights Sunoco may have under the law, Sunoco may withhold a retainage from each payment it makes to Contractor, to be paid Contractor after (1) the Work is completed as required and the retainage period required by applicable law has expired without issuance of a lien or claim, or (2) Sunoco is satisfied that all claims have been paid and liens removed. In addition, Sunoco may, at any time, require that Contractor post a bond, at no cost to Sunoco, to remove any claims or liens, or Sunoco may discharge or remove any such claims or liens by bonding, payment or otherwise, all of which are chargeable to Contractor, together with all attorney's fees and costs. Provided Sunoco agrees in writing, Contractor may provide an irrevocable standby letter of credit, naming Sunoco as beneficiary and in form and substance satisfactory to Sunoco, satisfaction of Contractor's obligations and liabilities as aforesaid and in substitution of any retainage.

14.2 Confidentiality: All plans, drawings, design and specifications supplied by Sunoco to Contractor shall remain the property of Sunoco, and any information derived therefrom or otherwise communicated to Contractor from Sunoco, shall be regarded by Contractor as confidential and shall not be disclosed to any third party without the prior written consent of Sunoco. Should Sunoco elect to provide Contractor with access to Sunoco's computer systems or network in connection with this Contract, Contractor agrees that upon termination or cancellation of this Contract, it shall immediately discontinue any further use of such systems or network and return to Sunoco any information related to such systems or network. Further, Contractor agrees to abide by all of Sunoco's policies and procedures applicable to such use and access.

14.2 Dispute Resolution. If Contractor disagrees with any action or decision by Sunoco, or any claim or dispute otherwise arises involving this Contract, Contractor shall proceed with the Work, without interruption or delay, shall follow Sunoco's directions, and may bring a claim as provided in this Section. Contractor's failure to proceed with the Work as directed during the pendency of any claim or dispute shall constitute a material breach of this Contract.

The parties agree that any dispute that cannot be resolved amicably shall first be submitted to mediation before a mutually acceptable mediator, prior to either party's resorting to legal action. If the mediation has not concluded within 60 days of the initial demand for mediation, either party may then pursue litigation in accordance with this Section, without further recourse to mediation. If the parties are unable to agree upon a mediator within thirty (30) days after either notifies the other in writing of its intent to mediate, the mediator shall be appointed by the American Arbitration Association located in closest proximity to the project. Each party will bear its out-of-pocket costs of the mediation; all other costs of the mediation, e.g., mediator fees and related charges, will be shared equally. If the parties are unable to agree upon a site, the mediation will be held at a location selected by the mediator. A request for mediation will immediately suspend

the running of any statute of limitations, until the mediation is completed or abandoned by either party, upon giving written notice to the other.

All disputes not resolved by mediation shall be decided by litigation in the federal of Philadelphia County. **BOTH PARTIES EXPRESSLY WAIVE THE RIGHT TO JURY TRIAL IN ANY LEGAL PROCEEDING IN ANY WAY ARISING OUT OF OR RELATED TO THIS CONTRACT, AND EXPRESSLY SUBMIT TO THE PERSONAL JURISDICTION OF THE COURTS NAMED IN THIS SECTION.**

14.3 Governing Law: This Contract shall be governed by and construed in accordance with the laws of Pennsylvania without regard to that state's otherwise applicable conflict of laws principles.

XIV. MISCELLANEOUS

15.1 Amendments: No amendment, modification or supplement to this Contract shall be

binding unless it is in writing, signed by both parties or their authorized representative. All notices under this Contract shall be in writing and addressed to Sunoco or Contractor as the case may be, and directed to the individual specified on the face of this Contract.

15.2 Controlling Provisions In Case Of Conflict: Should any conflict exist or seem to exist between any of the parts or Exhibits of the Agreement or Written Proposal or correspondence submitted by Contractor to Sunoco, the provisions of these Terms & Conditions shall control and be decisive of the issue. Contractor acknowledges that any correspondence or proposal submitted to Sunoco are not part of this Agreement unless accepted by Sunoco in writing. In the event of a conflict on the plans and specifications called for pursuant to this Agreement, Contractor shall notify Sunoco within 24 hours of noticing such conflict and Sunoco shall instruct Contractor, in writing, as to which plan or specification shall control. In no event shall Contractor be entitled to additional compensation for deviations or conflicts in drawings, plans or specifications.

15.3 Waivers: No waiver by either party of any breach of any of the covenants or conditions herein contained shall be construed a waiver of any succeeding breach of the same or of any other covenant or condition.

15.4 Assignment: Neither this Contract nor any claim against Sunoco arising directly or indirectly out of or in connection with this Contract shall be assignable by Contractor without Sunoco's consent in writing.

15.5 Severability: If any provision, or any part thereof, of this Contract is found by any court or governmental agency of competent jurisdiction to be invalid or unenforceable for any reason whatsoever, such invalidity or unenforceability shall not affect the remainder of such provision or any other provision hereof which shall remain in full force and effect.

15.6 Captions: Captions used in this Contract are not part of this Contract and are for convenience of reference only and shall not affect the meaning or construction of any of its provisions.

15.7 Integration: This Agreement contains all the terms and conditions agreed upon by the Parties, and no other Agreement, oral or otherwise, regarding the subject matter of this Agreement shall be deemed to exist or to bind any party hereto or to vary any terms contained in this Agreement.

15.8 No Joint Venture: The Parties do not intend to create, and nothing contained in this Agreement shall be construed as creating a joint venture arrangement or partnership between Sunoco and Consultant.

15.9 Independent Contractor: Contractor and its subcontractors shall be independent contractor with respect to the Work, and neither Contractor nor its subcontractors, nor any person employed by any of them shall be deemed to be Sunoco's employees, servants, or agents in any respect. Nothing in this Contract shall be construed as creating a joint venture or partnership between Sunoco and Contractor. Contractor, as an independent contractor under this Contract, shall assume all of the rights, obligations and liabilities, applicable to it as such independent contractor hereunder and any provisions in this Contract which may appear to give Sunoco the right to direct Contractor as to details of doing the Work herein covered or to exercise a measure of control over the Work shall be deemed to mean that Contractor shall follow the desires of Sunoco in the results of the work only.

15.10 No Third Party Beneficiaries: Nothing in this Agreement, express or implied, is intended or shall be construed to confer upon or give to any person, firm, corporation, or legal entity, other than the Parties, any right, remedies, or other benefits under or by reason of this Agreement.

15.11 Assignment by Consultant: Consultant shall not assign this Agreement, or any part of this Agreement, or any right to any monies to be paid under this Agreement, without, on each occasion, obtaining the prior written consent of Sunoco. In no case, shall approval by Sunoco of the assignment of any monies to be paid under this Agreement, relieve Consultant from its obligations hereunder, or change the remaining terms of this Agreement. Any purported assignment in violation of this Section shall be of no effect.

15.12 Counterparts: This Agreement may be executed simultaneously in multiple counterparts, each of which shall be deemed an original, but all of which taken together shall constitute but one and the same instrument.

15.13 Severability and Partial Invalidity: The provisions of this Agreement shall be severable. If any provision of this Agreement, or the application thereof, for any reason or circumstances, shall to any extent be held invalid or unenforceable, the remaining provisions of this Agreement, or the application of such provision to persons or entities other than those as to which it is held invalid or unenforceable, shall not be affected thereby, and each provision of this Agreement shall be valid and enforceable to the fullest extent permitted by law.

15.14 Survival: Any and all provisions set forth in this Agreement which, by its or their nature, would reasonably be expected to be performed after the termination of this Agreement, shall survive and be enforceable after such termination. Any and all liabilities, actual or contingent,

which shall have arisen in connection with this Agreement, such as the obligation to indemnify, defend and hold harmless Sunoco, its officers, employees and agents as set forth in Section 7.2 (Indemnification) and the rights and obligations set forth in Article IX (Ownership of Materials; Proprietary Information; Confidentiality), shall survive the termination or expiration of this Agreement.

15.15 Notice: Any notice or other communication required or permitted hereunder, shall be given in writing to the other Party at the address below, or at such address as shall be given by the other Party in writing. Notice shall be deemed to have been given or made when delivered personally, including overnight courier or electronic transmission, provided that if notice is given by electronic transmission, it is followed within three (3) days by mailed or delivered written notice, or, if mailed, by certified mail, return receipt requested.

To Sunoco: Sunoco Pipeline L.P. and/or Sunoco Partners Marketing & Terminals, LP
100 Green Street
Marcus Hook, PA 19060
Ph: 610-859-6316
E-mail: PMHenry@sunocologistics.com
Attention: Patricia Flynn Henry

To Consultant: Otis Easter Services, Inc.
2971 Route 417
Wellsville, NY 14895
Ph: 585-593-4760

Attention: Charles Joyce

15.16 Headings: The headings in this Agreement do not in any way define, limit, describe or amplify the provisions of this Agreement, or the scope or intent of the provisions, and are not a part of this Agreement.

15.17 Citations: All statutory or other citations of law referenced in this Agreement shall refer to the statute referenced, as it may be amended or superseded from time to time.

15.18 Days: Any references to a number of days in this Agreement shall mean "calendar" days, unless business days are specified.

15.19 Number and Gender: Whenever the context requires, words used in the singular shall be construed to mean or include the plural and vice versa, and pronouns of any gender shall be deemed to include and designate the masculine, feminine or gender neutral.

IN WITNESS WHEREOF, the Parties hereto, intending to be legally bound hereby, have caused this Agreement to be executed by their respective duly authorized representatives as of the date and at the place appearing at the heading of this Agreement.

Sunoco Pipeline L.P.

Sunoco Partners Marketing & Terminals, LP

By: [Signature]

Name: Patricia Henry

Title: counsel - Procurement contracts

Date: 7/16/15

Otis Eastern Service, LLC

By: [Signature]

Name: Tony Deusenbery

Title: Executive Vice President

Date: 7/15/15

EXHIBIT A
SCOPE OF WORK

Contractor to provide construction services as requested by Sunoco and authorized under a Purchase Order or Change Order to Contractor by Sunoco.

EXHIBIT B
COMPENSATION

Sunoco Equipment Rates 2014

EQUIPMENT DESCRIPTION	Hourly Rate
4x4 Pickup	12.00
1 Ton Flatbed	13.00
5 YD Dump Truck	17.00
10 YD Dump Truck	33.00
18 YD Dump Truck	45.00
Boom Truck/Tractor	79.00
Truck/Tractor	51.00
50 TON Lowboy	19.70
Oilfield Float	12.40
Weld Rig	30.60
Test Van w/Instruments	38.10
185 CFM Air Compressor	18.60
250 CFM Air Compressor	20.90
CAT 416 or equal	26.60
CAT 416 or equal w/attachments	105.30
Backhoe with breaker/CAT 312	140.40
CAT 312/314 or equal	49.90
CAT 320 or equal	68.00
CAT 329 or equal	77.00
CAT 966 or equal	42.50
CAT 963 (2.5 YD) or equal	50.80
Cat D-4 Dozer or equal	31.70
Cat D-5 Dozer or equal	55.70
Cat D-6 Dozer or equal	61.30
Cat D-7 Dozer or equal	97.50
Cat D-8 Dozer or equal	115.70
Cat 561 Sideboom or equal	40.80
Cat 572 Sideboom or equal	62.50
L-90 R.T. Loader/Boom	81.60

JD 450 Dozer/Boom	61.10
Volvo L70 Loader	58.90
Volvo L90 Loader	63.30
Vermeer CC-135	35.00
12 Ton Cherry Picker	71.20
18 Ton Cherry Picker	71.20
Road Bore Machine up to 30"	54.40
Vibratory Roller	22.60
25 Ton Tag Trailer	11.80
Fill Pump	59.50
Parts Van	8.40

Otis Eastern Service
 Confidential

12/26/2013
 Sunoco Logistics

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Office Trailer	8.40	Chipper-12"	34.50	Farm Tractor	29.80	Bush	Hog
	21.90						
6" - 20" Bending Machine						37.60	
16" - 30" Bending Machine						55.70	
2" - 3" Water Pump						5.50	
4" - 6" Water Pump	8.30	Power Mulcher	21.90				
5000 Watt Generator						15.90	
Light Plant						15.90	
Mats				Day Rate		7.00	
Core Equipment				Day Rate		1810.00	

State	County	Craft	Classification	Zone	TtlHrlyRate	halhrly	Dblhrly
DE	All	Administra	Foreman		\$159.63	\$215.55	\$271.47
DE	All	Administra	Office Man		\$119.80	\$159.57	\$199.33
DE	All	Administra	Superinten		\$190.06	\$258.41	\$326.76
DE	All	Labor	Labor	Statewide	\$45.64	\$56.69	\$67.74
DE	All	Labor	Labor Prem	Statewide	\$47.42	\$59.22	\$71.01
DE	All	Operator	Group 1	Statewide I	\$80.81	\$104.41	\$128.00
DE	All	Operator	Group 2	Statewide I	\$69.34	\$88.93	\$108.52
DE	All	Operator	Group 3	Statewide I	\$59.85	\$76.14	\$92.43
DE	All	Pipefitter	Journeyma	Statewide I	\$127.70	\$166.42	\$205.13
DE	All	Pipefitter	Premium w	Statewide I	\$131.26	\$171.47	\$211.67
DE	All	Pipefitter	Welder hel	Statewide I	\$62.85	\$79.89	\$96.92
DE	All	Pipefitter	W-H Grade	Statewide I	\$64.19	\$81.78	\$99.37
DE	All	Teamster	Teamster	Zone 3 loca	\$67.21	\$85.12	\$103.03
MI	All	Administra	Foreman		\$141.14	\$189.16	\$237.18
MI	All	Administra	Office Man		\$106.87	\$141.56	\$176.26
MI	All	Administra	Superinten		\$156.01	\$210.26	\$264.51
MI	All	Labor	Labor	Statewide	\$77.15	\$97.88	\$118.61
MI	All	Labor	Labor Prem	Statewide	\$80.66	\$102.86	\$125.06
MI	All	Operator	Group 1	Statewide I	\$97.95	\$123.37	\$148.79
MI	All	Operator	Group 2	Statewide I	\$79.98	\$100.43	\$120.88
MI	All	Operator	Group 3	Statewide I	\$74.14	\$92.35	\$110.56
MI	All	Pipefitter	Journeyma	Statewide I	\$128.90	\$168.22	\$207.53
MI	All	Pipefitter	Premium w	Statewide I	\$131.64	\$172.10	\$212.57

MI	All	Pipefitter	Welder hel	Statewide	\$74.77	\$96.85	\$118.92
MI	All	Pipefitter	W-H Grade	Statewide	\$76.14	\$98.79	\$121.44
MI	All	Teamster	Teamster	Statewide	\$80.51	\$106.22	\$131.92
NJ	All	Administra	Foreman		\$140.20	\$187.13	\$234.05
NJ	All	Administra	Office Man		\$106.16	\$140.21	\$174.25
NJ	All	Administra	Superinten		\$155.28	\$208.51	\$261.74
NJ	All	Labor	Labor	Statewide	\$96.32	\$121.95	\$147.57
NJ	All	Labor	Labor Prem	Statewide	\$99.87	\$126.98	\$154.09
NJ	All	Operator	Group 1	Statewide	\$121.31	\$157.04	\$192.78
NJ	All	Operator	Group 2	Statewide	\$109.14	\$141.72	\$174.29
NJ	All	Operator	Group 3	Statewide	\$102.57	\$132.39	\$162.22
NJ	All	Pipefitter	Journeyma	Statewide	\$128.42	\$167.42	\$206.42
NJ	All	Pipefitter	Premium w	Statewide	\$131.14	\$171.27	\$211.40
NJ	All	Pipefitter	Welder hel	Statewide	\$78.68	\$102.32	\$125.96
NJ	All	Pipefitter	W-H Grade	Statewide	\$79.86	\$104.00	\$128.13
NJ	All	Teamster	Teamster	Zone 3 loca	\$94.71	\$122.13	\$149.55
NY	All	Administra	Foreman	0	\$141.03	\$189.38	\$237.72
NY	All	Administra	Office Ma	0	\$108.22	\$143.29	\$178.36
NY	All	Administra	Superinten	0	\$157.19	\$212.03	\$266.87
NY	All	Labor	Labor	Zone 10 loc	\$80.27	\$102.93	\$125.59
NY	All	Labor	Labor Prem	Zone 10 loc	\$84.08	\$108.34	\$132.60
NY	All	Operator	Group 1	Zone 7C loc	\$101.12	\$131.28	\$161.44
NY	All	Operator	Group 2	Zone 7C loc	\$84.23	\$108.73	\$133.22

NY	All	Operator	Group 3	Zone 7C loc	\$73.11	\$92.93	\$112.75
NY	All	Pipefitter	Journeyma	Statewide	\$129.75	\$169.50	\$209.24
NY	All	Pipefitter	Premium w	Statewide	\$130.61	\$170.72	\$210.82
NY	All	Pipefitter	Welder hel	Zone 10 loc	\$76.29	\$99.05	\$121.80
NY	All	Pipefitter	W-H Grade	Zone 10 loc	\$77.68	\$101.01	\$124.35

NY	All	Teamster	Teamster	Zone 12 loc	\$78.54	\$100.77	\$123.00
OH	All	Administra	Foreman		\$136.67	\$182.84	\$229.01
OH	All	Administra	Office Man		\$105.06	\$138.55	\$172.04
OH	All	Administra	Superinten		\$152.25	\$204.61	\$256.98
OH	All	Labor	Labor	Statewide	\$76.86	\$97.93	\$119.01
OH	All	Labor	Labor Prem	Statewide	\$80.41	\$102.97	\$125.52
OH	All	Operator	Group 1	Zone 1 loca	\$96.41	\$128.05	\$159.69
OH	All	Operator	Group 2	Zone 1 loca	\$77.13	\$102.48	\$127.83
OH	All	Operator	Group 3	Zone 1 loca	\$66.91	\$88.00	\$109.10
OH	All	Pipefitter	Journeyma	Statewide l	\$126.17	\$164.12	\$202.08
OH	All	Pipefitter	Premium w	Statewide l	\$128.83	\$167.89	\$206.95
OH	All	Pipefitter	Welder hel	Statewide l	\$75.41	\$97.63	\$119.84
OH	All	Pipefitter	W-H Grade	Statewide l	\$76.58	\$99.28	\$121.98
OH	All	Teamster	Teamster	Zone 4	\$73.55	\$96.54	\$119.52
PA	Eastern	Administra	Foreman		\$141.63	\$190.53	\$239.42
PA	Eastern	Administra	Office Man		\$108.52	\$143.99	\$179.46
PA	Eastern	Administra	Superinten		\$157.94	\$213.40	\$268.86
PA	Eastern	Labor	Labor	Zone 1	\$85.54	\$108.36	\$131.18
PA	Eastern	Labor	Labor Prem	Zone 1	\$89.30	\$113.71	\$138.11
PA	Eastern	Operator	Group 1	Zone 1 loca	\$105.55	\$138.34	\$171.14
PA	Eastern	Operator	Group 2	Zone 1 loca	\$87.45	\$115.44	\$143.44
PA	Eastern	Operator	Group 3	Zone 1 loca	\$75.05	\$98.96	\$122.88
PA	Eastern	Pipefitter	Journeyma	Statewide l	\$130.15	\$170.35	\$210.55
PA	Eastern	Pipefitter	Premium w	Statewide l	\$132.95	\$174.32	\$215.69
PA	Eastern	Pipefitter	Welder hel	Zone 1 loca	\$74.90	\$97.32	\$119.74
PA	Eastern	Pipefitter	W-H Grade	Zone 1 loca	\$76.31	\$99.32	\$122.34
PA	Eastern	Teamster	Teamster	Zone 1	\$76.20	\$99.26	\$122.31
PA	Western	Administra	Foreman		\$163.45	\$221.52	\$279.60
PA	Western	Administra	Office Man		\$108.52	\$143.99	\$179.46
PA	Western	Administra	Superinten		\$157.94	\$213.40	\$268.86
PA	Western	Labor	Labor	Zone 2	\$76.49	\$97.47	\$118.46
PA	Western	Labor	Labor Prem	Zone 2	\$80.14	\$102.67	\$125.20
PA	Western	Operator	Group 1	Zone 2 loca	\$93.01	\$121.58	\$150.15

PA	Western	Operator	Group 2	Zone 2 local	\$75.98	\$98.61	\$121.23
PA	Western	Operator	Group 3	Zone 2 local	\$69.35	\$89.18	\$109.01
PA	Western	Pipefitter	Journeyman	Statewide local	\$130.15	\$170.35	\$210.55
PA	Western	Pipefitter	Premium welder	Statewide local	\$132.95	\$174.32	\$215.69
PA	Western	Pipefitter	Welder helper	Zone 2 local	\$70.70	\$91.35	\$111.99
PA	Western	Pipefitter	W-H Grade	Zone 2 local	\$71.92	\$93.09	\$114.25
PA	Western	Teamster	Teamster	Zone 3	\$78.76	\$102.89	\$127.02

EXHIBIT C
HEALTH AND SAFETY REQUIREMENTS

Exhibit C

Contractor Safety & Security Requirements

General

It is the goal of Sunoco Logistics Partners L.P. (Owner) to manage all construction projects to a plan of "Zero Incidents." Owner's contract representative will provide all general contractors working in and around projects with an overview of Owner's Safety and Security requirements. Each contractor will comply with all federal, state and local regulations, and any safety requirements Owner has listed pertinent to the job. The standard safety practices for general industry, construction, and the petroleum business must also be followed. All Sub-Contractors are also bound by the same regulations as the general contractor, and it is the general contractor's responsibility to inform and require all sub-contractors to follow Owner's safety and security regulations. The Contractor shall conduct operations in a manner which shall prevent personal injury and property damage through fires, accidents, or otherwise, and to this end the Contractor shall furnish all necessary protective equipment and devices as stated in the Work Permit or other documentation, unless specified otherwise in the Contract. **Contractor shall provide at no cost to Owner all personal protective equipment, air monitoring devices, and other safety equipment unless otherwise specified by the Contract.**

Nederland Terminal Only: All Contractor and subcontractor's personnel, who shall be working at Nederland Terminal, regardless of the type or duration of Work, shall have at no cost to Owner successfully completed "Basic Orientation Plus" and "Sunoco Logistics Site Specific" training through the Industrial Safety Training Council (ISTC). Proof of completed training will be required prior to entering the facility.

Owner's representative will conduct a Pre-Bid meeting, a Pre-Construction meeting, or both. During these meetings, OWNER'S representative will provide an overview of the contents of this document, discussing the minimum general and project specific safety requirements. Each contractor is then required to designate a project safety representative, develop a project specific Site Safety Plan and train all project personnel and subcontractor personnel in the project specific Site Safety Plan **PRIOR** to the commencement of any work. The plan and its contents are discussed in more detail in this document.

Pre-Construction Meeting

All Contractor and subcontractor's personnel, who shall be working at Owner facilities or Right of Ways, regardless of the type or duration of Work, shall attend a pre-construction safety meeting. This meeting shall be conducted by Owner's representative, and shall generally cover Owner's facility safety procedures and operating procedures. Material Safety Data Sheets (MSDSs) for Owner's hazardous materials present at the worksite will also be reviewed at this meeting.

Owner's representative and all Contractor personnel during the safety meeting shall review this Section, Safety and Security Requirements. A safety meeting attendance sheet shall be completed and filed in Owner's facility project files.

All subsequent workers, primary contractor employees, or sub-contracted employees must have the same information presented to them. This communication and acquisition of signatures is the responsibility of the Primary Contractor Rep.

The Work Permit form shall be reviewed during the Safety meeting.

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Start-of-Work

Upon daily entrance onto Owner's work sites, all Contractor personnel shall identify themselves to Owner's representative, and will sign-in. Owner's representative shall be notified whenever entering or exiting Owner's facility. The prime contractor shall require all sub-contractors to also sign-in and inform the Owner representative of their arrival and departure.

The Contractor shall obtain the required Work Permit(s), before starting any work. The Contractor must inform Owner's representative of all work to be conducted at the worksite and any safety concerns on a daily basis. Owner's representative shall be involved in the general supervision and direction of the work dealing solely with the contractor and **not** with subcontractors. Owner's representative shall have full authority to stop the work when such stoppage may be deemed necessary for safety purposes and/or to ensure proper execution of the contract.

Safety Procedures

Health & Safety Plan

The Contractor shall prepare a Health & Safety Plan for the Work that is being performed. This will include:

- An organization structure chart with the safety representative designated,
- A work plan with a list of tasks,
- Emergency Procedures with directions to the closest hospital,
- Emergency phone number list,
- Specific safety requirements for each task listed in the work plan.

Additional procedures may be required, examples of which are in the list below. A copy of this plan shall be available to Owner or other outside authorities on-site for inspection. The project specific "Site Safety Plan" shall address the following items to the satisfaction of the construction manager. The construction manager will review the site-specific safety hazards with the contractor before the starting of any work activities. The site safety plan need only address the items that pertain to the work being conducted, which may include:

- Work Permits, including Hot Work
- Confined Space
- API Tank Ventilation Procedure
- Tank Entry and Work Area Ventilation
- Open Excavations
- Flammable and explosion Hazards
- Rigging and Handling of Large or Bulky Lifts
- Ladders and Scaffolding requirements
- Electrical Lockout and Tagout Procedures
- Emergency Response Requirements
- Emergency Response contact list

Exhibit C

- Accident and Injury reporting
- Hazard Communication
- Proper Personal Protective equipment required
- Product Transfer on Site - (Tank to Tank or Tank to Truck)
- Line and Tank Purging of Product
- The Contractor is encouraged to contact the Owner Health, Environmental & Safety (HES) Department or facility representative for assistance in developing the project-specific "Site Safety Plan."

Emergency Procedure

- Each site shall develop, post, distribute, and maintain an emergency response list. This emergency response list shall be maintained by the general contractor, managed by the construction group and issued before the start of construction. The general contractor shall update the list as changes occur. An evacuation area will be designated for each job site.
- Owner reserves the right to have the Contractor stop all Work at any time job conditions occur which would endanger personnel or property of either Owner or the Contractor should such Work continue. The Contractor's personnel shall follow the instructions given by Owner's representative during an emergency.
- If a hazardous material spill occurs, only properly trained personnel should attempt cleanup activities. All other personnel should notify Owner's representative immediately.
- The Contractor will make each of his Sub-Contractors aware of these procedures and requirements.

Electrical Equipment - Lockout and Tagout Procedures

- Before any Work is started on electrical equipment, the electrical circuit must be de-energized by turning the control switch to the off position and then locked or sealed in that position.
- Owner's representative must be advised of such de-energizing before work. All OSHA lockout / tag-out procedures must be followed.

Asbestos

Some pipeline coatings may contain non-friable asbestos. Worker exposure monitoring for airborne asbestos has been conducted while removing the pipeline coatings using methods described below. All contractors conducting pipeline coating removal must use the methods listed below and ensure that contractors' employees have been trained in these methods as well as the requirements specified in the OSHA Asbestos Construction standard (29 CFR 1926.1101). Refer to the Training section of this document for more information regarding training requirements for working with pipeline coatings containing asbestos.

Unless there is evidence to the contrary, assume that the pipeline coating contains asbestos, and use the following procedures or equivalent:

Exhibit C

- The material shall not be sanded, abraded, or ground.
- All removal or disturbance of pipeline asphaltic wrap shall be performed using wet methods.
- Manual methods, which prevent the material from becoming 'non-intact', shall be used as follows:
 - Wet down the pipe coating with amended water (water with a few drops of a mild dish soap such as Dawn)
 - Strike the coating with a hammer, cracking the coating into relatively large pieces, catching the pieces that fall on plastic sheeting below the pipe.
 - Scrape off any coating that remains on the pipe using a drawknife as needed to prepare the pipe for repair.
 - Decontaminate tools using amended water and double-bag and disposable PPE, plastic sheeting and pipe coating in 6 mil poly bags for disposal
 - Repair pipe as needed
 - Re-coat pipe with non-asbestos coating and backfill excavation.
- Use of respirators, labeled disposal bags, and performance of air monitoring are NOT required for removal of intact non-friable asbestos pipe coating.

Chemicals (Hazard Communication)

Upon request, the Contractor shall supply the Owner representative with MSDSs for all hazardous materials and supplies brought on the job site which are being used, stored, or installed.

Confined Space Entry Procedures

- Owner requires the Contractor to provide an Oxygen level meter, a combustible gas meter, and detectors for any hazardous substance that could be in or near the confined space. The Contractor is responsible for monitoring the atmosphere whenever his employees are working in a confined space.
- All contractors shall strictly comply with requirements of 29 CFR 1910.146, particularly as it pertains to the confined space attendant. This attendant must be positioned so that all contractor personnel working within the confined space can be kept under observation and communication shall be maintained at all times.
- The contractor shall provide a qualified confined space entry supervisor who shall be responsible for all health, safety, and environmental aspects of confined space work.
- For aboveground storage tanks containing petroleum products, an Oxygen meter and combustible gas meter are acceptable at most facilities. Owner's representative shall use the facility's own monitoring equipment to confirm proper operation of the Contractor's equipment. This shall be done upon issuance of the Work Permit requiring such equipment. The contractor must conduct follow up testing and continuous monitoring. To assure reliability, all air quality testing equipment must be calibrated before confined space entry.
- A Work Permit must be issued before entry into any confined space.

Exhibit C

- Owner representative will discuss the following information regarding confined space entry with the Contractor:
 - The Contractor shall be informed that some Owner workplaces contain confined spaces requiring permits and that confined space entry is allowed only through compliance with the confined space entry program.
 - The Contractor shall be informed of the location of all confined spaces on the worksite.
 - The Contractor shall be apprised of the elements, including the hazards identified and Owner's experience with the confined space, that make the space in question a confined space requiring a permit.
 - The Contractor shall be apprised of any precautions or procedures that Owner has implemented for the protection of personnel in or near confined spaces where the Contractor shall be working.
- Owner shall coordinate confined space entry operations with the Contractor, when both Owner's personnel and Contractor's personnel will be working in or near the confined space.
- The Contractor shall be debriefed at the conclusion of the confined space entry operation regarding the confined space entry program followed and regarding any hazards confronted or created in confined spaces during entry operations.
- The Contractor shall obtain any available information regarding confined space entry hazards and entry operations from Owner.
- The Contractor shall inform Owner of the confined space entry program that the Contractor will follow and of any hazards confronted or created in the confined space, either through a debriefing or during the entry operation. These procedures are to be implemented according to Owner's Confined Space Entry Procedures.

Hot Work

- Hot work is defined as any operation or procedure involving sources of ignition or temperatures sufficient to cause ignition of a flammable mixture. This includes work requiring the use of welding, burning, grinding, or soldering equipment, blow torches, some power driven tools, portable electric equipment not intrinsically safe or contained with an explosion-proof housing, sand blasting, or operating internal combustion engines.
- Unless otherwise specified, the contractor shall provide the equipment and qualified personnel to test the work site with a calibrated combustible gas indicator, and hot work shall not commence until the area is tested and declared vapor free and safe for hot work. A **hot work permit** issued by Owner's representative will be used in conjunction with the monitoring. Adequate ventilation shall be provided to disperse gases, which might otherwise accumulate during progress of work. Where conditions are such that flammable vapors could be generated, the work site shall be kept under surveillance by a combustible gas monitor in continuous use. All hot work shall cease whenever the atmosphere in the vicinity of work reaches 10% of the lower flammable limit (LEL) or greater. Work shall not resume until the source of vapors has been located and controlled.

Exhibit C

Fire Protection

- Fire protection and extinguishing equipment must be available and deployed as necessary in all work areas, especially where "Hot Work" is being performed. This includes one or more personnel designated as fire watches, as appropriate. The Contractor will furnish this equipment unless otherwise specifically agreed to in writing by Owner's representative. Before beginning work, the contractors shall determine the type and amount of fire equipment needed.
- The fire watch shall man extinguishers during hot work operations. Depending on the scope of hot work, more than one fire watch may be required.
- Whenever a fire extinguisher has been used, this fact must be reported immediately to Owner's representative. The used fire extinguisher must either be removed from the area or be identified as being spent, or immediately recharged.

Personal Protective Equipment (PPE)

- When working on a Owner job, the Contractor's personnel are required to wear ANSI-approved safety glasses with attached side shields and to be fully clothed, including appropriate foot wear and full length trousers. All PPE must be worn per the manufacturer's instructions. Owner's PPE requirements are attached to the end of this document.
- Special protection, such as particulate respirators or air breathing equipment, may be required especially when working in or around equipment, which has contained leaded gasoline or where exposure of friable asbestos has been identified. The contractor shall ask the Owner representative regarding the PPE requirements. The representative will specify other PPE requirements or exceptions on the work permit.

Substance Abuse

- The use of or possession of alcohol, illegal drugs, or the improper use of legal drugs is prohibited within Owner facilities. The contractor's employees, agents, or suppliers shall not enter Owner facilities while under the influence of illegal drugs or alcohol.
- Entry onto the property of Owner constitutes consent on the part of all contractor employees to submit to a substance test when reasonable cause warrants such testing. Such testing shall be conducted at the direction of Owner and at the sole expense of the contractor. Any contractor employee testing positive for alcohol, illegal drugs or the improper use of legal drugs shall be removed from the facility.
- Any Contractor employee removed from Owner facilities under the Substance Abuse policy will be removed for a minimum of one year.
- Any contractor employees using prescription medicine shall notify their supervisor, and where the medication could affect the safe performance of the work, job reassignment will be made. Anyone violating the requirements of this section shall be removed from the facility.

Equipment Inspection

- All equipment, including heavy equipment, must be inspected before use for safe operations.

Exhibit C

Training Requirements

HAZCOM (HAZard COMmunication) Training

- If any Contractor personnel handle potentially hazardous materials, then they are required to have Hazard Communication Training. This training includes a review of MSDSs for materials being used as part of the Work, either Owner's or Contractor's materials, plus a review of safety precautions, first aid measures and personal protective equipment required for safe handling of these materials.

Asbestos

Some pipeline coatings may contain **non-friable** asbestos. Contractors conducting pipeline coating removal must ensure that contractors' employees have been trained in these methods as well as the requirements specified in the OSHA Asbestos Construction standard (29 CFR 1926.1101). Refer to the pipeline coating procedure on page three of this document. When installing, removing, repairing, or maintaining intact pipe line asphaltic wrap which contains asbestos fibers encapsulated or coated with bituminous or resinous compounds, compliance with all the requirements below are deemed to be in compliance with the OSHA Construction Standard for Asbestos, 29CFR1926.1101(g)(11) and (k)(9)(viii).

All employees performing work on intact pipeline asphaltic wrap shall be trained as follows under 29CFR1926.1101(k)(9)(viii).

- The training must be conducted in a manner that the employee can understand;
- The employee must be informed of the following:
 - Methods of recognizing asbestos;
 - The health effects associated with asbestos exposure
 - The relationship between smoking and asbestos in producing lung cancer
 - The nature of operations that could result in asbestos exposure, necessary protective controls, work practices, respirators, housekeeping procedures, hygiene facilities, protective clothing, decontamination procedures, emergency procedures, waste disposal procedures, and instruction in these control procedures
 - The purpose, proper use, fitting instructions, and limitations of respirators
 - The appropriate work practices for performing the asbestos job
 - Medical surveillance program requirements (non-required for work tasks with Negative Exposure Assessment)
 - The content of OSHA Standard 29CFR1926.1101
 - The names, addresses, and phone numbers of public health organizations which provide information, materials and/or conduct programs concerning smoking cessation
 - The requirements for posting signs and affixing labels and the meaning of the required legends for such signs and labels.

Exhibit C

HAZWOPER (HAZardous Waste Operations and Emergency Response) Training

- For Contractors conducting emergency response or spill clean-up activities, the Contractor employees will have the required OSHA Hazwoper training (29 CFR 1910.120) prior to beginning work. All other contractors will have the Hazwoper Awareness Level training.
- If the Contractor may be involved in an uncontrolled release but will not clean up the hazardous material, then **First Responder awareness level** training is required. This level requires sufficient training or proven and documented experience in specific competencies. Hazardous communication training and general awareness as to the chemicals and hazards located at the site will meet this requirement. This type of training usually involves one to four hours at the work site
- If the Contractor may be involved in an uncontrolled release and will clean up a small release of hazardous material with absorbent pads, then **First Responder operations level** training is required. This is an 8-hour training course.
- If the Contractor may be involved in an uncontrolled release, plan on patching or plugging the release, and will clean up a large release of hazardous material, then **Technician level** training is required. This is a 24-hour training course.
- If the Contractor is going to be involved in disposal and/or clean up of hazardous materials from Owner's facility, then a 40-hour Hazwoper training course is required.

Electrical Equipment - Lockout and Tagout

- The Contractor's personnel are required to have Lock Out/Tag Out training if they will be performing the necessary task to de-energize, lockout and tag out electrical and power sources and equipment on Owner projects.

Confined Space Entry

- All contractor personnel shall have **Confined Space Entry** training prior to entering storage tanks or other areas with limited entrance/egress that are determined to be permit required confined spaces by the Owner representative.

Site Safety Plan

- Each contractor is required to train all project personnel and sub contractor personnel in the project specific site safety plan **PRIOR** to commencement of any work.

PPE

All contractor personnel shall be trained by the contractor on the proper use, care, and storage of the personal protection equipment required during the project.

Training Documentation

- **Before arriving on site** for the start of the Work requiring any of the above training, the Contractor shall give Owner's representative either copies of certificates from a training agency for each employee, or a letter from the Contractor. This letter shall state the names of Contractor employees who attended the training, the name of the trainer and Company who conducted the training, a brief description of the training session content, the length of the training session and when the training took place. No Work shall be allowed to start until the necessary documentation is received.

Exhibit C

- **Nederland Terminal Only:** All Contractor and subcontractor's personnel, who shall be working at Nederland Terminal, regardless of the type or duration of Work, shall have at no cost to Owner successfully completed "Basic Orientation Plus" and "Sunoco Logistics Site Specific" training through the Industrial Safety Training Council (ISTC). Proof of completed training will be required prior to entering the facility.
- Owner shall not be responsible for any costs incurred by the Contractor if Owner rejects any of their personnel due to a lack of Owner-required training.

Operational Procedures

Licenses

- The Contractor shall provide Owner with copies of all required Licenses prior to the start of the Work, as appropriate, e.g., lead abatement, asbestos removal, etc.

Area Restrictions

- Contractor personnel must **not** enter any area other than the one in which the Contractor is performing Work. In going to and from such work areas, Contractor's employees must remain on established routes specifically agreed to by Owner representatives.

Blocking Roadways

- In order that fire and emergency vehicles shall have clear access to all parts of the facility, tools, equipment, vehicles, debris, or mobile equipment should not block roadways.
- In the event it is necessary to block a roadway temporarily, permission must be secured from Owner's representative.

Compressed Gas Cylinders

- The following rules must be followed concerning all compressed gas cylinders, including but not limited to, air, oxygen, acetylene, nitrogen, ammonia and hydrocarbons:
 - Cylinders must be removed immediately upon the completion of a job. Owner's representative must specifically authorize exceptions to this.
 - Cylinders must be used, stored, and transported with extreme care.
 - Cylinders must be securely fastened and supported at all times. Chains are recommended for fastening large equipment.
 - Protective caps must be kept on all cylinders not in use; if a cylinder is left unattended with a hose and torch connected, the cylinder valve must be closed, regardless of the duration of time unattended
 - Oxygen and acetylene cylinders stored in the same location must be segregated by a minimum distance of (20 ft), or a five-foot-tall non-combustible fire wall capable of withstanding a fire for one-half hour.
 - The number of cylinders used on a job in an operating area must be kept to an absolute minimum.

Exhibit C

- Cylinders being transported to or from a job by truck or other conveyance must have protective caps and be surely fastened and supported (or be in a suitable cylinder basket). They may not be carried in a choke hitch.
- Cylinders must be stored away from an operating area with protective caps in place and securely fastened or supported.
- Oxygen cylinders must not be used or stored where oil spills could come into contact with the valve or attached equipment.

Excavations

- All excavations over 5 feet are to be sloped, stepped back, or shored with adequate designed shoring to protect the contractor's and Owner's personnel and in accordance with federal OSHA standards. Excavations less than 5 feet will require sloping at the discretion of an Owner's competent person.
- All surface encumbrances must be removed or supported to safeguard employees.
- The location of underground utilities and other installations, such as sewer, power lines, water lines, etc. must be determined prior to initiation of excavation through use of the One Call system.
- Utility Companies or Owners shall be contacted and advised of proposed work prior to work.
- When excavations approach the approximate location of underground installations, the location of the installation shall be located using safe and acceptable methods.
- Structural ramps used by employees for entry and egress from the excavation must be designed by competent person
- No employee shall be permitted underneath loads handled by lifting or digging equipment.
- If there is the potential for a hazardous atmosphere, the Contractor will conduct appropriate air monitoring.
- Ventilation shall be provided, when necessary to assure that workers are not exposed to atmospheres containing concentrations of flammable gases in excess of 10 % of the Lower Explosive Limit (LEL)
- Workers may not work in excavations where water has accumulated or is accumulating unless adequate precautions have been taken to assure protection of workers from the hazards of such accumulation.
- Daily inspections of sites must be performed by a "competent person" to determine if cave-ins, failures of protective systems, hazardous atmospheres, or other hazardous conditions have developed.
- Owner's confined space entry procedures are to be followed for excavations, which meet the definition of a confined space.
- Contractor must also provide necessary guardrails and night lighting along trenches, roadways, or cross walks where operating personnel might be injured.
- Excavations greater than 20' depth require protection designed by a professional engineer.

Exhibit C

- Protective shield systems must be from a shield manufacturer, not "home-made."
- Travel distance within an excavation shall not exceed 25' to the nearest ladder or other means of egress.

Dike Walls, Fire Walls and Operating Areas

- No cars, trucks or other internal combustion engine equipment, nor any fire or heat producing equipment shall be permitted inside storage tank dike walls or fire walls without first having obtained a Work Permit from Owner's representative. Contractor equipment must **not** be left operating while unattended in a hazardous area unless specifically authorized by Owner.
- A Work Permit shall be required for the opening of any dike wall or firewall. Any dike wall or firewall opened under authority of such permit shall be closed at the end of each and every workday. An exception to this requirement would involve a dike wall or firewall where **no liquid material is being stored**.

Temporary Lights & Flashlights

- Lights and flashlights used must be of the explosion-proof type approved as 'Permissible' by Underwriter's Laboratory and/or Mine Safety and Health Administration when used in a potentially explosive area.
- Portable electric lighting used in wet or moist location shall be operated at a maximum of 12 volts.
- No artificial lights, other than the Owner's-approved artificial lighting shall be used inside a storage tank until the tank has been tested and found to be gas free.

Housekeeping

- During the course of the project, all construction operations, alteration, or repairs, shall be performed in accordance with specific OSHA standards (29 CFR 1926.25) applying to housekeeping at worksites. The following general housekeeping requirements shall be strictly adhered to:
 - Form and scrap lumber with protruding nails, and other debris, shall be kept cleared from work areas, passageways, and stairs
 - Combustible scrap and debris shall be removed at regular intervals in a safe manner.
 - Containers shall be provided and used for the collection and separation of waste, trash, oily and used rags, and other refuse.
 - Over-weighting of floors and catwalks with equipment and debris is to be avoided.
 - Curbing is to be installed on scaffolds, catwalks, and upper floor when necessary to prevent debris from falling or spilling overboard.
 - Stairways and passageways are to be kept open and free of obstruction.

Injury to Contractor Employee

- It is the Contractor's responsibility to provide first aid injury treatment, transportation, hospital arrangements, investigation and OSHA reporting of all accidents occurring to Contractor's employee while on Owner's premises or job.

Exhibit C

- The Contractor is requested to report such injury promptly to Owner's representative so that appropriate reports can also be filed in Owner's office.
- The Owner Incident Reporting and Investigation form (SIRIS form) shall be completed for each contractor injury on a Owner work site.

Line Shut-off

- The opening and closing of any of Owner's valves is to be performed only by Owner's representative, or under his direct supervision.

Parking

- Owner shall cooperate when possible in efforts to provide Contractor's employees parking space within a reasonable distance of the Work site.
- Advance notice of requirements must be given to Owner's representative, who shall advise the Contractor of the approved parking area and the gate which must be used by Contractor's employees to reach the designated area.
- Some facilities require vehicles to be backed into parking places. The Contractor will check with the Owner representative regarding the parking requirements.
- Contractor's employees must not use parking facilities provided for Owner's employees, unless Owner authorizes such action.
- All Contractor equipment or vehicles should be removed from hazardous areas (e.g., tank farms) during non-working hours
- Contractor shall be solely responsible for any cost related to transporting contractor's employees from assigned parking areas to the construction site.

Photographs

- Photographic equipment is prohibited, except as specifically authorized in writing by Owner.
- Photography using a flash requires a hot-work permit in an operations area.

Railroad Right-of-Ways and Railroad Cars

- Standard clearance of 10 feet from the closest rail shall be maintained so as not to interfere with use of the tracks.

Sanitary Facilities

- The Contractor and subcontractor shall provide sanitary facilities for their personnel, which shall meet applicable local codes.
- The Contractor's personnel are not to use Owner's toilet, locker room, or wash up facilities unless specifically authorized to do so by Owner's representative.

Ladders and Scaffolding

- Ladders and Scaffolds must be of standard approved construction, and must be erected to meet OSHA, state and local codes. The ladders and scaffolds must be constructed/used in accordance with the manufacturer's guidelines.

Exhibit C

Signs

- The erection of signs by the Contractor on Owner's property should be discussed with Owner's representative.
- When necessary to erect signs, permission must be given by Owner's management.

Smoking

- Smoking by Contractor personnel in Owner's facility or other work areas is prohibited except where specifically designated by Owner.
- Owner's designated smoking areas or shelters may be used by the Contractor's employees if specifically authorized by Owner's representative. If overcrowding results because of the large number of Contractor employees, Owner's representative shall deny permission to use Owner's facilities.
- Requests for additional or alternate Contractor smoking areas must be submitted to Owner's representative. Written approval must be obtained prior to erection or use of such alternate facilities or area.

Temporary Buildings

- Temporary buildings must not be erected without first obtaining written approval of Owner's representative and then only in accordance with such approval.

Temporary Walks, Floors and Roadways

- Temporary walks, floors and roadways must be installed whenever an existing walk, floor or roadway is disturbed. Owner's representative must approve variance from this.

Utility Connection

- Connection to any of the facility's utility systems (water, electric, plant air, etc.) must be approved through Owner's representative.

Exhibit C

Hazard Assessment (Review with personnel & contractors before a project begins)

Location: _____ Date: _____

Emergency phone numbers:

Sunoco contact person _____ At _____ - _____
Ambulance phone # _____ - _____
Hospital phone # _____ - _____
Fire Department # _____ - _____
Directions to hospital: _____ - _____

Potential Hazards¹

_____ Exposure to vapor	_____ Hydrogen Sulfide present
_____ Pressure in the line	_____ Benzene present
_____ Release of hydrocarbon with pressure	_____ Trenching, sloping, shoring
_____ Fire/explosion	_____ Confined space entry
_____ Equipment connections between	_____ Unmarked pipelines, cables, and other
_____ underground and surface	_____ hazards
_____ Electric exposure	_____ Poison ivy, oak, etc.
_____ Welding flash	_____ Housekeeping
_____ Slips, Trips, Falls	_____ Pinch points
_____ Terrain	_____ Slings/Rigging failing
_____ Rocky	_____ Falling objects
_____ Slippery	_____ Noisy Equipment
_____ Steep	_____ Other Hazards _____
_____ Other	_____ Other Hazards _____

Required PPE under certain conditions

<u>Condition</u>	<u>Precaution</u>
_____ Line is open	_____ Flame resistant clothing
_____ Noisy Equipment	_____ Hearing protection
_____ Handling materials	_____ Work gloves appropriate for task
_____ Materials stored overhead	_____ Hard hats
_____ Exposure to liquid hydrocarbons	_____ Rubber gloves, e.g., Nitrile
_____ Welding	_____ Welding goggles or hood
_____ When Total Hydrocarbons > 100PPM	_____ Respirators
_____ Measured with GasTech or Draeger	
_____ tube	

Review MSDS for product hazards and chemical components

Exhibit C

Insert contractor company name here

Site Safety Plan for

Insert Project Name

Insert Sunoco Logistics Facility Name here

Emergency Phone Numbers:

Fire 911

Ambulance 911

Police 911

Hospital

Hospital Name	Insert name here
Address	Insert address here
Directions	Insert detailed directions

Insert Contractor Company Name Emergency Phone Numbers:

Name	Title	Numbers

Sunoco Logistics Emergency Phone Numbers:

Name	Title	Numbers

Exhibit C

Serious Incidents:

24 Hour Sunoco Logistics Emergency Number: 800-SUN-CALL (800-786-2255)

Sunoco Logistics Management: Insert Contact Name

Insert Phone No. (Office)

Inset Phone No. (Cell)

Insert Phone No. (Home)

Emergency Response:

In the event of a fire, the following steps will be taken:

1. The first person on the scene shall assess the situation and call Insert emergency number, 911 or direct dial giving the dispatcher all pertinent information including the terminal address, which is:
Insert Sunoco Logistics Facility Address
2. Sunoco Logistics facility manager and operator will also be informed immediately.
3. After the initial steps of responding to an emergency are performed the Insert Contractor Company Name employees must report to the emergency assembly area.

In the event of an injury/incident, the following steps will be taken:

1. The first person on the scene shall assess the situation. If medical assistance above and beyond First Aid is needed an ambulance shall be called for. The person calling for an ambulance shall stay on the line and give the dispatcher all pertinent information including the facility address, which is:
Insert Sunoco Logistics Facility Address
2. In the event of a minor injury that just requires first aid the first qualified person on the scene shall assist the injured person. If the minor injury requires medical attention the injured person should go to:
Insert local hospital name and address
3. All injuries must be immediately reported to the Insert Contractor Company Name foreman who will notify Sunoco Logistics representatives.

Emergency Assembly Area:

Employees will proceed Insert/specify designated assembly point (be specific). All personnel will remain there until everyone that signed in to the Insert Sunoco Logistics Facility Name are accounted for according to the evacuation plan posted in the facility office.

Hazard Communications:

MSDS for all chemicals that are being used on the job are Specify location of Contractor MSDSs. All MSDS for chemicals used by Insert Contractor Company Name employees are also held by their safety director Insert

Exhibit C

Contractor Safety Director Name. MSDSs for all chemicals used by Sunoco Logistics can be found Insert specific Sunoco Logistics Location

Work Permits:

Upon daily entrance into the terminal, the contractor foreman must check in with Sunoco Logistics representatives and sign off on all work to be conducted on the worksite that day and any related safety concerns. The foreman shall acquire the appropriate permits before performing any work that day.

Energized Equipment – Lockout Tagout Procedures

Before any work is performed on and energized equipment, that equipment shall be locked and tagged out according to insert Contractor Company Name and Sunoco Logistics Lockout / Tagout procedures.

Personal Protective Equipment:

All personnel will wear the personal protective equipment appropriate for the task(s) being performed. This will include the following:

- ☐ Hard Hat,
- ☐ Safety Glasses with ANSI Z87 approved side shields,
- ☐ Face shields,
- ☐ Gauntlet or welding style work gloves and long sleeve shirts will be worn when grinding, buffing, or torch cutting.
- ☐ Low voltage gloves (with a glove rating of 1KV) for performing hot tap procedure on CB-11.
- ☐ ABC type Fire extinguishers will be available for all employees performing hot permit work.
- ☐ Respirators will be worn for all employees working in areas that may have a hazardous atmosphere, which can be abated by the use of a respirator.
- ☐ Employees subject to working areas that have hazardous atmospheres must test that area before entering with the use of an air-sampling meter appropriate for gasses, mists or vapors present in that area.

Confined Space Work

All confined space work will be performed according to insert Contractor Company Name and Sunoco Logistics "Confined Space Entry" procedures.

Hot Work:

1. A hot work permit must be obtained from Sunoco Logistics representatives before performing any hot work.
2. Before and while performing any hot work within the terminal the work site must be tested with a combustible gas indicator. insert Contractor Company Name employees will use a calibrated combustible gas indicator that measures both LEL and oxygen. The air sampling equipment will be calibrated before its use each shift.
3. Two 30 lb. ABC type fire extinguishers will be present when any hot work is performed. A fire watch is required during hot work.

Fall Protection

All work over the height of 6' will be done according to 29 CFR 1926 Subpart M (Fall Protection).

Exhibit C

Other:

Any work outside the scope of these safety guidelines will be followed according to the insert Contractor Company Name Safety Program or as directed by insert Contractor's Safety Directr name.

Exhibit C

The following *THREE EXAMPLES* are provided to assist in completion of JSAs (Job Safety Analysis) for the project. Add, delete, or modify as necessary.

Insert company name here

JSA

Insert Project Name

Insert Sunoco Logistics Facility Name here

<i>Job</i>	<i>Hazards</i>	<i>Abatement</i>
Transporting personnel and equipment to the job site	<ul style="list-style-type: none">-Vehicular Failures-Driver Failures-Environmental Failures	<ul style="list-style-type: none">-Drivers will hold the appropriate licensing for the class of vehicle they are driving.-Driver will perform a pre trip inspection before vehicle departs.
Move in to the job site	<ul style="list-style-type: none">-Personnel unfamiliar with job site-Lost of loads due to improper material handling procedures	<ul style="list-style-type: none">-Hold a site specific safety meeting with all company personnel-Hold a pre-job safety meeting-Provide training for proper material handling and rigging.-Tour the work site and review the work to be done with all personnel.
Excavating & Dirt Removal	<ul style="list-style-type: none">-Contaminated Soil-Damage to underground piping utilities or conduit-Back Injuries-Struck by injuries	<ul style="list-style-type: none">-Observe and test soils for contamination during excavation.-Separate contaminated soil-Locate all underground utilities and other obstructions.-Barricade equipment-operating area.-Hand dig delicate obstructions.-Use proper hand digging techniques to avoid back injuries.

Exhibit C

Insert company name here

JSA

Insert Project Name

Insert Sunoco Logistics Facility Name here

Job	Hazards	Abatement
Installation of Petroleum Counter, Blend Valve, and Temperature Probe.	-Possibility of Electrical Shock	-Lockout Tagout procedures will be followed to Lockout PP2 at JB120
Energizing Tank Lighting and Offload area Lighting	- Possibility of Electrical Shock	-Lockout Tagout procedures will be followed to Lockout PP2 at JB120
Installation of pump #2 (P-2)	-Possibility of Electrical Shock	-Lockout Tagout procedures will be followed to Lockout motor starter #2 (MS-2) at (SW-3) disconnect/breaker.
Installation of pump #3 (P-3)	-Possibility of Electrical Shock	-Lockout Tagout procedures will be followed to Lockout motor starter #3 (MS-3) at (SW-3) disconnect/breaker.
Installation of pump #4 (P-4)	-Possibility of Electrical Shock	-Lockout Tagout procedures will be followed to Lockout motor starter #4 (MS-4) at (SW-3)
Remove motor starter #3 (MS-3)	-Possibility of Electrical Shock	-Lockout Tagout procedures will be followed to Lockout (SW-3)
Circuit Breaker 11 (CB-11) Hot Tap Procedure	-Possibility of Electrical Shock	-Employee will wear all appropriate PPE including but not limited to low voltage gloves (1KV), Hard Hat with face shield or goggles and Rubber insulated shoes or mat. -Employee will have a hot tap watch. -Employee will not wear any conductive or loose clothing.
Installation of lighting power conduit into terminal office	-Foreign object in eye	-Employee will wear appropriate eye and face protection during block drilling procedures.

Exhibit C

Insert company name here

JSA

Insert Project Name

Insert Sunoco Logistics Facility Name here

<i>Job</i>	<i>Hazards</i>	<i>Abatement</i>
Wire Pulling	<ul style="list-style-type: none">-Strained body-Lacerations to hands	<ul style="list-style-type: none">-Employee will use correct body positioning when pulling wire.-If tension of wires being pulled exceeds that which is reasonably handled by one employee wire pulling equipment will be used.-Employee will wear appropriate gloves if there is a possibility of lacerations to the hands due to sharp objects near the pulling area
Cutting and Threading of rigid pipe.	<ul style="list-style-type: none">-Lacerations to hands.-Foreign objects in eyes-Cutting Fluid-Employee being caught in cutting head of threading and cutting equipment.-Possibility of electrical shock	<ul style="list-style-type: none">-Gloves will be worn when there is a chance of lacerations to the hands-Safety glasses will be worn at all times-MSDS for cutting fluid will be kept on site.-Employee will not wear loose clothing or other articles of clothing that could become caught in the cutting and threading head.-Cutting and threading equipment will be used with GFCI protection.
Electrical Grounding	<ul style="list-style-type: none">-Possibility of burns from Cad welding process-Ignition possibilities	<ul style="list-style-type: none">-Employee will wear gloves during Cadwelding operations.-Employee will follow all the guidelines of a hot work permit

Exhibit C

		when performing Cadwelding procedures.
Installation of Tank Lighting	-Falling hazards	-Employee will wear appropriate fall protection when working off of unguarded surfaces over 6'.

EXHIBIT D
Lump Sum Acknowledgement

Execution of this Purchase Order is evidence that Contractor has read and fully understands the Agreement, all associated Lump Sum risks Contractor assumes hereunder, Specifications, Drawings, and Construction hereto and desires to contract for the work in accordance with the Agreement on their Firm Offer.

Company reserves the right to negotiate a set price for Extra Work directed by Company that is clearly outside the scope of the original Firm Offer and Agreement price, when accepted by both parties, shall become the basis for full compensation for such extra work, defined by the negotiated agreement. Payment for any such Extra Work must be authorized through a change order in accordance with Section 5 of this Agreement.

Contractor Name:
Representative Name:
Signature:
Title:
Address:
Address:
Phone:
Facsimile:
Email Address:

EXHIBIT E
FINAL WAIVER OF LIENS

State of _____
County of _____

Subject of Project: _____

Job No: _____

Address/Legal Description of Project: _____

To: (Contractor) _____

Owner: _____

Subcontractor: _____

Sub-Subcontractor: _____

IN CONSIDERATION for the final payment of _____ Dollars (\$ _____), the amount due the undersigned sub-subcontractor for the **final payment** for labor, materials and services furnished by the undersigned for the above-described project, pursuant to subcontract dated with Contractor, the undersigned, being first duly sworn, does hereby represent and certify to Contractor, as an inducement to Contractor to make final payment, and as representations upon which Contractor may rely in making said payment, as follows: there are no additional costs or claims for any extras or additions for labor or material with respect to the above-described subcontract and project; all work performed or materials installed are in accordance with the approved plans and specifications for the above-described project; all bills, charges and expenses for labor, supervision, materials, supplies, equipment, utilities, overhead, rentals and for all other things furnished or caused to be furnished for the above-described project by the undersigned have been paid in full; there are no unpaid claims or demands of subcontractors, sub-subcontractors, material suppliers, equipment suppliers, mechanics, laborers, lessors or others resulting from or arising out of any work done or materials or equipment supplied pursuant to said subcontract by the undersigned or by any other subcontractor, sub-subcontractor, material supplier, equipment supplier, mechanic, laborer, lessor or other person or entity; all federal and state payroll taxes and contributions for unemployment insurance, old age pensions, annuities, retirement benefits and union dues, imposed or assessed under any provision of any law (state or federal) or contract (and measured by wages, salaries or other remunerations paid by the undersigned to its employees or to its subcontractors engaged in said work or in any other operation incidental thereto) have been paid in full; and all payments received by the undersigned for this project will be used exclusively for the benefit of this project.

IN CONSIDERATION of the final payment, the undersigned does hereby release Contractor and the Owner from all claim(s), demand(s), action(s), and suit(s) of any kind arising under or by virtue of said subcontract and work done and/or materials and/or equipment supplied by the undersigned for the above-described project, and does hereby waive and release all present and/or future liens, rights of lien and lien and/or payment or performance bond claims of any kind whatsoever for any work done or labor or materials furnished for the project.

The undersigned sub-subcontractor and the undersigned individual signing on behalf of sub-subcontractor do hereby jointly and severally agree to indemnify, defend and hold harmless Contractor and the Owner of the project, against any loss or damage, including reasonable attorney's fees, which the Contractor and/or the Owner of the project may sustain by reason of the untruth or inaccuracy of any of the foregoing statements and representations, or by reason of the filing of any claim(s), lien(s) demand(s), suit(s), charge(s) or other action(s) by any subcontractors, sub-subcontractors, material suppliers, mechanics, laborers, lessors or others resulting from, or arising out of, any work done or materials or equipment supplied pursuant to, or in connection with, the work required by said subcontract.

The references to Contractor and Owner shall include their respective parents, subsidiaries, affiliates, sureties, officers, directors, employees, agents and assigns.

WITNESS the hand and seal of the undersigned this _____ day of _____,
20_____

(Name of Sub-subcontractor)

By: Its: _____
(Signature of Person Signing) (Office of Person Signing)

Witness/Attest: _____

Witness/Attest: _____

STATE OF _____)
COUNTY OF _____)

I, the undersigned, a Notary Public in and for said County in said State, hereby certify that
_____, as _____ of
_____, whose name is signed to the foregoing instrument and who is
known to me, being first duly sworn, acknowledged before me on this day that the statements and
representations made therein are true, and being informed of the contents of the foregoing instrument, and
being duly authorized to execute same on behalf of said corporation (s)he executed the same voluntarily
on the day the same bears date.

Given under my hand and official seal, this _____ day of
_____, 20_____.

My Commission Expires: _____

_____, NOTARY PUBLIC

EXHIBIT G
CONTRACTOR'S COMPLETION AFFIDAVIT

_____ ("Contractor") located at _____, having entered into a contract
with _____ ("Sunoco"), dated _____, 20__ for the following:

does hereby certify that said contract has been fully and finally completed; that all labor has been fully and entirely paid; that all Federal and State Unemployment Taxes have been paid, or will be paid when due; that all valid State Sales and Use Taxes properly levied on materials, equipment, supplies and services furnished by Contractor have been paid; that all Federal or State Income Taxes required by law to be withheld from employees or others have been withheld and remitted to the proper taxing authority, or will be remitted when due; that all premiums for insurance requirements, all claims for damages of any nature arising from the fulfillment of said contract, all materials, supplies, etc., all labor and bills for materials, supplies, etc., of any and all subcontractors, have all been paid; that payment has been made in full of all claims for damages for which Contractor is required to indemnify Company, its parent and affiliated companies, hereunder, and that any other items payable by the Contractor under said contract have all been paid.

Contractor agrees to indemnify, save and hold harmless Company from any claims, damages, or expenses arising from Contractor's failure to perform or fulfill any of the acts or obligations referred to above.

Contractor: _____

Signature: _____

Name: _____

Title: _____

State of _____

County _____

_____, an individual, makes oath and says that he/she is
representing _____ with headquarters at _____, and that he/she
examined the foregoing statement and that it is a true and correct statement of facts in respect to each and
every matter set forth therein.

Subscribed and sworn to before me this _____ day of _____, 20__.

_____ County _____ State.

Notary Public

My commission expires _____

Exhibit SPLP MG- 4

SPLP
MG-4



Sunoco Logistics

Sunoco Pipeline L.P. and Affiliates CONSTRUCTION STANDARDS

Subject:

GENERAL REQUIREMENTS

Prepared By: John Legge (REI)	Revision: 2	Page: 1 of 7	Code:	Number: 0100
Approved: Lindy Barile	Date: 9/03/2013	Replaces: 0100 Rev. 1		

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Sunoco Pipeline L.P. and Affiliates CONSTRUCTION STANDARDS

Subject:

GENERAL REQUIREMENTS

Prepared By: John Legge (REI)	Revision: 2	Page: 2 of 7	Code:	Number: 0100
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1.0 Introduction

1.1 Scope

- 1.1.1 This specification prescribes the general requirements for Engineering specifications.
- 1.1.2 These general requirements are complementary to General Conditions of the Contract contained in the RFQ (Request for Quotation) and are not intended to duplicate or contradict the General Conditions.

1.2 Terminology

- 1.2.1 Terminology is covered in the General Contract Conditions.
- 1.2.2 Additions are as follows, and apply wherever such terms are used:
 - A. Engineer: Sunoco Logistics Representative
 - B. Owner: Sunoco Logistics, L.P., Sunoco Pipeline, L.P., Sunoco Logistics Partners Marketing and Terminals, L.P. or any affiliates.
 - C. Owner's Representative: Individual, partnership, company or corporation retained by and representing the Owner and responsible for general engineering, observation and inspection activities during Construction.
 - D. Contractor: Appropriate individual, partnership, company, or corporation as established by work assignments, and becomes contractually obligated to the Agent and the Owner.
 - E. Trade: Workmen or Mechanics with special skills, or firms that hire them, as applicable.
 - F. Any: The term "any" in the Contract Documents shall be interpreted as "any and all" whenever more than 1 item would be applicable for completion of the Work of the Project; for example, "any other general expenses."
 - G. Shop Drawings: Drawings, diagrams, schedules, and other data specifically prepared for the work by the Contractor to illustrate some portion of the work.
 - H. Product Data: Illustrations, standards, schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate a material, product, or system for some portion of the work.
 - I. Samples: Physical examples which illustrate materials, equipment, or workmanship, and establish standards by which the work will be judged.

1.3 References

- 1.3.1 The publications listed below form part of this specification. Each publication shall be the latest revision and addendum in effect on the date this specification is issued for construction unless noted otherwise. Except as modified by the requirements specified herein or the details of the drawings, Work included in this specification shall conform to the applicable provisions of these publications.

**Subject:****GENERAL REQUIREMENTS**

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- A. ACI (American Concrete Institute)
- B. AISC (American Institute of Steel Construction)
- C. AISI (American Iron and Steel Institute)
- D. ANSI (American National Standards Institute)
- E. Applicable State Department of Highways Specification
- F. ASTM (American Society for Testing and Materials)
- G. AWI (American Wood Institute)
- H. AWPB (American Wood Preservers Bureau)
- I. AWS (American Welding Society)
- J. BOCA (Building Official Code Administration)
- K. CRSI (Concrete Reinforcing Steel Institute)
- L. CSI (Construction Specifications Institute)
- M. ETL (Electric Testing Laboratories)
- N. FM (Factory Mutual)
- O. IPCEA (Insulated Power Cable Engineers Association)
- P. NEC (National Electric Code)
- Q. NEMA (National Electric Manufacturers Association)
- R. NFPA (National Fire Protection Association Codes)
- S. NRMCA (National Ready Mixed Concrete Association)
- T. OSHA (Occupational Safety and Health Administration Standards)
- U. UL (Underwriters Laboratories)
- V. U.S. Department of Commerce, Bureau of Standards for Lumber
- W. Code of Federal Regulations, Title 49, Transportation of Hazardous Liquid by Pipeline.
- X. Code of Federal Regulations, Title 49, Transportation of Natural or Other Gas by Pipeline.

**Sunoco Pipeline L.P. and Affiliates
CONSTRUCTION STANDARDS****Subject:****GENERAL REQUIREMENTS**

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- 1.4.1 Words and abbreviations which have well-known technical or trade meanings are used in the specifications and drawings in accordance with such recognized meanings.
- 1.4.2 Where custom built equipment is specified, and an independent testing laboratory label or listing is not applicable to the completed product, components used in the construction and assembly of such equipment must be labeled or listed by an independent testing laboratory acceptable to the local governing authorities, where such label or listing is applicable to the components. These labels shall be securely affixed to the components in a conspicuous location.
- 1.4.3 The Mechanical and Electrical Drawings are diagrammatic, intending to show general locations and arrangements of piping, wiring, equipment, and specialties and not necessarily showing the required offsets, connections, or appurtenances. Accurately lay out work in cooperation with other trades to avoid conflicts and to obtain a neat and workmanlike installation which will afford maximum practical accessibility for operation, maintenance, and headroom.
- 1.4.4 Drawing scale is selected for convenience in presentation and not for establishment of dimensions.
 - A. Use drawing dimensions for performance of work.
 - B. Verify actual dimensions at the site to determine that sufficient space exists and that no interference will be caused.

1.5 Submittals**1.5.1 Filing of Drawings**

- A. The Contractor shall file necessary drawings with the Insurance Authority and Local Authorities, if their approval is required.
- B. Copies of these drawings bearing the stamp of approval of the authorities having jurisdiction shall be submitted to the Owner prior to starting the Work.

1.5.2 Record Documents and Samples

- A. The Contractor shall maintain, at the site, one (1) record copy of all drawings, specifications, addenda, change orders, and other modifications, in legible condition.
- B. The Contractor shall mark all record documents to accurately record all changes made during construction.
- C. The record documents shall be made available, by the Contractor, to the Owner's Representative and shall be delivered to the Owner's Representative upon completion of the Work.



Sunoco Pipeline L.P. and Affiliates CONSTRUCTION STANDARDS

Subject:

GENERAL REQUIREMENTS

Prepared By: John Legge (REI)	Revision: 2	Page: 5 of 7	Code:	Number: 0100
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1.5.3 Shop Drawings, Product Data, and Samples

- A. Shop drawings shall be provided in Autocad 2010 format for return with remarks noted.
- B. Product data shall be submitted in a quantity of 6 copies.
- C. Submit samples in a quantity of three (3); one to be retained by the Owner's Representative, one to be retained at the construction site, and one to be returned by the Owner's Representative to the originator after approval.
- D. Approval indicates conformance to contract documents (not performance, code compliance, dimensions, or quantities) and does not constitute approval to vary from contract documents. Resubmit disapproved shop drawings, product data, and samples for approval in same manner as for first submittal.
- E. No portion of the work requiring shop drawings, product data or sample approval shall be started until Owner Representative approval is obtained in writing.

2.0 Products

2.1 Substitution for items described in the contract documents will be as follows:

- 2.1.1 Where "Approved Substitute" is omitted for the item, product, material, system, or equipment, provide exactly as specified. No substitution will be considered or approved.
- 2.1.2 Where "Approved Substitute" is included for an item, product, material, system, or equipment, substitution may be submitted for approval.

2.2 Proposed substitution shall be:

- 2.2.1 Available in quantity sufficient to prevent delay of the work.
- 2.2.2 Provided in same range of colors, textures, gages, dimensions, capacities, functions, types, and finishes.
- 2.2.3 Equal to specified item in strength, durability, efficiency, serviceability, ease, and cost of maintenance.
- 2.2.4 Accompanied by certified data.
- 2.2.5 Compatible with the engineering design, without requiring design modifications by the Owner's Representative, or without requiring additional cost.

3.0 Execution

3.1 Field Quality Control

- 3.1.1 Workmanship contemplated under this work agreement shall be first class in every respect.
- 3.1.2 Surfaces, members, frames, and units shall be true, even, and in alignment. No warped, bent, dented, or otherwise damaged members of units shall be built into the work. Connections shall be

**Sunoco Pipeline L.P. and Affiliates
CONSTRUCTION STANDARDS****Subject:****GENERAL REQUIREMENTS**

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true, tight, and neat. Arises, soffits, and intersections shall be straight and true. Finishes shall be free from chips, dents, or other imperfections not in conformity with first-class work.

3.1.3 Factory assemblies shall conform to the first-class standards of the trades concerned.

3.1.4 Defective materials shall not be built in and, if built in, shall be removed at the Contractor's expense. Where, in the opinion of the Owner Representative or Owner, doubt exists as to the quality or effectiveness of the work, the work shall be reinstalled as directed.

3.2 Cleanup

A. Daily Cleanup

3.2.1 Maintain the premises and Project site in a reasonable neat and orderly condition, free from accumulations of waste materials and rubbish during the entire construction period.

3.2.2 Remove crates, cartons, trash, and flammable waste materials from the work areas by the end of each working day.

3.2.3 Do not dispose of trash or debris by burning on Project site.

3.2.4 Clean and leave free from rubbish, construction debris, dust and dirt; dust electrical closets, roof drains and roof areas.

3.2.5 Clean and restore any finished surface which is defaced in any way.

3.2.6 Contractor to provide supply and exchange of trash bins for his/her use.

B. Final Cleanup

3.2.7 Immediately prior to final building inspection by Owner, prepare building for occupancy by thoroughly cleaning surfaces on which dirt or dust have collected or which have tarnished. Cleanup shall be performed according to respective manufacturer's instructions.

3.2.8 Soiled items that cannot be cleaned shall be touched up or replaced to the satisfaction of the Owner's representative. Items damaged during cleanup shall be repaired or replaced at no additional cost to the Owner.

3.2.9 Final cleanup shall include, but is not limited to, the following:

- A. Equipment Skids.
- B. Electrical Equipment and Enclosures.
- C. Clean floor toppings.
- D. Clean and polish tarnished finish hardware.
- E. Clean doors and frames.
- F. Piping and appurtenances.
- G. Structural Steel Supports.
- H. Upon completion of the Work, remove temporary building, structures, scaffolding, surplus materials, and refuse from the site.



Sunoco Pipeline L.P. and Affiliates CONSTRUCTION STANDARDS

Subject:

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Prepared By: John Legge (REI)	Revision: 2	Page: 7 of 7	Code:	Number: 0100
Approved: Lindy Barile	Date: 9/03/2013	Replaces: 0100 Rev. 1		

End of Specification

4.0 Revision Log

Revision No.	Revision Date	Document Authorizer	Document Reviewer	Document Author	Document Administrator	Revision Details
1	08/28/2006			John Legge	NA	
2	09/04/2013	L. Barile	REI		NA	Added CFR Title 49, Part 192 and 195



Sunoco Logistics

Sunoco Pipeline L.P. and Affiliates CONSTRUCTION STANDARDS

Subject:

SITE PREPARATION

Prepared By: S. Mun [REI]	Revision: 2	Page: 1 of 5	Code:	Number: 0300
Approved: Lindy Barile	Date: 8/29/2013	Replaces: 0300 Rev. 1		

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**Subject:****SITE PREPARATION**

Prepared By: S. Mun [REI]	Revision: 2	Page: 2 of 5	Code:	Number: 0300
Approved: Lindy Barile	Date: 8/29/2013	Replaces: 0300 Rev. 1		

1.0 Introduction**1.1 Scope**

1.1.1 The work required under this section includes the furnishing of supervision, labor, equipment, materials, and services necessary for site preparation, clearing, and grading, including all work necessary for water or soil control, such as shoring, cofferdams, dikes, and levees.

1.1.2 Any deviation from this specification must be authorized in advance by the Owner's Representative.

1.2 References

PIP CVS02100

2.0 Site Security**2.1 Fences and Gates****A. Along the right of way**

2.1.1 The Contractor shall verify, with the Owner's Representative, that permission of the property owner has been obtained before modifying fence lines.

2.1.2 Where necessary to cut or remove to permit passage of equipment onto or along the right-of-way, all openings resulting in the fence shall be closed with temporary or permanent gates constructed and / or installed in a manner acceptable to the Owner's Representative and/or the property owners.

2.1.3 Components of existing fences shall be preserved and reused to the extent economically feasible.

2.1.4 The Contractor shall furnish suitable materials for, and shall install a suitable, substantial gate in every fence, at the point of intersection of the proposed pipeline with the fence, for access to land crossed by the line.

2.1.5 Gates shall not exceed the width of the Right-of-Way.

2.1.6 To prevent damages to said fences, before cutting the fences to make the gates, the Contractor shall brace and reinforce the fence on each side of the gate to be installed.

2.1.7 Gates shall be so constructed that they can be securely closed and shall be the type directed by the Owner's Representative, and shall satisfy the property owner and tenant.

2.1.8 After all construction operations are completed, the Contractor shall remove all temporary gates and shall rebuild all fences to a condition as good, or better than, the original condition.

B. Inside Owner's Facilities

Contractor shall verify with Owner's Representative, if any type of fencing will be required around the project site.



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2.2 Security

- 2.2.1 The Contractor shall be solely responsible for damages resulting from negligence of his employees in failing to keep any gates securely closed at all times.
- 2.2.2 The Contractor shall furnish a watchman where necessary, in order to comply with the site security requirements.

3.0 Clearing

3.1 Requirements

- 3.1.1 Clearing shall include work necessary for the clearing of all trees, brush, debris or other obstacles lying within the confines of the area to be used for the project.
- 3.1.2 Clearing shall be limited to the area that is contained in the Owner's property (Right-of-Way) as indicated on the drawings.
- 3.1.3 The Contractor should become familiar with areas that have been secured for temporary access (Right-of-Way) and workspace outside of the established owner's property or Right-of-Way.
- 3.1.4 In the event that the Contractor causes damage to property beyond the owner's property, temporary or permanent Right-of-Way, such damage shall be the Contractor's liability. All work shall be done in such a manner as to limit damages to an absolute minimum.
- 3.1.5 In any area requiring grading, all stumps shall be removed. Outside the areas to be graded, including the ditch line strip, the stumps shall either be removed or cut off at grade level, root plowed or grubbed in accordance with the owner's property or Right-of-Way restrictions.
- 3.1.6 Loose debris shall be removed a sufficient distance from the project area or ditch line so that the spoil bank from the ditching or excavation operations will not fall on foreign matter that might become mixed with the excavated soil.
- 3.1.7 All debris, such as brush, stumps, tree limbs, etc., shall be disposed of in a manner satisfactory to the Owner's Representative, landowner, and any governmental body having jurisdiction.
- 3.1.8 Debris shall not be pushed back onto non-cleared areas where it would become inaccessible and / or cause damage to occur to growing trees. The Contractor shall not bury debris, stumps, tree limbs, brush, etc., on the non project area or Right-of-Way.
- 3.1.9 All clearing shall comply with all local, state and federal requirements.

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- 3.1.10 Contractor shall comply with all requirements and restrictions in right-of-way agreements, including methods of vegetation removal, preservation of trees to remain and tree-trimming operations. Contractor shall accurately identify trees and other features to remain. Trees designated to remain shall be trimmed utilizing only approved, proper tree trimming saws, for all limb removal. Excavating equipment shall not be used to break off limbs and branches.

4.0 Grading**4.1 Requirements**

- 4.1.1 This shall include all the work necessary to grade and properly prepare the construction area for performing the contracted construction operations.
- 4.1.2 Prior to any trench excavation or grading (outside paved area limits), the Contractor is required to "topsoil strip" the top six (6) inches of surface area to be excavated or graded. All topsoil shall be stored and replaced in accordance with the Erosion and Sedimentation Control Plans.
- 4.1.3 Grading shall be done in such a manner as to minimize interference with existing natural drainage. Except where indicated otherwise on the project drawings, all existing surface drainage channels that are disturbed or blocked during construction shall be restored to their original condition of grade and cross section after the work of construction is completed.
- 4.1.4 All grading shall be finished to maintain the original drainage or water flow conditions as nearly as practicable and shall conform to regulations of the Federal, State, County or other local authorities having legal jurisdiction. Where terracing or diversion dams are cut, they shall be left a minimum time and shall be completely restored to their original state.
- 4.1.5 The Contractor shall conduct their operations in such a manner as to minimize airborne dust. Contractor shall implement all necessary dust control measures as required by the Owner's Representative, the property owner, and any governmental body having jurisdiction, for the duration of the contracted scope, at no additional expense to the Owner.
- 4.1.6 The Contractor shall accomplish all the grading necessary to permit the passage of his equipment across roads, streams, gullies, etc. without interfering with the flow capacity or damaging the banks.
- 4.1.7 When necessary, temporary bridges or flume pipe shall be constructed by the Contractor, at no extra cost to the Owner.
- 4.1.8 No public ditches, drains, or canals shall be filled or bridged for passage of equipment unless the Contractor has secured approval of the authorities having jurisdiction over same.
- 4.1.9 The Contractor is required to supply all necessary materials, equipment and manpower necessary to establish all access roads. Access roads shall have proper drainage controls that will not interrupt the existing drainage channels.

End of Specification



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Sunoco Logistics

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Subject:

DEMOLITION

Prepared By:
C. Armstrong [REI]

Revision:
1

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C. Armstrong [REI]**Revision:**
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0301 Rev. 0**1.0 Introduction****1.1 Scope**

- 1.1.1 This specification prescribes the requirements for the preparation and demolition or removal of existing pipelines or facilities.
- 1.1.2 This specification also prescribes the requirements for the removal, handling, and disposal of surplus materials.

1.2 References

- 1.2.1 Each publication shall be the latest revision and addendum in effect on the date this specification is issued for construction unless noted otherwise.
- 1.2.2 Except as modified by the requirements specified herein or the details of the drawings, work included in this specification shall conform to the applicable provisions of these publications.
- 1.2.3 The publications listed below form part of this specification:
 - A. OSHA Construction Industry Standards: Title 29, Code of Federal Regulations, Part 1926, Safety and Health Regulations for Construction, Subpart T - Demolition.
 - B. Code of Federal Regulations: Title 49 – Transportation, Subtitle B, Chapter I – Pipeline and Hazardous Materials Safety Administration, DOT
 - C. SPLP Technical Manual

2.0 Preparation**2.1 Protection****2.1.1 Existing Facilities**

- A. Protect existing facilities that are to remain in place, that are to be reused, or that are to remain the property of the Owner using temporary covers, shoring, bracing, and/or supports. Repair to the original condition, or replace with new, those items designated to remain or to be reused that are damaged during performance of the work.
- B. Protect structural elements from being overloaded.
- C. Provide new supports, braces, or reinforcement for existing facilities weakened by demolition and removal work.

2.1.2 Weather Protection

- A. Protect from the weather at all times facilities and equipment designated to remain in place.
- B. Maintain temporary coverings to ensure their effectiveness and to prevent their displacement.

2.2 Dust Control**2.2.1 Existing Buildings**

- A. Provide dust proof barricades to prevent the intrusion of dust or inclement weather into interiors of existing buildings exposed by the work.



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B. Construct barricades using substantially braced framing covered with a suitable polyethylene sheeting material. Remove and properly dispose of barricades when no longer needed (as determined by the Owner's Representative).

- 2.2.2 Take appropriate measures to avoid accumulating dust in work areas, so as not to create a nuisance to surrounding areas.
- 2.2.3 During demolition work covered by this specification, take appropriate measures to protect personnel from being injured by airborne contaminants such as asbestos fibers and metal dusts. Such measures shall comply with the requirements of OSHA Construction Industry Standards pertaining to airborne contaminants.
- 2.2.4 The use of water will not be permitted when it will result in hazardous or objectionable conditions such as pollution or flooding of usage areas.

3.0 Execution

3.1 Pipelines and Related Appurtenances

3.1.1 The following pipelines shall be removed:

- A. Existing lines designated on the drawings to be removed.
- B. Portions of abandoned lines that are:
- Less than 24 inches below proposed finished grade and may result in a dead leg.
 - Above grade piping that may be considered a dead leg.
 - Within construction areas of new buildings, roads, equipment, foundations, or pipe supports.
 - Interfering with installation of new pipelines.
 - Otherwise interfering with performance of the work.

3.1.2 Abandonment of Pipelines

- A. Purge, clean, fill, or terminate pipelines that are to be abandoned in a manner conforming to the requirements of the nationally recognized code covering the specific product and as indicated on the construction drawings and in these specifications.
- All local safety and permitting requirements shall be followed.
 - Due to the potential of residual product or vapors that may exist in pipelines, only cold cutting methods will be acceptable for pipe demolition activities.
- B. For DOT pipelines and pipeline facilities, refer to the following manuals for additional requirements:
- DOT Maintenance Manual Section 195.402.c10, "Abandoning Pipeline Facilities" and "Purging of Combustibles"
 - Technical Manual, Procedure PR-11-0037, "Activating and Deactivating Pipelines"
 - ENGR-PR-0013, Engineering Drawing Relocation As Built Requirements
- C. Package the salvageable materials in such a manner to prevent damage by handling.
- D. Store salvageable materials in the area designated by the Owner's Representative in an orderly manner. Remove other materials and equipment from the site.

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E. Salvage will require approval of the Owner's Representative before any salvaged material can leave the site.

3.1.3 Disconnecting Utilities

- A. When demolition or abandonment work requires the disruption or interruption of service or disconnection of a service connection, coordinate such work with the affected utility supplier to ensure that proper measures are taken to protect the utility from damage.
- B. The Owner's Representative shall also be informed of these interruptions.

3.2 The use of explosives shall not be permitted.

3.3 Burning debris and rubbish on the Owner's property will not be permitted.

3.4 The Owner reserves the right to keep identified materials and equipment scheduled to be demolished removed. Prior to removal, obtain from the Owner's Representative a list of materials to be salvaged.

3.5 Perform demolition in accordance with applicable requirements of the OSHA Construction Industry Standards.

3.6 Remove from the project site materials, rubbish, and other debris resulting from the demolition work. Leave the site clean and safe.

3.7 Local regulations regarding hauling and disposal shall apply.

END SPECIFICATION

4.0 Revision Log

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1.0 Introduction

1.1 Scope

- 1.1.1 This specification prescribes the requirements for the excavation, fill and embankment construction required to achieve the finished site grades indicated on the plans or otherwise required by the contract documents. For backfill requirements around pipelines or other utilities, refer to SPLP DOT Maintenance Manual Section 195.252 and Construction Spec 308, Pipe Padding, Shading and Backfilling for additional requirements.
- 1.1.2 Also prescribed are the requirements for the removal, replacement, and disposal of unsuitable materials; the disposal of surplus materials; and the furnishings, placement, and compaction of borrowed material.

1.2 Definitions

- 1.2.1 Soil classification Symbols; Symbols based on the Unified Soil Classification System as determined per ASTM D2487 or ASTM D2488 (such as GW, SW, and CH).
- 1.2.2 Satisfactory Fill Material: Soil classified per ASTM D2487 or ASTM D2488 as one of the following:
 - A. Gravel (GW, GP, GM, GC)
 - B. Sand (SW, SP, SM, SC)
 - C. Inorganic lean clay (CL)
 - D. Inorganic silt (ML)
 - E. Gravel - silt, gravel-clay, sand-silt mixture containing 5 to 12 percent fines (GW-CL, SP-ML)

Satisfactory fill material shall be free from frozen lumps, refuse, stones or rocks larger than 3 inches in any dimension, or other material that might prevent proper compaction or cause the completed fill or embankment to have insufficient bearing capacity for the expected super imposed loads.
- 1.2.3 Unsatisfactory Material: Soil having insufficient strength or stability to carry the loads that will be superimposed on the completed fill or embankment without excessive settlement or loss of stability; material containing refuse, frozen lumps, large rocks, debris, or other materials that could cause the fill or embankment not to compact; and organic soils (Pt, OH, OL).
- 1.2.4 Cohesive Materials: Soils classified per ASTM D2487 or ASTM D2488 as GC, SC, ML, CL, MH, CH, and materials classified as GC or SC (fine fraction has a plasticity index greater than 7).
- 1.2.5 Cohesion-less Materials: Soils classified per ASTM C2487 or ASTM as GW, GP, SW, SP, and materials classified as GM or SM (fine fraction has a plasticity index less than 4).
- 1.2.6 Modified Proctor Density: The maximum dry density achieved per ASTM D1557 for a sample of material representative of that to be compacted in the field.
- 1.2.7 Optimum Moisture Content: The moisture content at which the Modified Proctor Density is achieved.
- 1.2.8 Inspection and Testing Agency: The entity retained to perform the inspections and testing is required to determine and verify compliance of the work with the requirements of this specification.

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- 1.2.9 Soils Engineer: The registered professional engineer (or designated representative) who is responsible for evaluating the suitability of the soil and rock materials involved in the work, and for verifying the compliance of the soil related work to the requirements of the specifications.
- 1.2.10 Rock: Solid, homogenous, interlocking crystalline material with firmly cemented, laminated, or foliated masses, or conglomerate deposits. Also large boulders, buried masonry, or other concrete masses (except sidewalks and other pavements and slabs) larger than ½ cubic yard in volume.
- 1.2.11 Proof-Rolling: Applying test loads over the surface of a designated area to locate and permit the timely correction of deficiencies in subsurface soils that are likely to adversely affect the performance of an overlying pavement or structure.

1.3 References

- 1.3.1 Each publication shall be the latest revision and addendum in effect on the date of contract in which this specification is issued for construction unless noted otherwise. Except as modified by the requirements specified in this document or the details of the drawings, work included in this specification shall conform to the applicable provisions of these publications.
- 1.3.2 The publications listed below form part of this specification:
 - A. ASTM D1557: Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.
 - B. ASTM D2487: Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 - C. ASTM D2488: Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
 - D. ASTM C33: Specification for Concrete Aggregate
 - E. ASTM C150: Specification for Portland Cement
 - F. OSHA (Occupational Safety and Health Administration)
 - G. OSHA Construction Industry Standards, Title 29, Code of Federal Regulations, Part 1926, Safety and Health Regulations for Construction.
 - H. SPLP DOT Maintenance Manual Section 195.252, "Backfilling"
 - I. Construction Spec 308, Pipe Padding, Shading and Backfilling
 - J. Process Industry Practices (PIP), PIP CVS02100, "Site Preparation, Excavation, and Backfill Specification"

1.4 Quality Assurance

- 1.4.1 An inspection and testing agency will be retained by the Owner to perform field and laboratory testing and soil evaluations to verify compliance of the work with the requirements of this specification and to ensure the achievement of the intents and purposes of the work.
- 1.4.2 The performance or lack of performance of such tests and inspections shall not be construed as granting relief from the requirements of these specifications or the other contract documents.

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1.5 Site Conditions

- 1.5.1 Existing site geo-technical conditions, if investigated by an independent geological company, shall be included in this project specification.
- 1.5.2 A report containing the findings, conclusions, and recommendations resulting from any investigation is by this reference made a part of these specifications.
- 1.5.3 A copy of the report, if applicable, shall be included in the contract documents. The information contained in the report, if included, shall not be construed as a guarantee of the depth, extent, or character of materials actually present.

2.0 Product and Materials**2.1 Materials**

- 2.1.1 Borrow material shall meet the requirements specified herein for satisfactory fill materials.
- 2.1.2 Structural and non-structural fill materials shall meet the requirements outlined in the geotechnical report provided for the project, and this specification.
- 2.1.3 Portland cement shall be according to ASTM C150, Type I or II.
- 2.1.4 Sand shall be fine aggregate per ASTM C33.

2.2 Flowable Fill

- 2.2.1 Flowable fill shall be a mixture of 1 part (by volume) Portland cement, 2 parts sand, and water, or as otherwise approved by the Owner's Representative.
- 2.2.2 The amount of water in flowable fill shall be only as necessary to produce a mixture with a consistency suitable for proper placement.
- 2.2.3 Flowable fill shall be used only as explicitly noted on the project drawings and as specifically approved by the Owner's Representative.

3.0 Preparation

- 3.1.1 Before starting work, thoroughly examine the site to ascertain conditions under which the work must be performed. Follow all required State and Local Jurisdictional requirements for Damage Prevention and 811.
- 3.1.2 Take protective measures to prevent existing facilities within the work area that are not designated for removal from being damaged by the work.
- 3.1.3 Locate and protect from damage survey monuments within the work area. Properly relocate or witness any monument that must be disturbed by the work. After completion of the work, restore the monument witnesses.
- 3.1.4 Before starting earthwork operations on any particular area of the project site, install measures for the control, prevention, and abatement of erosion and accumulation of silt for that area as required by the project specifications and any applicable federal, state or local codes or regulations.

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3.2 Construction Layout

3.2.1 Unless otherwise stipulated elsewhere in the contract documents, the work covered by this specification shall include the performance of calculations, and the setting of marks and stakes in the field necessary to ensure that the work conforms to the required lines, grades, and dimensions. Personnel performing the construction staking shall be supervised by a land surveyor licensed by the jurisdiction where the work is performed, unless approved otherwise by the Owner's Representative. Relate layout to the site coordinate grid system, elevation datum, and related survey monuments and benchmarks identified on the drawings and elsewhere in the contract documents.

4.0 Excavation

4.1 General

- 4.1.1 Remove soil, rock, and other materials as necessary to achieve the finished grades, sub-grades, or other limits of excavation indicated and as otherwise required to satisfy these specifications. Utilize satisfactory materials resulting from excavation work in the construction of fills and embankment, and for the replacement of removed unsuitable materials.
- 4.1.2 Stockpile excavated satisfactory materials that are surplus to the quantity needed for construction of required fills and embankments, or for replacement of unsuitable fill, in a manner indicated on the drawings or elsewhere in the contract documents. Dispose of surplus materials offsite if no provisions for stockpiling are cited or if the quantity of surplus material exceeds the quantity needed to complete the contracted scope.
- 4.1.3 After the excavation to the required grade is completed, re-compact materials that are to remain but have been loosened or otherwise disturbed by the excavation operations, to a firm, stable condition, and to a density equal to or greater than the surrounding undisturbed material.

4.2 Slope Stabilization

- 4.2.1 Stabilize the sides of excavations and any other simply sloped bank as necessary to prevent slope failure or any other earth movement that might injure personnel, or damage existing buildings, structures, or other facilities in the vicinity of the work. The stabilization method employed shall comply with all pertinent requirements of OSHA Standards and all other applicable federal, state, and local codes and regulations.
- 4.2.2 Remove sheeting, bracing, and shoring systems employed for slope stabilization as the work proceeds, unless they are permitted or required to remain by other provisions of these specifications or the other contract documents. Carefully remove such systems in a manner that will prevent subsidence or other soil movement that might damage any existing or newly constructed structure or other facility.
- 4.2.3 Existing or Completed Utilities
 - A. Exercise care in moving machinery and equipment over existing or newly installed pipes and utilities during construction so as not to cause damage to completed work. Do not use power-driven equipment to excavate closer than 2 feet from any existing utility or structure.

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- B. For work immediately adjacent to, or for excavation exposing an existing utility or other structure, use manual or light equipment excavation methods until the obstruction is cleared. Support covered pipes and other existing work affected by the excavation until they are properly supported by backfill.

4.2.4 Structures and Surfaces

- A. Protect newly backfilled areas and adjacent structures, slopes, or grades from damage. Repair and re-establish damaged grades and slopes.
- B. Fill and backfill adjacent to structures such as retaining walls shall be compacted with hand operated equipment to a distance of 4 feet or greater beyond the sides of the structures. Unless otherwise approved by the Owner, fill materials shall be placed in lifts not exceeding 4 inches in loose depth for hand-operated compaction equipment.
- C. Do not backfill around or over cast-in-place concrete until the concrete has attained 75% of its specified 28-day strength, unless permitted otherwise by the Owner.
- D. Protect existing streams, ditches, and other storm water facilities from silt accumulation and erosion.

4.3 Ditches, Swales, and Channels

- 4.3.1 Construct new and modified ditches, swales, and channels to conform with the lines, grades, and cross sections indicated on the plans or otherwise required by the contract documents. Trim and dress roots, stumps, rock, and other foreign materials exposed by the work to conform to the required surface.
- 4.3.2 Backfill to grade any excessive excavation using either satisfactory materials thoroughly compacted to the density required for fills and embankments or place stone or cobble to form an erosion resistant ditch lining.

4.4 Fills and Embankments

- 4.4.1 Construct fills and embankments by placing and compacting satisfactory materials in successive, uniform, horizontal lifts of not greater than 8 inches loose thickness.
- 4.4.2 Compact each lift to the specified density before placing materials for the overlying lift.
- 4.4.3 Embankment Foundation
- A. Before placing the first layer of materials, scarify the surface of areas where fill is to be placed to a depth of no less than 6 inches, and then compact to no less than 92 percent of Modified Proctor Density (ASTM D1557).
- B. Where the fill or embankment is to be placed on an inundated area or on low swamp ground that will not support the weight of the hauling equipment, construct the first lift by dumping successive loads of satisfactory materials in a uniformly distributed layer, of a thickness not greater than that necessary to support the hauling equipment while placing materials for the subsequent lift. Compact the top of this special first lift to a firm and stable condition; however,



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it need not be compacted to the specified density, provided it is subsequently overlaid by at least two, 8-inch lifts that are placed and compacted as required. If the conditions are such that two full lifts cannot be properly placed over the special lift, notify the Owner's Representative so appropriate corrective measures may be developed and implemented.

C. Refer to the project drawings for other embankment construction requirements.

4.4.4 Compaction

D. Compact materials placed in fills and embankments to no less than 92% of maximum Modified Proctor density (ASTM D1557). The top 12 inches of sub-grade beneath structurally loaded areas (such as slabs, pavement, foundations, and railroads) shall be compacted to no less than 95% of maximum Modified Proctor Density.

E. Fill materials under all new facilities, including buildings, tanks, vessels, process equipment, above-grade piping, platforms, roadways and similar construction shall be Satisfactory Fill as defined in this specification.

F. Adjust the moisture content as necessary to achieve a condition suitable for compaction of cohesive materials. The moisture content at the time of compaction shall be within 2% of optimum moisture content (ASTM D1557).

G. Confirmation of site or foundation compaction shall be provided by the Contractor.

4.5 Surface Drainage

Conduct excavation, fill, and backfill operations in such a manner and sequence that proper drainage is maintained at all times in and around the work area. Promptly remove surface water accumulations. Remove and replace with satisfactory materials, or stabilize by approved mechanical methods materials that become loosened due to exposure to the elements.

4.6 Soft or Yielding Sub-Grades

If an area of soft or yielding sub-grade is detected during the performance of Work prescribed by this specification, report this condition immediately to the Owner's Representative for determination of appropriate corrective action.

4.7 Finish Grading

Trim and finish-grade the surface of areas involved in work covered by this specification to within plus or minus 0.10 feet of the required grade. The resulting surface shall be reasonably smooth and free of ruts, ridges, depressions, and other significant irregularities. Finish ditches so that no ponding of water occurs.

End of Specification



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Subject:

Excavation

Prepared By: C. Armstrong [REI]	Revision: 2	Page: 2 of 6	Code:	Number: 0303
Approved: Lindy Barile	Date: 8/29/2013	Replaces: 0303 Rev. 1		

1.0 Introduction

1.1 Scope

- 1.1.1 This specification covers the labor, supervision, equipment, and materials that are required to satisfactorily perform excavation work while on Sunoco Logistics' property, including all work necessary for de-watering, sheeting, and shoring.
- 1.1.2 Any deviation from this specification must be authorized in advance by the Owner's Representative.

1.2 Limits of Excavation

- 1.2.1 Excavation shall include the removal of any obstacles that may obstruct the line of work, and the excavation and removal of all earth, rock, or other materials. This includes whether by ditching machine, by power shovel, by hand, or by any other method, to the extent necessary to install the pipe, appurtenances or structure in conformance with the line and grades shown in the plans and as specified.
- 1.2.2 Where required to prevent damage to facilities, the Contractor shall ditch by hand at no extra cost to Owner.
- 1.2.3 Contractor shall notify the appropriate local Damage Prevention (811) one-call system prior to performing any excavation work.

1.3 Protection

- 1.3.1 The Contractor shall place and maintain in good condition temporary fences, guardrails, barricades, lights and other protective measures required for the safety of personnel and the premises.
- 1.3.2 All reference points, property markers, benchmarks, etc., shall be carefully maintained during excavation. Damage by the Contractor during performance of the work shall be repaired or replaced by the Contractor to the satisfaction of the Owner.
- 1.3.3 All necessary precautions shall be taken to protect and preserve utilities scheduled to remain after the work is completed. The Contractor shall install temporary service lines when such preservation and protection are impractical.
- 1.3.4 The Contractor shall use bracing and shoring to protect excavations adjacent to existing underground installations (i.e. foundations, piping, manholes, electrical, and duct banks) during construction. No excavation is permitted under foundations.
- 1.3.5 The Contractor shall be responsible for avoiding damage to and preserving trees, shrubs, and all other vegetation in the areas beyond the designated excavation area.
- 1.3.6 Any damage to structure, utility lines, or graded areas caused by the Contractor shall be repaired to the original condition at no additional cost to the Owner.

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2.0 Subsurface Conditions**2.1 Soft Sub-Grade**

- 2.1.1 Where soft or spongy soil is encountered at sub-grade and/or beyond the specified trench area it shall be removed to the approval of the Owner's Representative.
- 2.1.2 The additional excavated volume of soft or spongy soils shall be determined to the nearest cubic yard. This quantity shall be reported immediately to the Owner's Representative. Back-filling shall not proceed until this procedure has been completed.

2.2 Hazardous/Contaminated Sub-Grade

- 2.2.1 Suspected contaminated soil shall be excavated and stockpiled in a secure area and placed on and covered by 6-mil polyethylene.
- 2.2.2 The Owner's Representative shall be notified immediately to determine what further action (testing, remediation, disposal, etc.) is necessary.
- 2.2.3 The Owner's Representative shall determine what excavated materials, if any, are contaminated or hazardous and will also direct the Contractor on handling requirements.
- 2.2.4 The volume of excavated hazardous materials shall be measured to the nearest cubic yard.
- 2.2.5 Refer to the De-watering Excavation section, for handling of groundwater and de-watering from contaminated areas.
- 2.2.6 The Contractor shall handle all material in accordance with local, state and federal regulations along with Sunoco Logistics' Safety and Security Requirements.

2.3 Maximum and Minimum Width of Trench Excavations

- 2.3.1 Site excavations shall conform to Sunoco Logistics Excavation Safety Program, HS-G-005, as well as, meeting safe work permit requirements.
- 2.3.2 Sides of all excavations shall be cut as nearly vertical as possible. The Contractor shall implement all measures necessary to satisfy OSHA requirements, including trench safety and fall protection. Refer to contract provisions to determine whether payment will only be made for select backfill etc. within the trench width dimensions shown on the Design Drawings.
- 2.3.3 The maximum / minimum width of a single trench in which the pipelines may be installed shall be per the specified dimensions shown on the Engineer's Trench Detail Drawing, preferred spacing between multiple lines within a single trench is 3 feet in order to permit future excavation, if necessary.
- 2.3.4 The maximum width dimension is to be measured at an elevation in the trench, which is 12 inches above the top of pipe when it is laid to grade.
- 2.3.5 The minimum dimension is to be measured at the bottom of the trench.
- 2.3.6 Excavation clearances between other foreign structures shall adhere to the minimum spacing requirements as identified within Construction Specification 0303.

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3.0 Sheet piling and Shoring

- 3.1 The sides of all excavations and landslide areas shall be adequately sheeted and braced, sloped or trench boxed so as to maintain the excavation free from slides or cave-ins and safe for workers. Excavations shall be shored and braced to provide support for all nearby structures, poles, utilities and embankments.
- 3.2 Any sheet piling and shoring that is installed as a part of this job must follow all OSHA regulations, and all other applicable, federal, state and local guidelines.
- 3.3 Contractor is responsible for providing plans, sketches, and/or details along with supporting calculations by a registered professional engineer as required by OSHA regulations. The submittal shall include:
 - 3.3.1 Description of materials and shoring system to be used
 - 3.3.2 Indication of whether or not any components will remain after filling or backfilling
 - 3.3.3 Indication of sequence and method of installation

4.0 Dewatering Excavation

- 4.1 There shall be sufficient pumping equipment, in good working order, available at all times to remove any water that accumulates in excavations. If necessary, the Contractor shall provide and install a well point system of sufficient size and capacity to adequately remove all water from the soil to the depth of the required excavations.
- 4.2 Where the pipeline crosses natural drainage channels, the work shall be conducted in such a manner that unnecessary damage or delays in the execution of the work will be prevented. Provisions shall be made for the satisfactory disposal of all water pumped to the ground surface so as to prevent damage to public or private property.
- 4.3 Rain and groundwater which collects in the excavation will be handled in the following manner:
 - 4.3.1 During excavation of areas contaminated with petroleum hydrocarbon compounds, the Contractor shall be responsible for maintaining a dry excavation. It is incumbent upon the Contractor to prevent infiltration of storm water into the excavation to minimize the amount of water requiring possible treatment. The Contractor shall be responsible for all costs associated with the disposal of contaminated storm water.
 - 4.3.2 In areas where petroleum hydrocarbon contaminated soils are present, the Contractor shall notify the Owner's Representative to arrange for sampling of the water for the presence of petroleum hydrocarbon.
 - 4.3.3 Should the analytical results determine the water is free of petroleum hydrocarbon contamination; the water may be discharged in accordance with the Project Erosion and Sedimentation Control Plan.

5.0 Excavated Materials

- 5.1 Where sufficient Right-of-Way or Temporary Workspace is available, clean excavated material shall be stockpiled in designated areas or adjacent to the work and then used for back-filling as required.



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- 5.2 In specified areas, desirable topsoil shall be stockpiled separately in a careful manner and reused in restoration of the construction area after the installation of the pipe.

6.0 Solid Rock Excavation

- 6.1 Rock sections under this Specification shall be construed to mean solid rock in its original formation or other solid debris, such as railroad ties, asphalt, concrete, or timber, etc., which cannot be removed by standard excavation equipment.
- 6.2 The Owner's Representative shall make the determination as to whether other excavation techniques are acceptable when recommended techniques are found to be unsatisfactory.
- 6.3 Blasting will not be allowed without the written consent of the Owner's Representative. Blast plans will be required for REVIEW AND APPROVAL BY THE OWNER.

7.0 Removal of Existing Pipelines

- 7.1 The Contractor shall remove the existing abandoned pipelines as described on the design drawings.
- 7.2 The Owner's Representative shall verify the absence of product or contaminated water in those lines prior to their removal.
- 7.3 Should contamination be encountered during removal operations, the handling and disposal of contaminated material shall be in accordance with the instructions found in this Specification.
- 7.4 The Contractor is responsible for excavating, cutting, removal from the job site, and final disposition of these pipelines. Cold cutting is the only acceptable method for cutting pipe, torch cutting is not permitted.

8.0 Drain Tile Piping

- 8.1 The Contractor shall proceed with all due diligence to avoid disturbing any drain tile piping and other sub-surface dewatering features while working within or near the pipeline right-of-way.
- 8.2 Any damage to the drainage systems shall be promptly repaired using the same materials as the existing (or approved substitutes), using methods of repair acceptable to the Owner's Representative. The damaged location shall be spray painted with florescent paint for visibility until the repair is made.
- 8.3 Sunoco Logistics shall only be responsible for repairs to drain tile piping which must be removed in order to accommodate the installation of new pipelines. Repairs to damaged drain tile piping, incidental to pipeline construction, is the responsibility of the Contractor.

9.0 References

- 9.1 Process Industry Practices (PIP), PIP CVS02100, "Site Preparation, Excavation, and Backfill Specification"
- 9.2 OSHA 29 CFR 1926 Subpart P - Excavations

End of Specification



Sunoco Logistics

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Subject:

Excavation

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10.0 Revision Log

Revision No.	Revision Date	Document Authorizer	Document Reviewer	Document Author	Document Administrator	Revision Details
1	01/29/2007			C. Armstrong	NA	
2	08/29/2013	Lindy Barile	REI		NA	General updates



Sunoco Logistics

Sunoco Pipeline L.P. and Affiliates CONSTRUCTION STANDARDS

Subject:

Geologic Conditions

Prepared By: S. Mun [REI]	Revision: 2	Page: 1 of 3	Code:	Number: 0304
Approved: Lindy Barile	Date: 8/29/2013	Replaces: 0304 Rev. 1		

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Subject:**Geologic Conditions**

Prepared By: S. Mun [REI]	Revision: 2	Page: 2 of 3	Code:	Number: 0304
Approved: Lindy Barile	Date: 8/29/2013	Replaces: 0304 Rev. 1		

1.0 Introduction**1.1 Scope**

- 1.1.1 This specification prescribes the general information that may be made available by the Owner with respect to geologic conditions at the work site. This information, if available, is only general in nature and should not be used to assess the planning and management of underground work where detailed and site specific soil conditions must be known.
- 1.1.2 This specification also prescribes the necessary actions to be taken by the Contractor in the event that a geologic anomaly is discovered during the course of the construction on the work site.

1.2 General Information

- 1.2.1 Unless otherwise stated, the geologic information for the work site, if available, will generally only apply to the soil material within a depth of about six (6) feet. If the trench excavation is planned to be deeper, a site investigation by means of boring may be needed to indicate more accurate conditions.
- 1.2.2 If the Contractor determines that test pits or borings are necessary to plan the work, the Contractor shall submit a site investigation plan to the Owner's Representative for approval, one (1) week prior to conducting the investigation work.
- 1.2.3 Should there be geologic or soil analysis data available by the Owner for the work site, this data will be located in the construction documents as an addition to this specification. The geologic data or soil analysis will be that data which is developed by the United States Department of Agriculture Soil Conservation Service in cooperation with the appropriate State Department of Environmental Resources.

2.0 Landslide, Sink Hole, or Geologic Anomaly

- 2.1 Should a landslide, sinkhole, or any other geologic anomaly develop during the course of the construction, in close proximity to the work area, the Contractor shall immediately cease all operations and notify the Owner's Representative.
- 2.2 Upon discovery of a geologic anomaly, and subsequent direction by the Owner's Representative, the Contractor shall remove all equipment from the area and safe up the excavated area according to all applicable safety and security requirements contained in the construction document.

End of Specification



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Subject:

Geologic Conditions

Prepared By: S. Mun [REI]	Revision: 2	Page: 3 of 3	Code:	Number: 0304
Approved: Lindy Barile	Date: 8/29/2013	Replaces: 0304 Rev. 1		

3.0 Revision Log

Revision No.	Revision Date	Document Authorizer	Document Reviewer	Document Author	Document Administrator	Revision Details
1	09/26/2006			S. Mun		
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Sunoco Logistics

Sunoco Pipeline L.P. and Affiliates CONSTRUCTION STANDARDS

Subject:

Foreign Lines

Prepared By: C. Armstrong [REI]	Revision: 2	Page: 1 of 4	Code:	Number: 0305
Approved: Lindy Barile	Date: 9/25/2013	Replaces: 0305 Rev. 1		

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Subject:

Foreign Lines

Prepared By: C. Armstrong [REI]	Revision: 2	Page: 2 of 4	Code:	Number: 0305
Approved: Lindy Barile	Date: 9/25/2013	Replaces: 0305 Rev. 1		

1.0 Introduction

1.1 Scope

- 1.1.1 This specification prescribes the requirements for the protection of foreign lines and other nearby structures while completing construction as illustrated in the Owner's construction drawings.
- 1.1.2 Any deviation from this specification must be authorized, in writing, by representatives of Sunoco Logistics, LP, and the party who owns the foreign line(s).

2.0 Definitions

- 2.1 "Owner" or "Owner's Representative" – Employee or designated representative of Sunoco Logistics Partners, LP.
- 2.2 "Foreign Line(s)" – Any pipeline, buried utility line or other Underground Structure within or near the pipeline right-of-way or other SPLP construction area, which does not belong to or under the control of SPLP. Foreign Lines includes overhead power lines within, crossing or near the pipeline right-of-way or other construction area.
- 2.3 "Underground Structure" – Any buried structure, which includes, but is not limited to, any buried pipe, conduit, cable, culvert, drainage catch basin, building structure or associated foundation.
- 2.4 "Owner of the Underground Structure" – Representative of the company whose Underground Structure is involved in some way with the installation of any SPLP pipeline or other SPLP construction.

3.0 Protection of Structures

- 3.1 The Contractor shall be responsible for locating and protecting all conduits, cables, sewers, power lines, underground structures and pipelines. Contractor shall be responsible for adhering to all state and local requirements for placing One Calls as related to the project.
- 3.2 Unless expressly permitted by the Owner's Representative and the Owner of the Underground Structure, pipelines shall have at least 24 inches of clearance from any other underground structure..
- 3.3 Minimum required clearance from any underground structure interfering with or in close proximity of proposed construction shall be determined by the Owner's Representative, in accordance with the circumstances of each situation.

4.0 Unidentified Foreign Lines

- 4.1 Existing foreign lines may not be shown on the Owner's drawings. When such lines are encountered, the Contractor shall immediately furnish the Owner's Representative and the Owner of the Underground Structure with the size, material, depth and location of the line.
- 4.2 The Contractor shall immediately report to the Owner or Owner's Representative the discovery any unidentified Underground Structures is inherent to construction of buried infrastructure. The Owner and Contractor shall work together to identify any additional costs associated to perform all necessary work required to complete the pipeline crossing. . The Owner's Representative will assist in expediting the securing of crossing approval from the Owner of the Underground Structure when requested to do so by the Contractor.

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5.0 Execution

- 5.1 The Contractor shall furnish the necessary labor, equipment and materials necessary to complete the crossing of foreign lines or substructures in accordance with the drawings, in conformance with applicable codes, and to the satisfaction of both the Owner's Representative and the Owner of the Underground Structure.
- 5.2 Where necessary, the Contractor shall furnish the labor, equipment and necessary material to install and subsequently remove (if required) supports, bulkheads, dams, etc., as required to protect foreign lines or other underground structures from displacement during the construction operations, compensation for such work is subject to contract provisions regarding scope definition and additional work. Damages resulting from not providing necessary supports shall be repaired by the Contractor at no additional cost to the Owner.
- 5.3 Crossings will not be considered complete until an authorized representative of the owner of each foreign line or underground structure has certified, in writing, that crossing is complete and complies with their requirements.

6.0 Damages

- 6.1 Any damage caused to a foreign line or underground structure resulting from the Contractor's performance of this work shall be the Contractor's sole responsibility. At no additional cost to the Owner, the Contractor shall furnish all necessary labor, equipment and materials to repair the damaged line or structure, to the satisfaction of both the Owner's Representative and the Owner of the Underground Structure.
- 6.2 In the event the Contractor is unable or not permitted by the Owner of the Underground Structure to repair damage caused by the Contractor, the Contractor shall reimburse to the Owner of the Underground Structure all necessary and reasonable costs for repairs performed by the Owner of the Underground Structure or by others.

7.0 Notification of Utilities

- 7.1 The Contractor shall contact the state or local "One Call System (811)" in accordance with the applicable one call regulations for the area of construction prior to the start of any excavation work associated with the project. This does not relieve the Contractor of the responsibility of notifying or working with the Owners of Underground Structures with Underground Structures known or suspected of being within the construction area.
- 7.2 Contractor shall exercise extreme care when operating equipment near existing foreign lines and Underground Structures. The Contractor shall expose Underground Structures before proceeding with other excavation or construction work in the vicinity.
- 7.3 The Contractor shall notify the Owner of Underground Structures known or suspected to be within or near the construction area. Contractor shall comply with all requirements of the Owner of Underground Structure, including methods of excavation near the Underground Structure and scheduling such excavation and related work such that the Owner of the Underground Structure can be present during the work and supervise operations as necessary.



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8.0 References

- 8.1 Sunoco Logistics General Restrictions document
- 8.2 SPLP DOT Maintenance Manual Section 195.250, "Clearance between pipe and underground structures"

End of Specification

9.0 Revision Log

Revision No.	Revision Date	Document Authorizer	Document Reviewer	Document Author	Document Administrator	Revision Details
1	01/29/2007	Lindy Barile		C. Armstrong		
2	09/25/2013	Lindy Barile	REI			General Updates



Sunoco Logistics

Sunoco Pipeline L.P. and Affiliates CONSTRUCTION STANDARDS

Subject:

Aggregate Base

Prepared By: C. Armstrong [REI]	Revision: 2	Page: 1 of 6	Code:	Number: 0307
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Subject:

Aggregate Base

Prepared By: C. Armstrong [REI]	Revision: 2	Page: 2 of 6	Code:	Number: 0307
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1.0 Introduction

1.1 Scope

- 1.1.1 This specification prescribes the requirements for the construction of a graded aggregate roadway to the lines, grade, thickness, and cross sections shown on the drawings.
- 1.1.2 For structural fill subbase requirements, refer to SPLP Construction Specification 0302, "Earthwork".
- 1.1.3 Any deviation from this specification must be authorized in advance by the Owner's Representative.

1.2 References

The publications listed below form part of this specification. Each publication shall be the latest revision and addendum in effect on the date of contract in which this specification is adopted in Contract Documents, unless noted otherwise. Except as modified by the requirements specified herein or the details of the drawings, work included in this specification shall conform to the applicable provisions of these publications.

- A. ASTM C 117 Standard Test Method for Materials Finer than Number 200 Sieve in Mineral Aggregates by Washing
- B. ASTM C 131 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- C. ASTM C 136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
- D. ASTM D 698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
- E. ASTM D 1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.
- F. ASTM D 1883 Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils
- G. ASTM D 4318 Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- H. ASTM E 329 Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
- I. Process Industry Practices (PIP), PIP CVS02100, "Site Preparation, Excavation, and Backfill Specification"
- J. PIP CVS02350, "Roadway and Area Paving Construction Specification"
- K. SPLP Construction Specification 0302, Earthwork

1.3 Submittals

- 1.3.1 Product Data – Before delivery of materials, submit for approval the following certified laboratory test data for the aggregates to be used in the work.
 - A. Gradation (ASTM C 136 and C 117)
 - B. Bearing ratio (ASTMD 1883)
 - C. Atterberg limits (ASTM D 4318)
 - D. Percent of wear (ASTM C 131)



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0307

Approved:

Lindy Barile

Date:

8/29/2013

Replaces:

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1.3.2 Test Results – Submit results of the tests required during the performance of the work.

1.4 Quality Assurance

1.4.1 An inspection and testing agency may be retained by the owner to perform field and laboratory testing and soil evaluations to verify compliance of the work with their requirements of this specification, and to ensure the achievement of the intents and purposes of work.

1.4.2 The performance or lack of performance of such tests and inspections shall not be construed as granting relief from the requirements of these specifications or the other contract documents.

2.0 Aggregate Base

2.1 Products

2.1.1 Materials for aggregate pavement base shall consist of durable and sound crushed gravel, crushed stone, or slag. They shall be free from organic matter, lumps of clay, clay coatings, or other objectionable matter and shall conform to one of the following grades:

Percent's by Weight Passing Sieves

Sieve	Grade 1	Grade 2	Grade 3
2 inch	100	--	--
1-1/2 inch	70-100	100	--
1 inch	45-80	60-100	100
1/2 inch	30-60	30-65	40-70
No. 4	20-50	20-50	20-50
No. 10	15-40	15-40	15-40
No. 40	5-25	5-25	5-25
No. 200	0-10	0-10	0-10

2.1.2 The aggregate shall have a soaked California Bearing Ratio of at least 80 percent when tested in accordance with ASTM D 1883, and a percentage of wear (except slag) not exceeding 45 when tested in accordance with ASTM C 131. Slag shall be an air-cooled, blast furnace product having a dry weight of not less than 65 pounds per cubic foot and shall consist of angular fragments reasonably uniform in density and quality, and free from thin and elongated pieces, dirt, and other objectionable materials. That portion of the material passing the No. 40 sieve shall have a liquid limit of no more than 25 and a plasticity index of not more than 5 when tested in accordance with ASTM D 4318.

2.2 Execution

2.2.1 Preparation

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2.2.1.1 The underlying subgrade shall be true to line and grade, before placing the graded aggregate base course.

2.2.1.2 Clear the underlying subgrade of all foreign materials, ruts and soft yielding spots , areas of inadequate compaction, and excessive deviations in the surface.

2.2.2 Inspection

2.2.2.1 Examine the surface of the areas on which the graded aggregate base is to be placed. The surface shall be smooth, firm, clean, and frost free. Correct conditions detrimental to proper and timely completion of the work.

2.2.2.2 Do not proceed with placement of aggregate base material until unsatisfactory conditions are corrected.

2.2.3 Application

2.2.3.1 Limitations on Application

Do not construct graded aggregate base course when atmospheric temperature is below 35 degrees F, or when other weather conditions will detrimentally affect the quality of the base course.

2.2.3.2 Placing and Spreading

- When a compacted layer of 6 inches or less in thickness is required, place the material in a single layer. When a compacted layer in excess 6 inches is required, place and spread the aggregate base material in layers of equal, uniform thickness not more than 6 inches thick.
- Place layers so that when compacted, they will be true to grades required with the least possible surface disturbance.
- Where the base course is constructed in more than 1 layer, lightly scarify the surface of each previously placed and compacted layer to a depth of 1 to 2 inches immediately before the placement and spreading of materials for the subsequent course.
- Maintain water content of the material during the placing period as required to obtain the compaction specified. Make adjustments, as required, in placing procedures or equipment to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory base course.

2.2.3.3 Compaction and Finishing

- Compact each layer of base course to a dry density of not less than 95% of maximum compaction dry density determined by ASTM D 1557.



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- b. Compaction equipment shall be suitable for the type and depth of material, the area in which it is placed, and as required to efficiently and properly achieve the compaction required. All compaction equipment is subject to approval of the Owner's Representative.
- c. Begin rolling at the edges of the layers and proceed toward the center. Successive passes shall overlap at least 18 inches. Ends of roller passes shall be slightly staggered if it is not possible to go beyond the edge onto previously compacted material.
- d. On the final layer, the roller shall cover equal parts of the base material and the shoulder. The roller shall run forward and backward along the edge until the shoulder and coarse material are bound together firmly.
- e. Finish the surface of the layer by blading or rolling with a smooth roller or a combination thereof. The completed surfaces shall be firm, uniform and true to line and grade.
- f. If the base material is excessively moistened by rain, aerate it by means of blade graders or other approved equipment until the moisture content of the mixture is satisfactory.
- g. In places that are inaccessible to large rollers, the surface may be compacted with smaller mechanical equipment or hand tampers that are lightly oiled.

2.2.4 Field Quality Control

2.2.4.1 Thickness Test

- a. The average thickness of the base course, determined by computing the average of the depth measurement, shall not under run the specified thickness by more than 1/4 inch.
- b. Measure the thickness of the base course at intervals such that there will be a depth measurement for at least each 500 square yards of complete base course.
- c. Take depth measurements by making test holes, at least 3 inches in diameter, through the base course. Where base course deficiency is more than 1/2 inch, correct by scarifying, adding material of proper gradation, re-blading, and re-compacting.
- d. Where the measured thickness is more than 1/2 inch thicker than specified, consider it as the specified thickness plus 1/2 inch for determining the average.

2.2.4.2 Smoothness Test

- a. The smoothness requirements specified below apply only to the top layer.
- b. The surface of the completed aggregate base shall be shaped to a smooth and even surface, free of voids, and to the required elevation. Any deviation in excess of 1/4 inch in cross section or 1/4 inch in length when measured with a 16-foot straightedge shall be corrected. Appropriate deviations will be permitted for specified crown of the finished surface and curvature as indicated on the project drawings.

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- c. Correct deviations by loosening, adding, or removing material and then reshaping and recompacting by sprinkling and rolling.

2.2.5 Adjustment and Cleaning

2.2.5.1 Adjustment

When correcting deficiencies for smoothness and thickness, remove material in manner that does not disturb or mix material from the underlying course into aggregate base course layers. Scarify and feather edges of the added material so that the joint between new and original material is indiscernible.

2.2.5.2 Cleaning

Remove all debris, rubbish, and excess material from the jobsite.

2.2.6 Protection and Maintenance

2.2.6.1 After construction has been completed, protect and maintain the base throughout until final acceptance.

2.2.6.2 Maintenance shall include drainage, rolling, shaping, and watering as necessary to maintain the course in proper condition. Areas of aggregate base course damaged by freezing, rainfall, or other weather conditions shall be corrected to meet the specified requirements.

End of Specification

3.0 Revision Log

Revision No.	Revision Date	Document Authorizer	Document Reviewer	Document Author	Document Administrator	Revision Details
1	10/24/2006			C. Armstrong	NA	
2	08/29/13	Lindy Barile	REI		NA	General updates



Sunoco Pipeline L.P. and Affiliates CONSTRUCTION STANDARDS

Subject:

Pipe Padding, Shading, and Backfill

Prepared By: R. Todd [REI]	Revision: 2	Page: 1 of 6	Code:	Number: 0308
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Pipe Padding, Shading, and Backfill

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1.0 Introduction

1.1 Purpose

- 1.1.1 The purpose of this specification is to provide the requirements to properly pad, shade and backfill the pipeline after installation, according to industry accepted practices and regulatory guidelines.

1.2 Scope

- 1.2.1 This specification covers the requirements for supervision, labor, equipment, materials and services necessary to properly pad and shade the pipe and backfill the ditch after pipe installation.
- 1.2.2 Sunoco Logistics, L.P. or approved contractor is responsible for assuring the pipe is properly protected prior to being backfilled, in accordance with this specification.
- 1.2.3 The specification is not applicable to pipeline located offshore.
- 1.2.4 The specification is not applicable to plastic transmission lines
- 1.2.5 Roadway crossings and surface restoration shall follow Federal, State, or Local code requirements as described on applicable permits.
- 1.2.6 Deviations from this specification require the approval of Sunoco Logistics, LP personal or authorized representative.

2.0 References

2.1 Codes, Standards, and Regulations

- 2.1.1 Code of Federal Regulations, Title 49, Transportation of Hazardous Liquid by Pipeline.
- 2.1.2 Code of Federal Regulations, Title 49, Transportation of Natural or Other Gas by Pipeline.
- 2.1.3 ASTM D1557, "Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort", ASTM International.
- 2.1.4 Sunoco Logistics, L.P. Construction Specification 0318 "Line Marker Installation".
- 2.1.5 ASME B31.4, Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids.
- 2.1.6 ASME B31.8, Gas Transmission and Distribution Piping Systems.

3.0 Procedure

Prior to lowering the pipe into the ditch, bell hole or other tie-in excavations, the Contractor shall provide, to the satisfaction of the Company, a ditch which is free from excess debris, large rocks and roots, welding rods, skids or other such objects which can cause damage to the pipe and its protective coating during lowering-in operations. In addition, if there is any water or snow in the ditch, the snow will be removed and the water shall be pumped from the ditch.

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3.1 Padding and Shading

- 3.1.1 In all cases where rocks 2 in. and larger are encountered in the bottom of the ditch and no additional pipe coating protection is provided, the Contractor shall provide and install $\frac{3}{4}$ " minus padding material placed evenly and continuously to a minimum depth of 8 in. along the bottom of the ditch as approved by the Company.
- 3.1.2 In all cases, Contractor shall provide and install $\frac{3}{4}$ " minus material around the pipe and 12" above the pipe known as shading material, as approved by Company.
- 3.1.3 In all cases, Contractor shall pad and shade the pipeline with suitable material where the native material is not suitable for use as padding and shading material as outlined in the Construction Documents. The Contractor shall include a mechanical padding and shading machine (Ozzie Padder or equivalent) where native material is deemed unsuitable. Where it is not practical to use padding and shading machine, the Contractor shall locate, load, haul, and place as applicable Company approved padding and shading material.
- 3.1.4 Where pipe cannot be directly supported by the bottom of the trench, support shall be provided by sandbags or other Company approved materials. Sandbags shall be placed at points to provide stress-free support for the pipeline before installing padding and shading materials. Spacing intervals for sandbag supports shall be 15 ft. or less as required by the Company.
- 3.1.5 Supports comprised of materials other than sandbags shall be constructed in strict accordance with the manufacturer's instructions and at spacing intervals no greater than the appropriate maximum interval recommended by the manufacturer. Support shall be placed at points to provide a stress-free installation subsequent to backfill.
- 3.1.6 The Contractor shall not use any support method without the prior approval of the Company and without providing the Company with the manufacturer's recommended installation directions for the specific method being used.

3.2 Backfill

- 3.2.1 Backfill shall not be conducted until the depth of the pipe is confirmed to permit proper cover as described in more details in the Contract Documents, fits the ditch, the coating has been inspected/repared, and environmental inspections completed.
- 3.2.2 Above the 12" shading material on top of the pipe – Backfill material may include rock, 2" – 6" in diameter.
- 3.2.3 Large rock or boulders in excess of 6 in. in diameter, width or length, shall not be backfilled into the ditch. Such rock shall be disposed of properly. Rock disposal shall be in accordance with ROW Construction Line List requirements. Rock disposal within the ditch line that is not specifically prohibited by the landowner (as described in the Construction Line List), shall be at the discretion of the Company.

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3.2.4 In most cultivated areas, all surface rock in excess of 3 inch diameter shall be removed from the ROW, per the ROW Construction Line List requirements.

3.2.5 Acceptable rock-free padding and shading (3/4" minus) material may be obtained directly from the spoil, or by using padding machine with material taken directly from the spoil or rock-free padding material can be hauled in by the Contractor.

3.2.6 Backfill with "flowable fill" (fly ash free preferred) is permitted.

3.3 Compaction

3.3.1 Pipeline Right of Way – Upon pipeline padding, shading and backfill, the ditch line shall be wheel rolled with a road grader or equal

3.3.2 Road Right of Way - Upon pipeline padding, the trench shall be backfilled in lifts not to exceed 6", to a minimum density of 95% with a moisture content that is no more than 1% greater than or 2% less than the optimum moisture content in accordance with current ASTM D1557 or in accordance with the permitting agency or whichever is more stringent .

3.3.3 Road crossings or Driveway – Upon pipeline padding, backfill shall be in lifts not to exceed 6", to a minimum density of 95% with a moisture content that is no more than 1% greater than or 2% less than the optimum moisture content in accordance with current ASTM D1557 or in accordance with the permitting agency or whichever is more stringent.

3.3.4 Highways, within three (3') feet of the sub-base elevation, 2A modified or equivalent stone shall be used and a compaction of 98% is required or in accordance with the permitting agency or whichever is more stringent.

3.3.5 Backfill by method of flowable fill eliminates the need for additional compaction.

3.4 Cover

3.4.1 Petroleum

The minimum cover for a regulated petroleum pipeline shall meet the minimum requirements as provided in 49CFR Part 195, as follows:

Location	Normal Excavation	Rock Excavation
Industrial, Commercial, & Residential Areas	36"	30"
Crossings of Inland Bodies of Water with a width of 100' from High Water Marks	48"	18"
Drainage Ditches at Public Roads	36"	36"

3.4.2 Natural Gas or Other Gas

The minimum cover for a regulated Natural Gas or other Gas pipeline shall meet the minimum requirements as provided in 49CFR Part 192, as follows:

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Lindy Barile**Date:**
8/29/2013**Replaces:**
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Location	Normal Soil	Consolidated Rock
Class 1 Locations	30"	18"
Class 2, 3, & 4 Locations	36"	24"
Drainage Ditches of Public Roads and Railroad Crossings	36"	24"

3.5 Marking**3.5.1 Underground**

During backfill plastic Orange Warning Mesh (Linemark Mesh or equal) supplied by the contractor shall be installed at least 12" but not more than 24" below finished grade and centered directly over the pipeline.

- Orange plastic warning mesh shall be labeled with the following "WARNING – HIGH PRESSURE PIPELINE BURIED BELOW. CALL 811 AND PIPELINE OPERATOR IMMEDIATELY".
- Right of Way conditions may require additional pipe protection be installed above the pipeline, such as, concrete slabs or other material to provide a warning/barrier between the pipeline and the ground surface.

3.5.2 Aboveground

Aboveground marking shall follow the requirements of Sunoco Logistics, L.P. Construction Specification 0318 "Line Marker Installation".

3.6 General

- 3.6.1 Backfill should be conducted so that the center of the ditch is left slightly high to account for limited settling.
- 3.6.2 The contractor shall be liable for, and make all necessary repairs to existing roads, temporary roads, driveways, parking lots, drainage ditches, and stream beds due to the settlement of backfill.
- 3.6.3 Repairs of settlements shall include, but not limited to the following; excavation, placement of materials in lifts, re-consolidation, restoration of surface structure(s), traffic control during repairs, and all other items necessary to rectify damage caused by settlement of the excavation ditch.
- 3.6.4 All excavations shall be graded and restored in a manner satisfactory to the landowner or governing authority.

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End of Specification**4.0 Revision Log**

Revision No.	Revision Date	Document Authorizer	Document Reviewer	Document Author	Document Administrator	Revision Details
1	10/18/2006	Lindy Barile	Russ Todd	Russ Todd		General updates and formatting.
2	08/29/2013	Lindy Barile	REI			Added padding, shading and backfilling. Added installation of warning mesh during backfill.

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Introduction

1.1 Purpose

- 1.1.1 The purpose of this standard is to insure uniformity of Reinforced Concrete and Foundation Design Requirements for Sunoco.
- 1.1.2 This standard supplements ACI Standard 318 Building Code Requirements for Structural Concrete, in that it adds to and in certain cases specifies optional requirements for design of foundations, structures and concrete building elements used in refinery construction.
- 1.1.3 Concrete foundations and structures shall be designed in conformance with ACI Standard 318 as supplemented by this standard or shall comply with local regulations should they become more restrictive.
- 1.1.4 **The numerical identification of sections and paragraphs is the same as ACI Standard 318. Reference is made only to those sections or paragraphs where supplemental information is added or an option is expressed. Chapters 23 and 24 are added to cover foundations and construction details, not included in the ACI Code.**
- 1.1.5 The term "Building Official" in ACI Standard 318 or this standard shall mean a municipal building official where required by local regulations or Owner's Project Manager.
- 1.1.6 All new and/or revamped concrete construction shall conform to the safety requirements as set forth by the Occupational Safety and Health Administration (OSHA) publication 29CFR part 1926, Subpart Q, titled "Concrete and Masonry Construction Safety Standards".

1.2 Scope

- 1.2.1 This standard provides minimum requirements for design and construction of reinforced concrete structural elements for any structures located within or forming part of Owner's operating units and facilities.
- 1.2.2 All specifications, standards, and codes referred to shall be the latest revision and considered a part of this standard.
- 1.2.3 Concrete roads and pavements are not included in this standard.
- 1.2.4 Any exception or addition to this standard shall be contained in the project documents as an addendum to this standard.
- 1.2.5 These concrete standards, where applicable, apply to all Sunoco facilities.

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PART 1 – GENERAL**Chapter 1 – General Requirements****1.1 Scope**

- 1.1.1 This standard provides minimum requirements for design and construction of reinforced concrete structural elements for any structures located within or forming part of Owner's operating units and facilities.
- 1.1.2 All specifications, standards, and codes referred to shall be the latest revision and considered a part of this standard.
- 1.1.7 Concrete roads and pavements are not included in this standard.
- 1.1.11 Any exception or addition to this standard shall be contained in the project documents as an addendum to this standard.

1.2 Drawings and Specifications

- 1.2.1 Where applicable, the Engineering Contractor or Project Manager, shall be responsible for obtaining permits and filing appropriate drawings and calculations with building officials or other governmental regulatory agencies.

All drawings and Specifications shall bear the seal of a registered engineer or architect as required by the jurisdiction in which the construction will take place. A person entrusted with the design of the work shall be a recognized engineer qualified by virtue of education, training or experience to discharge that responsibility.

- 1.2.2 All drawings are to be prepared and numbered in accordance with the procedures established by Owner. Final original calculations shall be forwarded to the Owner for his file. Computer calculations shall be furnished with a print out that can be interpreted by the Owner. Where drawings are computer generated, a copy of the computer files shall also be forwarded to Owner.

1.3 Inspection

- 1.3.1 The Contractor shall be responsible for determining the onsite inspection procedures and records required, subject to the approval of the Owner's Project Manager.

PART 2 – STANDARDS FOR TEST AND MATERIALS**Chapter 3 – Materials**

For Material Specification see Sunoco 0309A – Cast in Place Structural Concrete

PART 3 – CONSTRUCTION REQUIREMENTS**Chapter 4 – Durability Requirements**

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4.2 Sulphate Exposures

- 4.2.1 Concrete exposed to refinery wastewater shall be evaluated for potential exposure to Sulphates and other chemically aggressive solutions.

CHAPTER 5 – CONCRETE QUALITY, MIXING, AND PLACING**5.1 General**

- 5.1.1 Unless otherwise noted in project documents, the specified compressive strength (F'_c) shall be 4,000 psi at 28 days.

5.6 Evaluation and Acceptance of Concrete**5.6.1 Frequency and Testing**

- 5.6.2 Frequency and testing shall be indicated in Sunoco Construction Standard 0309A.

5.7 5.7 Through 5.13

See Sunoco Construction Standard 0309A – Cast in Place Structural Concrete

Chapter 6 – Formwork, Embedded Pipes and Construction Joints

See Sunoco Construction Standard 0309A – Cast in Place Structural Concrete

Chapter 7 – Details of Reinforcement

See Sunoco Construction Standard 0309A – Cast in Place Structural Concrete

PART 4 – GENERAL REQUIREMENTS**Chapter 8 – Analysis and Design – General Considerations****8.2 Loading**

- 8.2.2 Floor slabs and roof slabs supporting equipment shall be designed for concentrated loads that may occur while servicing the equipment. Warehouse floor slabs shall be designed for the maximum wheel load concentrations from industrial lift trucks or other warehousing equipment. Other floor load concentrations shall be as specified in the local Building Code, or the latest version of the International Building Code if there is not a local building code.

PART 5 – STRUCTURAL SYSTEMS OR ELEMENTS**Chapter 14 – Walls****14.1 Scope**

The section added to this chapter of the standard apply to retaining walls only. For masonry wall see Sunoco Construction Standard 0300-Site Preparation.

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14.2 General

14.2.1 A. Retaining walls shall be designed to resist the lateral pressure of the retained material. Walls retaining earth which can drain naturally through the terrain or soil or can drain through holes placed in the wall, may be designed for pressures equivalent to that exerted by a fluid weighing not less than 40 pounds per cubic foot and having a depth equal to that of the retained earth. Any surcharge (pressure exerted by a roadway, railroad tracks or equipment) shall be in addition to the equivalent fluid pressure.

B. A retaining wall used as a firewall shall be designed to retain water to its full height. If the liquid to be retained is heavier than water, the wall shall be designed to retain the heavier liquid. The dynamic effect of a sudden failure of a tank under test shall also be considered.

C. For walls 8 ft. or less in height, the dynamic effect shall be considered as a wave 1 ft. in height moving with a velocity of 20 ft. per second with the basin 2/3 full. For such consideration, the factors of safety against overturning and sliding may be reduced to 1.10. The maximum allowable soil pressure may be increased 100% for this shock loading, and full passive pressure of earth on the toe of the footing and stem included. The earth inside of the basin may be considered impervious and any effect of hydrostatic pressure acting upward on the bottom of the footing neglected. Retaining walls higher than 8 ft. require special design consideration which shall be established with Owner's Project Manager.

14.2.9 Stability Criteria

A. Retaining walls shall be designed to have a minimum factor of safety against overturning of 1.50 except as allowed in section 14.2.1c. Normally, the passive resistance of the soil acting on the outside of the stem and footing should be neglected when computing this factor of safety. For special applications, having very deep footings and the absence of any underground lines near the toe of the footing, the passive resistance may be included in the stability calculations with approval of Owner's Project Manager.

B. Retaining walls shall have a minimum factor of safety against sliding of 1.25 neglecting the passive pressure of the earth on the front of the stem and footing as specified above. When cut-off walls are provided in the bottom of the footing, full passive pressure can be used against the face of the cut-off-wall.

PART 6 – SPECIAL CONSIDERATIONS**CHAPTERS 23 AND 24 SUPPLEMENT ACI 318****Chapter 23 – Foundations****23.1 Depth of Footings and Foundations**

23.1.1 Except when placed on solid rock or protected from frost, foundation walls, piers, footings and other supports shall extend below the frost line for the geographic location. The frost line shall be

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considered as 1 ft. 6 in. for Tulsa, 2 ft. 6 in. for Marcus Hook, Eagle Point and Philadelphia, 3 ft. 6 in. for Toledo below the finished grade.

- 23.1.2 Where footings are adjacent to sloping ground or where the bottom of footings are at different levels, the difference in footing elevations shall be subject to the following limitations:

A. When the ground surface slopes downward adjacent to a footing, the sloping surface shall not encroach upon a prism of bearing material under the footing having sides that make an angle with the horizontal of 30°. The horizontal distance from the lower edge of the footing to the sloping surface shall be not less than 3 ft. except, for minor foundations setting in earth firebanks. This distance can be 2 ft.

B. For footings in granular soils, soft plastic clays and clay-silt mixtures, a line drawn between the lower adjacent edges of adjacent footings shall not have a steeper slope than two horizontal and one vertical.

C. For medium-stiff to stiff clays where the concrete for footings is deposited directly against the vertical sides of the excavation, a line drawn between the lower adjacent edge of the upper footing and the upper adjacent edge of the lower footing shall not have a steeper slope than two horizontal and one vertical. The lower footing is installed before the upper footing if the slope shall be steeper than 3:1 (H:V).

- 23.1.3 The requirements of section 23.1.2 above shall not apply under the following conditions:

A. Adequate provision is made for the lateral support of material supporting the upper footing, subject to the approval of Owner's Project Manager.

B. Where soil test analysis shows that the average shear stress is not more than 25% of the shear strength of the soil.

23.2 **Bearing Value of Soils**

- 23.2.1 The project specifications shall state the allowable bearing values to be used in design of foundations. Net allowable bearing pressures should be stated.

- 23.2.2 The allowable bearing value shall be determined by one of the following methods:

A. Complete soil investigation by an independent consultant who shall supervise borings and soil testing and shall make recommendations for foundation design.

B. A soil boring program by a recognized soil boring contractor. The logs of the borings shall include a visual classification of the soil and result of the standard penetration tests taken at intervals not exceeding 5 ft. in depth and at every recognizable change in soil stratification. Soil samples taken from the sampling spoon shall be submitted in air-tight jars to the responsible engineer. The Project Manager shall review and approve this soil boring program and resulting interpretations.

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C. For foundations installed in a new plot area less than 100 ft. x 100 ft. within an existing unit area, the allowable bearing values may be based on the design criteria used for the existing area.

23.3 Foundation Design – General

23.3.1 The minimum factor of safety against overturning shall be 1.50, including the weight of backfill over foundations, for any condition of loading, for all structures, with the following exception: The minimum factor of safety against overturning for vertical vessels and stacks combining any normal operating loads, including wind, shall be 2.50. The effect of eccentric loads such as piping and platforms shall be considered in all designs.

23.3.2 Soil pressure shall be considered as acting uniformly or varying linearly. For combined footings and mats, the center of gravity of the foundation shall, as near as practical, coincide with the center of gravity of the equipment and superstructure with normal operating loads. For large mats, the characteristics of the soil under the mat shall be considered and due allowance made for possible concentrated soil pressure under heavily loaded columns.

23.4 Foundations for Machinery

23.4.1 Machinery foundation design and installation shall be in accordance with API RP-686 and Sunoco STD 1310 -2 (supplement to API RP- 686).

23.5 Foundation for Process Storage Tanks

23.5.1 Foundations for process storage tanks shall be designed with leak detection system per Sunoco STD 2401 and Sunoco Sketch S24-8-R3.

23.6 Piles

23.6.1 Piles may be any generally approved type such as precast concrete, cast-in-place concrete, concrete-filled steel pipe or rolled structural steel. Timber piles shall not be used except that for special applications, treated timber piles with a maximum load capacity of 20 tons may be considered. Approval shall be in writing by the Owner's Project Manager.

23.6.2 For loads exceeding 40 tons per pile, the allowable pile load shall be determined by load tests. Tests shall be conducted in accordance with the procedure outlined in ASTM D-1143 or ASTM D-4945, and IBC.

Chapter 24 – Construction Details**24.1 Grouting****24.1.1 General**

Structural baseplates, vessel bases, and bases with skid mounted units shall be grouted to their respective foundation in such a manner as to insure a uniform bearing. The minimum thickness of grout shall be 1 in.

24.1.2 Machinery Bases

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For grouting machinery bases, see API RP-686, Sun STD 1310-2 (supplement to API RP-686), and Sunoco Sketch S13-17.1-2-R1 (page 1) and S13-17.1-2-R1 (page 2).

24.1.3 Vessels

24.1.4 A. Tall vertical vessels that are subject to considerable wind force and vibration, and heavy vessels that produce relatively high bearing stresses, shall be grouted with a non-shrink grout to assure 100 percent bearing of the base ring. The following criteria shall govern:

1. Vessels over 100 ft. high and where the ratio of the height, including skirt, to the diameter is greater than 15
2. Any vessel where the maximum bearing stress (including test load conditions) is 750 psi or greater

B. Other vertical vessels may be grouted with a non-shrink Portland cement grout provided they are dry packed with a stiff mix that is worked from both inside and outside of the base ring to assure 100 percent filling and compaction of the grout space. Other, non-shrink grout products may be used subject to approval of the Project Manager.

C. Where towers and vessels are erected on pre-set steel bearing pads, these pads may remain in place provided they are completely encased in grout.

24.2 Exchanger Bearing Plates

24.2.1 Use of bearing plates under exchanger support saddles to allow expansion of the exchanger shall be considered when designing the exchanger foundation. The type of bearing surface shall be selected as follows:

A. Where average shell operating temperature is less than 300°F, saddles shall be grouted directly to foundation piers with no supplemental bearing plates provided.

B. Where average shell operating temperatures are between 300°F and 600°F, an intermediate steel bearing plate, at least 3/8 in. thick, shall be provided at expansion end of exchanger. The bearing surface of this plate shall be cleaned free of rust and mill scale. The entire surface of bearing shall be coated with a molybdenum disulfide coating as per manufacturer's recommendation. Use Molykote 44MA Grease manufactured by DOW Corning or Owner's approved equal. Anchor rod nuts shall be finger-tight after exchanger is set. Bearing plates shall be grouted to foundation pier as per Section 24.1. The use of a steel bearing plate at the fixed end of exchanger is optional. Anchor rods at fixed end shall be wrench-tight.

C. Where the average shell operating temperature is above 600°F, the expansion end of exchanger shall be provided with a selflubricating bearing plate (Lubrite or equal), Teflon bearing pads, or other Owner approved type. The design shall assure that the exchanger foot completely covers the bearing pads to prevent dirt and grit from accumulating on the bearing surface. Anchor rods shall be hand-tight at expansion end and wrench-tight at fixed end.

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CONSTRUCTION STANDARDS****Subject:****Reinforced Concrete and Foundation Design**

Prepared By: K. Robles [REI]	Revision: 3	Page: 10 of 10	Code:	Number: 0309
Approved: Lindy Barile	Date: 11/1/2013	Replaces: Sunoco 1201 Rev. 2		

24.3 Anchor Rods

- 24.3.1 All anchor rods shall comply with ASTM F1554 "Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength", with matching grade nuts and washers. Hex nuts and heads shall be Heavy Hex per ANSI B18.2.2 (latest).
- 24.3.2 Where sleeves are used with anchor rods, the embedment within the sleeve can be included in the minimum embedment if there is a minimum of 10 diameter embedment below the bottom of the sleeve. For special cases, where large anchor plates or washers are provided for use with the full-length sleeves, the sleeve should be of steel pipe and bear on the anchor plate.
- 24.3.3 Normally, anchor rods shall be designed per ACI 318 Appendix D and the IBC.
- 24.3.4 Use of high strength anchor rods requires special approval. Additional lateral reinforcement in anchor rod area shall be required.
- 24.3.5 Anchor rods shall have a minimum of 4 diameters edge distance minimum of 4 inches. Lateral reinforcement shall satisfy ACI 318 requirements.

Revision Log

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0	3/15/05				Sandy Restaneo	Added OEMS Formatting
1	5/9/05	Joel Maness	Vinod Srivastava	C. Watson	Beverly Valerio	For Revision Details, see the Sunoco LOR Sunoco Std 1201 05-31-05 Alert.
2	6/30/10	K. Robles	B. Brodwater/ T. Dougher	T. Hirt	Beverly Valerio	Reaffirmed
3	10/1/13	L. Barile	REI	T. Hirt	NA	General Formatting

**Subject:**

Cast in Place Structural Concrete

Prepared By: Lindy Barile [REI]	Revision: 0	Page: 1 of 7	Code:	Number: 0309A
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1.0 Introduction

1.1 Purpose

- 1.1.1 The purpose of this standard is to ensure uniformity of concrete construction and material requirements of the Sunoco Logistics Engineering.
- 1.1.2 This standard supplements ACI Standard 301, Specifications for structural concrete. It adds to and specifies optional requirements for ready mixed concrete, reinforced steel, concrete construction and concrete testing.
- 1.1.3 Cast-in-Place structural concrete construction shall be in conformance with ACI Standard 301 as supplemented by this standard unless otherwise specified in the job specifications or shall comply with local regulations if they are more restrictive. For cold weather concreting, ACI 306.1 may be followed in conjunction with ACI Standard 306R Cold weather Concreting.
- 1.1.4 The numerical identification sections and paragraphs are the same as ACI Standard 301. Reference is made only to those sections or paragraphs where supplemental information is added or an option is expressed.
- 1.1.5 Where applicable, the Engineering Contractor or Owner's Project Manager shall be responsible for obtaining permits and filing appropriate drawings and other pertinent information with building officials or other governmental regulatory agencies.
- 1.1.6 All new and revamped concrete construction shall conform to the Safety requirements as set forth by the Occupational Safety and Health administration (OSHA) publication 29 CFR part 1926, Subpart Q, titled "Concrete and Masonry Construction Safety Standards".

1.2 Scope

- 1.2.1 This standard covers cast-in-place concrete construction requirements for buildings, structures and foundations located within or conforming part of the Owner's operating units except as noted in 1.2.2.
 - All specifications standards, and codes referred to in this Standard shall be the latest revision of same and considered part of the standard
 - Any exception or addition to this standard shall be contained in the project document as an addendum
 - Three sets of shop drawings, showing all dimensions necessary for fabrication and placing of the reinforcing steel and accessories without reference to the project drawings shall be submitted for owner's representative for approval. When combination design and placing drawings with bending schedule are prepared by owner, shop drawings are not required from the fabricator.

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1.2.2 The following subjects are considered outside the scope of this standard:

- Concrete chimneys
- Fireproofing

1.3 Reference Standard and Cited Publications

The latest editions of the specifications of the Society of the American Society for Testing and Materials (ASTM) referred to in this Standard shall also apply and they shall be considered as part of this standard.

2.0 Quality Assurance and Quality Control

2.1 General

2.1.1 Routine testing materials, propose mix designs and resulting concrete for compliance with technical requirements of the specification shall be the duty of the construction contractor to the satisfaction of owner and shall be performed without additional to the owner.

2.1.2 All references to the Architect /Engineer in this chapter shall mean owner

2.2 Duties and Responsibilities

2.2.1 At Owner's request, the contractor shall test the approved ready-mixed concrete supplier's proposed materials for compliance with specifications.

2.2.2 At owner's request, the contractor shall review and test the approved ready-mixed concrete supplier's proposed mix design.

2.2.3 Of the required three specimens, test one specimen at 7 days and test the remaining two specimens at 28 days in accordance with "Methods of Test for Compressive Strength of Cylindrical Concrete Specimens (ASTM)". The 28 day test result shall be the average of the strengths of the two specimens. If one specimen in a test manifests evidence of improper sampling, molding or testing, the 28 day test result shall be discarded and the test result shall be the average of remaining 28 day specimen strength multiplied by the 7-28 day strength ratio as found in previous tests of the same mix design. Should more than one specimen in any tests show any of the above defects, the entire tests shall be discarded. When high early strength cement (type III) is specified, test one specimen at 3 days, one in 14 days and one at 28 days.

2.2.4 When concrete is supplied by an approved ready mixed concrete supplier in accordance with ASTM C94, strength tests shall be specified by Owner Project Manager. The following testing program, unless specified otherwise shall be used:

Slump readings shall be taken in accordance with section 4.2.2.2 of ACI 301 and the following guidelines:

- Changes in moisture content of aggregate may cause the water/cement ratio to be out of compliance with ACI 117.
- Whenever cylinders are made for testing

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- Every 100 cubic yards with consistent mix characteristics
- After each batch delivered that has a slump above working slump accordance with the requirements of ACI 301 section 4.2.2.

2.2.5 Determine air content of concrete of normal; weight on a regular basis to ensure that air entrainment is in accordance with section of section 4.2.2.4 of ACI 301.

2.2.6 Unless more frequent tests are requested by the Owner's Project Manager or his representative take a minimum of one test each day that air entrained concrete is placed.

2.2.7 One strength test for every 100 cubic yards of structural concrete and concrete paving placed each day .Testing is not required for placements less than 6 cubic yards in a day. Testing of non-critical concrete (sidewalks, bollard fill, etc.) may be waived at the discretion of the Owner's representative.

2.2.8 Included in the test above, at least one set of tests shall be made for each of the following types of structures:

- Elevated concrete table tops for supporting vertical vessels.
- Concrete T-type saddle supports for horizontal vessels or exchangers.
- Structural concrete floors or roofs for buildings, other than slabs-on-grade.
- Open concrete support structures for accumulators, condensers and compressors.
- Unit area paving slabs.

2.2.9 Report all test results to the Owner's project manager or his representative on the same the tests are made.

3.0 Formwork and Accessories

3.1 Expansion Joint Filler

The Joint Filler shall be pre-molded and conform to ASTM D994 or D1751 unless otherwise specified by the owner.

3.2 Other Embedded Items

When shown and specified on the designed drawings, waterstops shall be a type as manufactured by Green streak or Owner's approved equivalent. Waterstops shall be ribbed or serrated type Polyvinyl Chloride construction complying with the US corps of Engineers Specification CRD-C572 .All joints in the waterstops shall be spliced by heating the ends to be joined with a thermostatically controlled electric splicing iron, then pressing the ends together until the material has cooled. The heating temperature shall be as recommended by the manufacturer. For hydrocarbon and chemical exposure, other compatible waterstop material should be evaluated.

3.3 Performance and Design Requirements

3.3.1 Earth cuts made in rock or firm soil that will not be spall or slough may be used as forms for concrete that will not be exposed to view or weather after construction.

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3.3.2 All reinforcing steel and welded wire fabric shall be continued across joints. Keys and dowels shall be provided as shown in the drawings. Longitudinal keys shall be provided only where shown on the drawings.

3.4 Fabrication and Manufacture

All edges and corners of the concrete that will be exposed in the finished construction shall have a $\frac{3}{4}$ " chamfer unless otherwise specified by the owner. The formed edges at the perimeter of the exterior slabs and sidewalks will be finished with an edge radius of $\frac{1}{4}$ +/- $\frac{1}{8}$ ".

4.0 Reinforcement and Reinforcement Supports

4.1 Reinforcing Bars

Reinforcing bars shall be ASTM A615 grade 60, unless otherwise indicated in the project documents.

4.2 Welding

Fully welded splices or other welding to reinforcement shall be permitted only when shown on the drawing and when the welding follows procedures specified on the drawing. This reinforcing steel shall be of weldable quality (A615 S1 or A706 rebar). Tack welding or spot welding or reinforcing bars for any purpose is not permitted.

5.0 Concrete Mixtures

5.1 Concrete Materials

When required by owner, a delivery ticket shall be furnished with each load of concrete listing the quantities and types of materials used.

5.2 Cementitious Materials

5.2.1 Unless otherwise indicated in the project documents, cement shall be type I or II ASTM C150.

5.2.2 Natural cement, Slag cement, Pozzolan admixtures, ASTM C618 shall not be used unless prior written approval from owner is obtained.

5.3 Aggregates

The maximum size of coarse aggregate permitted shall be 1 $\frac{1}{2}$ ".

5.4 Concrete Temperature

5.4.1 Cold Weather

When necessary, arrangements for heating, covering, insulating or housing the concrete work shall be made in advance of placement and shall be adequate to maintain the required temperature without injury due to concentration of heat. Combustion heaters shall not be used during the first 24 hours unless precautions are taken, prevent exposure of the concrete to exhaust gases which contain carbon dioxide.

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5.4.2 Hot Weather

When necessary, provision for windbreaks, shading, fog spraying, sprinkling, ponding, or wet covering with a light colored material shall be made in advance of placement, and as such protective measures shall be taken as quickly as concrete hardening and finishing operations will allow.

5.4.3 Rate of Temperature Change

Changes in temperature of the air immediately adjacent to the concrete curing and immediately following the curing period shall be kept as uniform as possible and shall not exceed 5°F in any hour or 50°F in any 24 hour period.

6.0 Handling, Placing, and Construction**6.1 Depositing**

The free fall of concrete shall be as follows:

Aggregate dispersion is not an issue with modern equipment when concrete is placed in a timely manner per other requirements of ACI 301.

6.2 Construction Joints and Other Bonded Joints

Unless otherwise shown on the design drawings, an isolation joint ½" performed material shall be placed around all pads, pedestals and other foundations protruding through concrete slabs at grade. The joint filler shall be installed flush with the top.

6.3 Finishes and Tolerances

The following shall be used as applicable:

- Scratch finish: For surfaces intended to receive bonded applied Cementitious applications.
- Float finish: For surfaces intended to receive roofing, waterproofing membranes or sand bed terrazzo.
- Trowel finish: For floors intended as walking surfaces or subsequent installation of floor coverings.
- Broom or belt finish: Paving and upper surfaces of concrete structures shall receive a broom finish unless otherwise specified in the project documents.

Only the types of finishes listed above are permitted unless otherwise specified by the owner's project manager or his representatives.

6.4 Curing and Protection

During the curing period, the concrete shall be protected from damaging mechanical disturbances such as load stresses, heavy shock and excessive vibration. All finished concrete surfaces shall be protected from damages by construction equipment materials or by application for curing procedures and protected from the adverse effects of rain or running water. Self-supporting structures shall be loaded without overstressing the concrete.

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7.0 Mass Concrete

Concrete sections more than 3ft in the least dimension are termed mass concrete and shall conform to the special provisions of this chapter in addition to all other applicable provisions of this standard.

8.0 Grouting

- 8.1 Grout may be placed by any applicable method such as pressure grouting, pouring or dry packing that will assure 100% filling of the grout space and elimination of air pockets and voids .The grout mixture shall be of minimum consistency compatible with the placement method.
- 8.2 All grout for column baseplates and machine bases shall be a manufactured,premixed,non-shrink product as approved by the Owner's engineer
- 8.3 Cement-Based Non-Shrink grout shall be premixed, proportioned, factory packaged product consisting of a mixture of cement, sand and inert materials. It shall have a minimum compressive strength of 5000psi at 28 days. The amount of water added to the premixed dry product and the placing of the materials shall be in strict accordance with the manufacturer's printed instructions. No admixtures, additional cement or aggregate shall be added to the grout .Unconfined edges shall be cut back and sealed with plain cement grout cap or epoxy type paint. Grout should be sloped downward away from the outside bottom edge of the equipment or structure base plate to the edge of the foundation in order to shed excess water off the foundation.
- 8.4 Grout shall be cured and protected against rapid drying in warm weather and freezing in cold weather as prescribed by the grout manufacturer.

End of Specification

9.0 Revision Log

Revision No.	Revision Date	Document Authorizer	Document Reviewer	Document Author	Document Administrator	Revision Details
0	09/20/2013	Lindy Barile	REI	REI		New standard, Update to 1203.



Sunoco Logistics

Sunoco Pipeline L.P. and Affiliates CONSTRUCTION STANDARDS

Subject:

Chain Link Fencing and Gates

Prepared By: Lindy Barile [REI]	Revision: 2	Page: 1 of 9	Code:	Number: 0310
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1.0 Introduction

1.1 Purpose

- 1.1.1 This specification prescribes the requirements for the installation of galvanized steel chain link fence (permanent and temporary) and associated gates, end, corner, gate and line posts; barbed wire extension; foundations; controls and other related items necessary to provide a complete and secure enclosure.
- 1.1.2 The Contractor shall provide all necessary labor, material and equipment as required to complete all work as outlined on drawings and as specified in the Scope of Work and this specification. All work shall be subject to the terms and conditions of the Construction Contract.
- 1.1.3 Materials shall conform with the Standard Guides of the Chain Link Fence Manufacturers Institute (CLFMI) for metallic-coated steel chain link fence and fabric.
- 1.1.4 Unless specified otherwise, all ferrous fence material shall be galvanized. Imperfectly galvanized material, or material upon which serious abrasions of the galvanizing occurs shall not be used.

2.0 References

- 2.1 Process Industry Practices - CVS02830
- 2.2 American Society for Testing and Materials (ASTM)
 - ASTM A-53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - ASTM A-116 Standard Specification for Metallic-Coated, Steel Woven Wire Fence Fabric
 - ASTM A-121 Standard Specification for Metallic-Coated Carbon Steel Barbed Wire
 - ASTM A-123 Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - ASTM A-153 Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware
 - ASTM A-392 Specification for Zinc-Coated Steel Chain-Link Fence Fabric
 - ASTM A-702 Standard Specification for Steel Fence Posts and Assemblies, Hot Wrought
 - ASTM A-824 Standard Specification for Metallic-Coated Steel Marcellled Tension Wire for Use With Chain Link Fence
 - ASTM C-94 Specification for Ready Mixed Concrete
 - ASTM F-567 Standard Practice for Installation of Chain-Link Fence

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ASTM F-656 Standard Specification for Fence Fittings

ASTM F-900 Standard Specification for Industrial and Commercial Swing Gates

ASTM F-1043 Standard Specification for Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework

ASTM F-1083 Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures

ASTM F-1553 Guide for Specifying Chain Link Fence

2.3 Sunoco Standard Drawings

S_STDS_C200000, Standard Fence Details, Sunoco Logistics Standard Drawing

3.0 Products and Materials

- 3.1 Galvanized steel pipe used for posts, rails, braces and gate frames shall conform to ASTM A53 and the following.
- 3.2 Line Posts shall be standard pipe steel posts, no less than 2.375 inches outside diameter, weight not less than 3.65 pounds per foot.
- 3.3 End, Corner and Pull Posts shall be standard pipe steel posts, no less than 2.875 inches outside diameter, weight not less than 5.79 pounds per foot.
- 3.4 Gate Posts shall be standard pipe posts of minimum diameters and weights as indicated below for the nominal widths of a single gate or for one leaf of a double gate.

<u>Nominal Gate Width</u>	<u>Minimum Outside Dia. in Inches</u>	<u>Minimum Weight in Pounds/Foot</u>
6 feet and less	2.875	5.79
Over 6 feet to 13 feet incl.	4.000	9.11
Over 13 feet to 18 feet incl.	6.625	18.97
Over 18 feet	8.625	28.55

- 3.5 Top Rails shall be 1-1/4 inch schedule 40 galvanized pipe.
- 3.6 Braces shall be 1-1/4 inch schedule 40 galvanized pipe braced with a 3/8" truss rod and turn-buckle attachment.
- 3.7 Chain link fabric shall conform to ASTM A392 and shall have a uniform square mesh measuring approximately two inches between parallel sides. The fabric shall be woven of 9 gauge (0.148 inches diameter) wire with top and bottom edges twisted and barbed. Fabric shall be hot dipped galvanized after weaving with Class II zinc coating (minimum 2.0 oz./sq.ft.). The height of fence fabric for pump and valve

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stations shall be 8'-0". Fabric for electrical substations shall be 7'-0" high. Use 6'-0" high nce fabric for all other permanent fencing installations.

- 3.8 Barbed wire shall be double stand twisted of 12-1/2 gage aluminum of Class 3 zinc coated steel wire; and 14 gage, 40-point minimum barbs spaced at not more than 5" centers, conforming to the requirements of ASTM A121. Barbed wire extension arms shall be designed to carry and to anchor securely, three strands of equally spaced barbed wire one foot high. Unless specified otherwise, single extension arms shall be used. Each arm shall incline inward at a 45 degree angle with the post, except over gates where they shall be vertical. Arms shall be capable of withstanding a 250 pound pull down load from the end of the arm.
- 3.9 Tension wire shall be at least seven (7) gauge with a minimum tensile strength of 80,000 psi and a zinc coating not less than 2.0 ounces/square foot
- 3.10 Brace bands, tension bands and tension bars shall be fabricated of 1/8" by 7/8" galvanized steel with galvanized steel carriage bolts and nuts in accordance with ASTM A123. Tension bars shall be 1/4" by 3/4" galvanized steel bar in accordance with ASTM A 153.
- 3.11 The wires shall be nine (9) gauge galvanized wire with Class C zinc coating. The use of galvanized steel or non-corrosive metal bands will be permitted in lieu of tie wires for fastening chain link fabric to posts and gate frames if prior approval is received by the Owner's Engineer.
- 3.12 Stretcher bars shall be steel, 1/4" by 3/4" with bands, nuts and bolts. Stretcher bars shall be of lengths equal to the full length of the fabric with which THEY ARE TO BE USED.
- 3.13 **Swing Type Gates**
Gate frames shall be constructed of standard weight galvanized pipe not less than 1.900 inches outside diameter and weighing not less than 2.72 pounds per foot. Gate frames shall be cross trussed with 3/8" adjustable truss rods. Members shall be securely connected at joints to provide a rigid frame. Frames over ten (10) feet wide shall have a vertical center member and shall be braced as required.
- 3.14 **Sliding Type Gates**
The gate frame shall be fabricated from aluminum alloy extrusions. The primary members (top and bottom) shall be "P" shaped in cross section, and vertical members at the ends of the frame and between the counter balance and opening shall be square in cross section with nominal base dimensions of no less than 2" x 2". Intermediate vertical spacer bars shall be 1" x 1" square tubing, spaced 2'-0" on center.

4.0 Execution

- 4.1 **Permanent Fencing**
 - 4.1.1 All materials used for permanent fencing shall be new and comply with the pertinent provisions of the relevant standards listed in this Specification.
 - 4.1.2 Install chain link fencing consisting of, but not limited to; corner posts, end posts, chain link fabric, tension bars, tension bands, brace banks, post hangers, rail ends, post caps, and all related connecting hardware.

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4.1.3 Between posts, chain link fabric shall be fastened to a top rail and bottom tension wire. If the top rail is eliminated per the instructions of the Owner's Engineer, a tension wire shall also be stretched at the top of the fence fabric.

4.1.4 Posts Tops, extension arms, stretcher bars and other required fittings and hardware shall be steel, malleable iron or wrought iron, and shall be galvanized in accordance with ASTM A153.

4.2 Temporary Fencing

4.2.1 Used materials in good condition may be used for temporary fencing.

4.2.2 Fence and installation shall be the same as for permanent fencing except use 7 foot high galvanized steel chain link fabric; top and bottom tension wire (no top rail required); corner, tension and gate posts set in concrete; line posts driven, no concrete; gates as indicated or as otherwise required for equipment access during construction.

4.3 Modification of Existing Fencing

4.3.1 Contractor shall verify with Owner's Representative that permission of the property owner has been obtained before modifying existing fences. Where necessary to cut or remove to permit passage of equipment onto or along the right-of-way, all openings resulting in the fence shall be closed with temporary or permanent gates constructed and/or installed per this specification and/or the property owner. Components of existing fences that are in good condition shall be preserved and reused in restoring the fence to the extent economically practical.

4.3.2 Gates shall not exceed the width of the right-of-way. To prevent damages to said fences, before cutting the fences to make these gates, Contractor shall brace and reinforce the fence on each side of the gate to be opened. The preferred sequence is to install the gate posts and brace assemblies before cutting/removing any of the existing fences. Gates shall be constructed per this specification, and shall satisfy property owner and tenant. Contractor shall be solely responsible for damages resulting from negligence of Contractor's employees failing to keep any gates securely closed at all times. Contractor shall furnish a watchman where necessary, in order to comply with the foregoing requirements.

4.3.3 After all construction operations are completed, Contractor shall remove all temporary gates and shall rebuild all fences to a condition as good, or better than, they were originally found.

4.4 Installation

4.4.1 All concrete shall be ASTM C94 with Type IA/IIA Portland cement, minimum 2500 psi @ 28 days, 3 inch slump +/- 1". Set all posts in concrete footings cast rough in the ground. Depth and diameter of the concrete shall be in accordance with the table below, unless shown otherwise on the project drawings. Concrete shall extend 4" below bottom of posts and shall be crowned 1" above grade to shed water.



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Post Type	Minimum Concrete Base Dimensions	
	Diameter	Depth
Line Post	12"	30"
Pull or Corner Post	12"	36"
Gate Post \leq 4" Nom. Dia.	12"	36"
Gate Post $>$ 4" Nom. Dia.	18"	48"

- 4.4.2 Install line posts, corner posts, terminal posts and horizontal rails with back bands, rail ends, rail sleeves, line post caps (barbed wire extension arms), tension bands, tension bars, chain link fabric and gates, to provide a rigid structure for fence.
- 4.4.3 Space line posts uniformly and on 10'-0" maximum centers.
- 4.4.4 Set all posts plumb, and true to line and grade. Where grade changes gradually from post to post, grade the posts to provide a "rolling" effect to avoid abrupt changes to the top of the fence line. If abrupt changes in grade are encountered, accomplish them with the use of a corner or pull post, with the chain link fabric cut on a bias where necessary to provide tension over the entire height.
- 4.4.5 Position the bottom of the fabric 2 inches maximum above the finished grade.
- 4.4.6 Pass top rail through barbed wire extension arms and attach securely to terminal posts.
- 4.4.7 Install brace rail and adjustable truss rod between all end, corner and gate posts and first line post.
- 4.4.8 Stretch chain link fabric taut between terminal posts, supporting its weight as necessary with temporary tie wires.
- 4.4.9 Attach fabric to end, corner and gate posts with tension bars, and tension bands, using one less band than the height of the fabric in feet, or approximately 14" on center.
- 4.4.10 Attach fabric to horizontal rails with tie wires and to tension wire with hog rings, 5 tie wires, or hog rings per 10-foot bay or approximately 24 inches on center.
- 4.4.11 Attach fabric to line posts with self-locking aluminum bands, using one less band than the height of the fabric in feet, or approximately 14 inches on center. Securely form the double locking ends and hammer down flat on the back side of the post.
- 4.4.12 Install strands of barbed wire on arms, tensioned and secured. Lock barbed wire securely into the slots on the arms by appropriate means.
- 4.4.13 Install gates and adjust true to fence line and grade. Install appropriate hold-open devices.

5.0 Gates

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5.1 General Gate

- 5.1.1 Gate shall be of the same height and shall have the same type and number of barbed wire strands as the fence. Gate fabric shall also be of the same type used in the fence construction.
- 5.1.2 Clearance between roadway and the bottom of the gate in the closed position shall be such as will provide good security. Clearance between the roadway and the lower edge of any required overhead support structure for gate shall be a minimum of 15'-0".
- 5.1.3 The Constructor is responsible for any grading necessary to ensure proper gate functioning.
- 5.1.4 Except where noted; gate hinges, latches and all other moving parts of gates shall be certified malleable cast iron, with all components hot-dip galvanized. All latches to have provision for positive locking with a padlock; wrap-around chains are not permitted for this purpose. Padlocks and keys are provided by others.

5.2 Swing Type Gates

- 5.2.1 Provide stops to hold gates open. Provide a center rest for double swing gates.
- 5.2.2 Gate hinges to be a ball-and-socket design with offset arms to permit a full 180 degree swing from the closed to the open position. Single gate latches to be so designed as to permit the gate to swing in only one direction.
- 5.2.3 Gate hinges shall be designed and arranged to prevent removal of the gate from the hinges without mechanical disassembly of the hinges.

5.3 Sliding Type Gates

- 5.3.1 The gate frame shall be fabricated in modular sections, then shop or field assembled for the specified opening. The gate frame shall then be reinforced and post-tensioned with 1.66" OD x .055" minimum wall, 0.083" maximum wall, galvanized or aluminized tubular steel running continuously through the full length of the top and bottom horizontal primary members.
- 5.3.2 The gate frame shall have a separate semi-closed track extruded from aluminum alloy which when shop or field riveted to the assembled gate frame becomes an internal part of and forms a composite structure with the top of the gate frame. Rivets shall be the internal exploding type, of totally rustproof material, and shall be placed alternately along the top and side of the track on 1'-0" centers.
- 5.3.3 The gate frame is to be supported from the track by two stationery, 4 wheel, sealed lubricant, ball bearing truck assemblies which match the track dimensions. The bottom of the support posts shall be equipped with two pans of rubber-tired guide wheels.
- 5.3.4 Diagonal "X" bracing of 1/8" diameter stainless steel aircraft cable shall be installed to brace the gate panels.
- 5.3.5 Gate shall have a nylon ground roller installed to support the rear of the gate in the opened position.

Subject:

Chain Link Fencing and Gates

Prepared By: Lindy Barile [REI]	Revision: 2	Page: 8 of 9	Code:	Number: 0310
Approved: Lindy Barile	Date: 8/29/13	Replaces: 0310 Rev. 1		

6.0 Automatic Gate Operators

- 6.1 It is generally not recommended to install an automatic gate operator for swing type gates. Gates requiring automatic openers shall be sliding-type gates unless approved otherwise by the Owner's representative.
- 6.2 Contractor shall be responsible for the furnishing and installation of all required gate operator material and control components except as noted in these specifications.
- 6.3 Gate operator and all required control components and material shall be installed per manufacturer's recommendations.
- 6.4 Gate operator enclosure shall be weatherproof and all related equipment which is to be installed outdoors shall be suitable for permanent installation outdoors.
- 6.5 Gate operator shall be complete with means of manually operating gate in the event of a power failure.
- 6.6 Gate operator shall be heavy duty, with worm gear drive; OSCO Model #GSLG, Richards-Wilcox, or approved equal. Specify manufacturer and model number being quoted upon.
- 6.7 Provide a suitable support, including a concrete foundation as required for the gate operator.
- 6.8 Install two concrete filled pipe bollards at the gate operator. See drawings for a detail of bollard installation. Actual location of bollards shall be per instructions of the Owner's Engineer.
- 6.9 Where wire loops are installed embedded into existing concrete driveway, Contractor shall patch over loops using a non-shrinking type epoxy filler material.
- 6.10 Where wire loops are installed embedded into existing blacktop driveway, Contractor shall use Celltite 2-part Coal Tar Epoxy, #42-90 Hyflex or approved equal patching material.
- 6.11 The Contractor shall provide Owner's Representative with three (3) sets of printed electrical control schematics and maintenance manuals from the gate operator manufacturer following receipt of contract.
- 6.12 One set of electrical control schematics will be given to the Facility Manager and two sets will be retained by the Owner's Representative.

7.0 Electrical

- 7.1 Contractor shall install the complete electrical system, power and controls, between the panel board, gate operator and gate operator control components to enable control of new gate as described in the Scope of Work and in compliance with related specifications.
- 7.2 Install a minimum of 20% spare wires in new conduit to the gate operator.
- 7.3 All junction and pull boxes which are to be installed outdoors, and outside of hazardous areas, shall be weatherproof
- 7.4 The Contractor shall install a disconnecting device for both power and control wires at the gate operator. Disconnecting devices shall be in weatherproof enclosures and shall be lockable.
- 7.5 The gate shall be operable from "open-close-stop" momentary-contact type push buttons to be located in the office area. Actual location shall be per the instructions of the Owner's Engineer. The new gate shall remain open when operated from the manual "open" push-button until closed via the "close" push-button.



Sunoco Logistics

Sunoco Pipeline L.P. and Affiliates CONSTRUCTION STANDARDS

Subject:

Chain Link Fencing and Gates

Prepared By: Lindy Barile [REI]	Revision: 2	Page: 9 of 9	Code:	Number: 0310
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End of Specification

8.0 Revision Log

Revision No.	Revision Date	Document Authorizer	Document Reviewer	Document Author	Document Administrator	Revision Details
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Sunoco Logistics

Sunoco Pipeline L.P. and Affiliates CONSTRUCTION STANDARDS

Subject:

Soil Erosion and Sediment Control

Prepared By: C. Armstrong [REI]	Revision: 2	Page: 1 of 2	Code:	Number: 0311
Approved: Lindy Barile	Date: 8/29/13	Replaces: 0311 Rev. 1		

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CONSTRUCTION STANDARDS****Subject:****Soil Erosion and Sediment Control**

Prepared By: C. Armstrong [REI]	Revision: 2	Page: 2 of 2	Code:	Number: 0311
Approved: Lindy Barile	Date: 8/29/13	Replaces: 0311 Rev. 1		

1.0 Introduction

Scope

- 1.1.1 In the performance of the work contained in the Construction Contract it shall be necessary for the Contractor to install the work while conforming to an approved Soil Erosion and Sedimentation Control Plan.
- 1.1.2 The Owner's Engineer, as related to the specific work site, shall develop a Soil Erosion and Sediment Control Plan. A copy shall be included in the package of construction drawings.

2.0 References

The Contractor shall adhere to the Owner's Soil Erosion and Sediment Control Plan, and the provisions, ordinances, regulations, orders, and requirements of all Local, State, Federal or other government agencies, boards, or commissions.

3.0 Revision Log

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Sunoco Logistics

Sunoco Pipeline L.P. and Affiliates CONSTRUCTION STANDARDS

Subject:

Site Drainage

Prepared By: C. Armstrong [REI]	Revision: 2	Page: 1 of 4	Code:	Number: 0312
Approved: Lindy Barile	Date: 8/29/13	Replaces: 0312 Rev. 1		

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**Subject:****Site Drainage**

Prepared By: C. Armstrong [REI]	Revision: 2	Page: 2 of 4	Code:	Number: 0312
Approved: Lindy Barile	Date: 8/29/13	Replaces: 0312 Rev. 1		

1.0 Introduction**1.1 Scope**

- 1.1.1 This specification covers the procedures that are required to satisfactorily address site drainage issues while performing construction operations on Sunoco Logistics properties, including all work necessary to control the flow of storm water.
- 1.1.2 Refer to project drawings for details of permanent site drainage features and facilities to be constructed as part of the Contract scope.
- 1.1.3 Any deviation from this specification must be authorized in advance by the Owner's Representative.

2.0 Control of Water**2.1 General Conditions**

- 2.1.1 Prevent or control water flow into excavations, or water accumulation in excavations, to ensure that the bottoms and sides of all excavations remain in a firm and stable condition throughout construction operations.
- 2.1.2 All measures, methods and procedures shall be in compliance with applicable provisions of United States Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) Storm water Program, including approved Storm water Pollution Prevention Plans (SWPPP's) and storm water permits for the site or project. Development of SWPPP's and the party responsible for applications for permits varies by location. Refer to Contract provisions, EPA NPDES and Owner's Representative for definition of responsibilities for specific projects.

2.2 Surface Waters

- 2.2.1 Plan and conduct excavation operations so as to minimize the disruption of storm water drainage in the vicinity of the work.
- 2.2.2 Provide diversion ditches, dikes, and other suitable measures to control and direct runoff around and away from the excavation. Protect the sides of excavations from erosion and sloughing caused by storm water runoff.
- 2.2.3 Provide silt fences, sediment traps, surface treatments and other erosion control measures as required to comply with SWPPP's and EPA storm water discharge permits.
- 2.2.4 Promptly remove storm water accumulations in excavations. The systems and equipment for control of surface water shall be of sufficient capacity to accommodate the runoff rate that can be expected from the two year (50% annual chance) rainfall event, with no significant disruption of the construction schedule, or damage to existing features or facilities in the vicinity of the work.

2.3 Groundwater

Subject:

Site Drainage

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2.3.1 When the bottom of the trench must be carried to an elevation below the groundwater piezometric surface, or to such proximity to the piezometric surface that the excavation bottom will become soft, due to its being saturated by groundwater; take measures to lower the piezometric surface sufficiently to maintain the stability of the excavation bottom.

2.3.2 Design the groundwater control system using accepted professional methods of design and engineering consistent with the best modern practice. The system shall include trenches and sumps with pumps, well points, and such other equipment, appurtenances, and related earthwork necessary to achieve the groundwater control needs of the work.

2.3.3 Carefully design and operate the system to avoid damage to existing structures and other facilities in the vicinity of the work.

2.4 Disposal of Removed Water

2.4.1 Convey water removed by the water control systems to a settling basin or an existing storm water drainage facility with sufficient capacity to accommodate the flow rates involved without damage as outlined in the approved SWPPP and discharge permit.

2.4.2 Secure permits and other approvals required from authorities having jurisdiction for such storm water discharge prior to commencement of construction.

2.5 Disposal of Contaminated Water

All removed water shall be periodically tested by the Contractor (revise as needed) for contamination as required to confirm it satisfies the conditions of the discharge permit. Should the removed water be contaminated with hydrocarbons, immediately cease operations and notify the Owner's Representative.

2.6 System Removal

After completing construction operations needing water control, remove materials, equipment, and other facilities used for that purpose, and clean up and restore affected areas as required.

End of Specification

3.0 Revision Log



Sunoco Logistics

Sunoco Pipeline L.P. and Affiliates CONSTRUCTION STANDARDS

Subject:

Site Drainage

Prepared By: C. Armstrong [REI]	Revision: 2	Page: 4 of 4	Code:	Number: 0312
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Sunoco Logistics

Sunoco Pipeline L.P. and Affiliates CONSTRUCTION STANDARDS

Subject:

Pipe Abandonment or Removal

Prepared By: R. Todd [REI]	Revision: 2	Page: 1 of 4	Code:	Number: 0313
Approved: Lindy Barile	Date: 9/25/13	Replaces: 0313 Rev 1		

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Subject:

Pipe Abandonment or Removal

Prepared By: R. Todd [REI]	Revision: 2	Page: 2 of 4	Code:	Number: 0313
Approved: Lindy Barile	Date: 9/25/13	Replaces: 0313 Rev 1		

1.0 Introduction

1.1 Purpose

The purpose of this specification is to provide the minimum requirements for either removal and disposal or the abandonment of steel pipeline segments no longer in service.

1.2 Scope

1.2.1 The specification covers the division of responsibilities between the Owner and Contractor with respect to "Abandonment" or removal and disposal of old pipelines, unless otherwise indicated in the Construction Contract.

1.2.2 Deviations from this specification require the approval of Sunoco Logistics, LP personal or authorized representative.

2.0 References

- 2.1 Code of Federal Regulations, Title 49, Transportation of Hazardous Liquid by Pipeline, Part 195.59
- 2.2 Code of Federal Regulations, Title 49, Transportation of Natural or Other Gas by Pipeline, Part 192. 727.
- 2.3 ASME B31.4, Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids, Section 457 – Abandoning a Piping System.
- 2.4 Sunoco Logistics, LP, PR-11-0037 Activating and Deactivating Pipelines
- 2.5 Construction Standard 0301, Demolition

3.0 Definitions

3.1 Abandonment

(Abandoned Pipeline) means any pipeline or pipeline system that has been permanently removed from transportation service of gas or hazardous liquid subject to the pipeline safety laws by safe disconnection from an operating pipeline system, purged of combustibles with water or inert gas, ends capped and sealed. Upon request by a property owner of land occupied by the pipeline, easements in effect may be released. Minimal DOT 191, 192 or 195 maintenance requirements are followed.

3.2 Removal

Refers to the complete removal of a pipeline in its entirety or portions as deemed appropriate from the Right of Way. The Contractor is responsible for the restoration of Right of Way to pre-construction activities per the direction of the Company or authorized representative.

4.0 General - Requirements/Procedure

4.1 Owner

- 4.1.1 The Owner's work force will perform a nitrogen purge of all pipeline segments to be abandoned.

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Pipe Abandonment or Removal

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- 4.1.2 The Owner shall verify and advise the Contractor of any special abandonment requirements necessary at Railroad, Highway, Roadway or waterway crossings.
- 4.1.3 The Owner's work force will perform the first cut on the pipeline to demonstrate proper technique and safety measures.
- 4.1.4 The Owner's work force will complete the tie-in of the new sections of pipeline to the existing pipeline and will purge the abandoned portions of the pipeline.
- 4.1.5 Owner shall verify that upon completion all abandoned portions are permanently disconnected from possible supply sources, through the use of weld caps.

4.2 Contractor

- 4.2.1 If the pipeline is to be removed, the Contractor shall excavate the purged, blown down segment, following proper excavation procedures.
- 4.2.2 Prior to cutting the Contractor is cautioned that typical line segments have years of service carrying petroleum product(s) and as such residual product and vapor may linger in unknown locations, thus safety and caution are of utmost importance during the removal process.
- 4.2.3 Hot cutting torches are prohibited. Only cold cutting methods are permitted.
- 4.2.4 Consideration for providing product containment must be included in the work plan.
- 4.2.5 All portions of the pipeline that are abandoned and not removed shall have welded end caps installed.
- 4.2.6 Railroad crossings, highways, roadways may require to be filled with sand, grout, flowable fill, etc. The contractor is responsible to complete additional abandonment requirements per the Construction Contract.
- 4.2.7 Pipe that is specified to be disposed of by the Contractor shall be transported by the Contractor to a specified location provided by the Owner, as indicated in the Construction Contract.

5.0 Reporting

- 5.1 Any abandoned pipelines that cross over, under, or through a commercially navigable body of water or is located offshore shall be reported to the NPMS (National Pipeline Mapping System), per the requirements of 195 or 192 as part of the abandonment process.
- 5.2 Owner shall implement Sunoco Logistics, LP, and conversion of service process found in PR-11-0037, Activating and Deactivating Pipeline Systems, which includes information regarding the extent, if any, of the facilities that will be maintained.

End of Specification



Sunoco Logistics

Sunoco Pipeline L.P. and Affiliates CONSTRUCTION STANDARDS

Subject:

Pipe Abandonment or Removal

Prepared By: R. Todd [REI]	Revision: 2	Page: 4 of 4	Code:	Number: 0313
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Sunoco Logistics

Sunoco Pipeline L.P. and Affiliates CONSTRUCTION STANDARDS

Subject:

Site Clean-Up and Restoration

Prepared By:
S. Mun [REI]

Revision:
2

Page:
1 of 3

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Site Clean-Up and Restoration

Prepared By: S. Mun [REI]	Revision: 2	Page: 2 of 3	Code:	Number: 0314
Approved: Lindy Barile	Date: 8/29/13	Replaces: 0314 Rev. 1		

1.0 Introduction

1.1 Scope

- 1.1.1 The work required under this section includes the furnishing of supervision, labor, equipment, and services necessary for acceptable site cleanup and restoration of disturbed areas.
- 1.1.2 Any deviation from this specification must be authorized in advance by the Owner's Representative.

2.0 References

Process Industry Practices, CVS02100

3.0 Execution

- 3.1 The Contractor shall at all times keep the job site as free from all material, debris and rubbish, including but not necessarily limited to the following, paper, cardboard, cartons, cans and bottles, as is practicable. The Contractor shall remove same daily from any portion of the job site when it becomes objectionable or interferes with the progress of the project in the opinion of the Owner's Representative. Trash receptacles shall be provided by the Contractor and emptied on a regular basis.
- 3.2 Following installation and back-filling, the Contractor shall clear the surrounding ground and temporary workspaces and shall dispose of all waste materials, debris, rock, and excess spoils resulting from Contractor's operations. Disposal shall be made in a legal manner to an off-site location unless directed to place the material at another location on Owner's property.
- 3.3 All roads, slopes, and other areas where the Contractor has moved earth to facilitate the movement or operation of its equipment shall be restored to their original profile and condition, and to the satisfaction of the Owner's Representative. The Contractor shall fill and smooth over holes and ruts and shall repair all miscellaneous and unclassified ground damage caused by project, and shall restore the ground to such stable and usable condition of the ground prior to the installation of the pipeline section and/or equipment. Particular care shall be exercised in order to insure that all drainage ditches shall be maintained and left unobstructed to prevent the backing up of water and thereby flooding areas or diverting said water.
- 3.4 The Contractor shall remove from the premises all uprooted/cut plant and construction materials, including pipe, equipment, tools, and appliances which were used in the performance of the work. All of the foregoing operations of cleaning up the work area and adjoining premises shall be completed by the Contractor.
- 3.5 Sunoco Logistics will not prevent the Contractor from attempting cleanup on account of weather or ground conditions. However, the Contractor shall assume full risk of acceptance and may be required by the Owner's Representative to again do such cleanup at the Contractor's expense to meet the Owner's acceptance requirements of normal dry weather cleanup.
- 3.6 The Contractor shall be entirely responsible for all claims which may result from damage caused by the Contractor and shall make any repairs and restorations, and shall satisfy all proper claims.
- 3.7 The Owner's Representative and the Contractor shall cooperate to secure consent, instructions and cooperation, and to establish any other coordination or contacts with land owners of adjacent property or

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Site Clean-Up and Restoration

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proper authority toward the end of leaving the premises in condition satisfactory to such owners or proper authority.

- 3.8 Damage to private driveways and parking lots shall be excavated, backfilled and restored in accordance with the Construction Specifications and Engineering Drawings. Curb and gutter, drainage pipes and culverts shall be restored to pre-construction condition or better, in alignment as close to original as can be achieved.
- 3.9 The Contractor shall be responsible for seeding and re-vegetation where necessary to restore the site. All seed, plants and methods of application used shall be as specified in the Contract documents or as otherwise approved by the Owner's Representative. Contractor shall maintain soil moisture levels suitable for seed germination and establishment of root systems for a minimum of six weeks after seeding/planting.
- 3.10 Fences disturbed by construction shall be restored to their original or better condition in accordance with the project Drawings, Construction Specification 310, Chain Link Fence and to the satisfaction of the Owner's Representative, and the landowner or tenant. Gates shall be installed as indicated by the Owner. The Contractor shall furnish gates, fencing, and posts.

End of Specification

4.0 Revision Log

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Sunoco Pipeline L.P. and Affiliates CONSTRUCTION STANDARDS

Subject:

Horizontal Boring

Prepared By: Chet Kehs [REI]	Revision: 2	Page: 1 of 6	Code:	Number: 0315
Approved: Lindy Barile	Date: 9/5/13	Replaces: 0315 Rev. 1		

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**Subject:****Horizontal Boring**

Prepared By: Chet Kehs [REI]	Revision: 2	Page: 2 of 6	Code:	Number: 0315
Approved: Lindy Barile	Date: 9/5/13	Replaces: 0315 Rev. 1		

1.0 Introduction**1.1 Purpose**

The purpose of this procedure is to define the standards for engineering design, construction specifications and construction practices for the trenchless installation of casing or carrier pipe/s under highways, railroads, streams, rivers or other obstructions where standard trenching methods are not feasible.

1.2 Scope

Trenchless installation methods shall include jack and bore, slick boring, or jack and tunnel. Casing pipe shall be avoided and only used when required by regulatory or permitting agencies.

2.0 References**2.1 Industry Standards****2.1.1 American Petroleum Institute**

- A. Recommended Practice 1102 Steel Pipelines Crossing Railroads and Highways
- B. Recommended Practice 1109 Marking Liquid Petroleum Pipeline Facilities
- C. Standard 1104 Welding of Pipelines and Related Facilities

2.1.2 American Railroad Engineers Association

- A. Manual for Railway Engineering –Part 5 – Pipelines

2.1.3 American Society of Mechanical Engineers

- A. ASME B31.4

2.2 Government Regulations**2.2.1 American Petroleum Institute**

- A. Specification API 5L - Specification for Line Pipe.
- B. Specification API 13A - Specification for Oil Well Drilling Fluids Material.
- C. Recommended Practice Specification API RP 7G

2.2.2 U.S. Government Department of Transportation / DOT

- A. CFR Title 49, Part 192 – Transportation of Natural, Liquid and Other Gases by Pipeline.
- B. 2. CFR Title 49, Part 195 – Transportation of Hazardous Liquids by Pipeline.

2.3 Sunoco Logistics Reference Drawings

- A. S_STDS_C210013 Standard, Casing End Detail
- B. S_STDS_C250000 Typical Casing Details, Sizes 4" – 16" Pipeline
- C. S_STDS_C250001 Casing Detail, Railroad Crossing

**Subject:****Horizontal Boring**

Prepared By: Chet Kehs [REI]	Revision: 2	Page: 3 of 6	Code:	Number: 0315
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3.0 Definitions**3.1 Bentonite**

Absorbent aluminum silicate clay formed from volcanic ash. When thoroughly mixed with water, bentonite breaks down into small particles called platelets. The platelets plaster or shingle off the all of the bore and form a filter cake that cuts off the flow of the water into the surrounding formation.

3.2 Jack and Bore

A process that forces the casing pipe through the earth while simultaneously removing the spoil from inside the casing by means of a rotating auger. The two methods approved by Sunoco Pipeline LP (SPLP) are the Track Type and Cradle Type Bore.

- Track Type: the boring equipment is supported and guided by longitudinal rails/tracks secured to a solid foundation and/or braced against the back of the bore pit. The alignment and elevation of the rails/tracks are critical.
- Cradle Type: the boring machine is suspended by the cable out rigging of a side boom.

3.3 Jack and Tunnel

A process that forces the casing pipe through the earth and removing the spoil by tunneling methods, usually reserved for larger diameter pipes. The track type is the only approved method for jack and tunnel.

3.4 Slick Bore

A process that utilizes a drilling fluid transmitted to the drill bit to facilitate spoil removal and drill bit cleaning. A pilot hole may be bored the entire length of the crossing and serve as the centerline of the larger diameter hole to be bored.

4.0 General - Requirements/Procedure**4.1 Quality Control**

All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on site to maintain the system in good working order for the duration of the crossing.

4.2 Requirements

- 4.2.1 Prior to commencing work the contractor must submit a plan which describes the boring procedure to SPLP engineering. All boring operations shall be performed by supervisors and personnel experienced in trenchless excavation.
- 4.2.2 The alignment and elevations shall be accurately surveyed, bore and receiving pits located in the field, including offset markers/stakes; the contractor will be responsible to safeguard all markers.
- 4.2.3 The casing and/or carrier pipe must be installed at the design centerline location and profile elevations, the elevation and alignment tolerances shall be site specific and determined by (SPLP) engineering.



Sunoco Pipeline L.P. and Affiliates CONSTRUCTION STANDARDS

Subject:**Horizontal Boring**

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4.2.4 The contractor shall provide a positive indication of where the leading edge of the casing is located with respect to line and grade. This indication may be provided using a water gauge, laser guidance system, electronic transmitting and receiving devices. The contractor will be responsible to record the line and grade at site specific intervals as specified by SPLP Engineering,

4.2.5 The contractor shall provide the means for controlling line and grade of the casing and/or carrier pipe.

4.2.6 All materials used for sheeting, sheet piling, cribbing, bracing, shoring and underpinning shall be in good, serviceable condition. Bore and receiving pit shoring and/or sheeting design shall be certified by a Registered Engineer when applicable.

4.2.7 Casing pipe shall be sized according to drawing specifications found in the reference section of this document.

4.3 Procedures

4.3.1 Casing and carrier pipes shall be designed in accordance with all applicable federal, state, local and permitting agencies or authorities.

4.3.2 All foreign utilities must be field located prior to commencement of the bore to ensure adequate clearance is maintained during boring operations. The contractor shall contact the appropriate state one-call agency at least 3 days prior to any excavation activities and boring operations.

4.3.3 Contractor to install bore and receiving pits as specified by SPLP engineering obtaining all necessary approval for sheeting and/or shoring design prior to installation.

4.3.4 Jack and Bore

A. A suitable backstop able to withstand the jacking pressure and placed perpendicular to the centerline of the casing pipe shall be provided.

B. Heavy duty jacks suitable for forcing the casing pipe through the earth shall be provided. A suitable jacking head shall be provided so that pressure will be applied to the casing pipe uniformly around the casing pipe. While operating jacks even pressure shall be applied to all jacks used.

C. All rails/tracks shall be installed and anchored to withstand the pressure exerted by the boring machine, at the specified elevation and alignment.

D. The cutting head must remain inside the casing pipe to ensure no voids or over cutting occurs, unless prior approval from SPLP Engineering is obtained.

4.3.5 Jack and Tunneling

A. A suitable backstop able to withstand the jacking pressure and placed perpendicular to the centerline of the casing pipe shall be provided.

B. Heavy duty jacks suitable for forcing the casing pipe through the earth shall be provided. A suitable jacking head shall be provided so that pressure will be applied to the casing pipe

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uniformly around the casing pipe. While operating jacks even pressure shall be applied to all jacks used.

- C. Entry into the casing pipe shall be in accordance with all OSHA and SPLP safety and confined space entry rules and regulations.

4.3.6 Cradle Type

- A. A “dead man” of sufficient size and weight is to be buried perpendicular to the pipe alignment; the anchor point shall be at the same elevation as the centerline of the winch attached to the boring machine.
- B. The boring machine shall be advanced by use of a winch attached to the boring machine with the winch cable attached to the anchor point of the “dead man”.
- C. The elevation of the bore machine shall be maintained by a side boom traveling parallel to the casing alignment.
- D. The casing pipe must be free of dents and all debris prior to the installation of the carrier pipe.
- E. All carrier pipe welds must be inspected and x-rayed prior to installation.
- F. The carrier pipe must be inspected for holidays in the coating material and all coating repairs must be performed prior to installation in the casing pipe.
- G. Casing insulators and end seals must be installed in accordance with specifications found in Appendix – A.
- H. Upon completion of the carrier pipe installation into the bored crossing the final installation shall be electrically inspected and approved by SPLP’s representative prior to final tie-in to existing facilities. If there is any electrical contact the contractor shall determine the source and if necessary remove and repair the damaged coating and reinstall the carrier pipe at no expense to SPLP.

4.3.7 Slick Boring

- A. The cutting head shall be maintained centered inside the bore hole.
- B. The guided pilot boring method is recommended for bores in excess of 125 feet.
- C. The location and elevation of the exit pilot hole must be checked prior to pull back.
- D. Jetting shall not be permitted.
- E. Overcutting in excess of one inch (1”) shall be remedied by pressure grouting the entire length of the installation at no cost to SPLP.
- F. Contractor shall provide “As-Built” drawings showing; the station numbers and elevations of the casing pipe, the x-ray and station number of each carrier pipe weld installed in the casing.

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5.0 Materials

5.1 Pipe

5.1.1 Casing pipe specifications to be determined by Sunoco Pipeline LP Engineering.

5.1.2 Carrier pipe specifications to be determined by Sunoco Pipeline LP Engineering.

5.2 Bentonite

Technical criteria for bentonite shall be as given in API Spec. 13A, "Specification for Oil Well Drilling Fluids Material", for fresh water drilling fluids. Any modification to the basic drilling fluid involving additives must be indicated in Contractor's Boring Plan, and a description must be given of the type of material to be used.

End of Specification**6.0 Revision Log**

Revision No.	Revision Date	Document Authorizer	Document Reviewer	Document Author	Document Administrator	Revision Details
1	01/14/2008			Charles E. Kehs	NA	General Review and formatting
2	09/05/2013	Lindy Barile	REI		NA	General Updates, added reference drawings

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1.0 Introduction**1.1 Purpose**

The purpose of this procedure is to define the standards for engineering design, construction specifications and construction practices for directionally controlled horizontal drilling of pipelines.

1.2 Scope

Directional drilling shall include: A drill path survey, the removal of any obstacles that may obstruct the line of pipe, the drilling of a pilot hole, reaming of a large diameter hole to accommodate the line pipe with coating, pulling a preassembled pipeline string along the reamed path, and a four (4) hour pre and eight (8) hour post stabilized hydrostatic testing of the pipeline/s. Pipe welding to meet Sunoco Welding Manual requirements, including inspection.

2.0 References**2.1 American Petroleum Institute**

- Specification API 5L - Specification for Line Pipe.
- Specification API 13A - Specification for Oil Well Drilling Fluids Material.
- Recommended Practice Specification API RP 7G
- Specification - API Bulletin D20 - Directional Drilling Survey Calculation Methods and Terminology

2.2 U.S. Government Department of Transportation / DOT

- CFR Title 49, Part 192 – Transportation of Natural, Liquid and Other Gases by Pipeline.
- CFR Title 49, Part 195 – Transportation of Hazardous Liquids by Pipeline.

3.0 Definitions**3.1 Horizontal Directional Drilling**

A process that utilizes a specially built drill rig which pushes the drill stem through the earth. A survey system is utilized to monitor the location of the drill head, which is steered by the operator.

3.2 Entry Angle

The angle between the drill stem and the surface of the ground; usually it is less than 15 degrees.

3.3 Exit Angle

The angle between the drill stem and the surface of the ground, the larger the angle the higher the pipe string must be raised during pull-back, usually between 5 and 20 degrees.

3.4 Back Reamer

A tool attached to the end of the drill string, used to enlarge the hole, also mixes the drill fluid and cuttings.

3.5 Bentonite

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Absorbent aluminum silicate clay formed from volcanic ash. When thoroughly mixed with water bentonite breaks down into small particles called platelets. The platelets plaster or shingle off the wall of the bore and form a filter cake that cuts off the flow of the water into the surrounding formation.

3.6 Cuttings

Spoils created during drilling operations.

3.7 Frac Out

Ground fractures caused by excessive drilling fluid pressure in the bore hole, which allow the drilling fluid to escape the bore hole.

3.8 Radius of Curvature

It should be equal to or greater than 100 times the nominal pipe diameter, or no less than what is shown on the Construction drawings.

3.9 Roll

The position of the drill head as related to a clock face looking in the direction of the drill.

4.0 General

4.1 The crossings are to be installed by an owner approved directional driller.

4.2 Contractor shall undertake the following steps prior to commencing drilling operations in a location that might contain underground facilities.

4.2.1 Contact the utility location/notification service (One Call), if available, for the construction area. Records of the appropriate "one calls" shall be kept for the duration of construction. If, after initiating the "one call" process, there are known facilities in the area that have not been marked, the owner/operator shall be contacted to mark their facility.

4.2.2 Positively determine the location and depth of and stake all existing lines, cables, or other underground facilities including exposing any facilities that are located within 15 feet of the designed drilled path.

4.2.3 Modify drilling practices and downhole assemblies to prevent damage to existing facilities.

4.3 Contractor shall be responsible for locating all underground facilities regardless of Company previous efforts in this regard. Contractor shall be responsible for all losses and repairs occasioned by damage to underground facilities resulting from drilling operations.

4.4 The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pullback the pipe, a drilling fluid; mixing, delivery and recovery system, of sufficient capacity to successfully complete the crossing, a guidance system to accurately guide the boring operations. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on site to maintain the system in good working order for the duration of the crossing.

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5.0 Requirements

- 5.1 Contractor shall submit written descriptions of equipment, methods, and procedures for completion of the Work prior to commencement of Work. Equipment descriptions shall include model, date of manufacture, and data sheets including capacities and ratings. Methods and procedures shall include descriptions of approach to the Work and individual procedures required to affect the overall method. As part of this requirement, Contractor shall show the plan of the drill site equipment layout, including location of erosion and sediment control devices, water, drilling mud treatment equipment, design profile drawings, etc., and a site specific safety program to protect Contractor and Company personnel, the public and the environment.
- 5.2 Contractor shall submit an execution plan with scope of work and schedule, design profile drawings, and detailed procedures to Company for approval prior to commencing Work for the following operations as applicable for marine and land HDD:
 - 5.2.1 Type and size of drilling rig
 - 5.2.2 Type and size of drill pipe
 - 5.2.3 Type and size of rollers and other support equipment
 - 5.2.4 List of other equipment to be used
 - 5.2.5 Procedures for excavation of entry and exit transition trenches, including type of vessels, expected production rate, and method of retaining resultant spoil to be used for marine trenching
 - 5.2.6 Mud plume discharge control during excavation and directional drilling
 - 5.2.7 Pilot hole drilling procedure
 - 5.2.8 Reaming operation
 - 5.2.9 Mud system and control
 - 5.2.10 Buoyancy control
 - 5.2.11 Pullback procedure
 - 5.2.12 Type of drilling fluid including additives
 - 5.2.13 Inadvertent discharge control
 - 5.2.14 As applicable for onshore worksites, drilling fluid disposal including name and location of off-site facility
 - 5.2.15 Directional drilling profile, pipe stress calculations, drawings, and method for monitoring the borehole profile



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5.2.16 Procedures for directional drilling of the crossing, including design profile, specified limits on pressures, tensions, sea-state motion, flow, or other limits within the capabilities of Contractor's equipment

5.2.17 Method of monitoring drilling progress

5.2.18 Procedures for positioning of the pipeline and pull back of the pipeline in the crossing

5.2.19 Maximum variance expected during directional drilling due to variations in mud types, weights, and flow capacities

5.2.20 Procedures for ensuring stability of the pipeline at the transition areas until the final tie-ins are completed

5.3 All procedures or material descriptions requiring Company approval must be submitted by the Contractor a minimum of ten days prior to commencing any HDD activities at the proposed crossing locations. The work shall not commence until said documentation has been approved by Company and lack of Contractor-obtained approval shall not constitute grounds for extra work claims by Contractor.

5.4 Contractor shall provide all necessary labor, supervision, professional and technical services, installation plans and procedures, plants and equipment, vessels, materials (except where stated otherwise in the "Company-supplied Materials" list), consumables, inspections, surveying, diving, testing, mobilization/demobilization transportation, and shall perform the Work described in the Scope of Work including, but not limited to the following:

5.4.1 Clearing, grading, and general site/access preparation necessary for construction operations, including installation of all turbidity mitigation structures (if required) and excavation of entry and exit holes.

5.4.2 Transportation of all equipment, labor, consumables, and Company supplied materials, including pipe and appurtenances, to and from the jobsite.

5.4.3 Erection of horizontal drilling equipment at the rig sites defined on the Drawings.

5.4.4 Drilling of a small diameter pilot hole along the path defined on the Drawings.

5.4.5 Reaming the pilot hole to a diameter suitable for installation of the prefabricated pull section.

5.4.6 Prefabrication of the pull section.

5.4.7 Hydrostatically pre-testing the fabricated pipe pull section for four (4) hours before pullback.

5.4.8 Installation of the prefabricated pull section in the reamed hole.

5.4.9 If applicable, the marine pipeline installation contractor is responsible for tie-in of the marine end of the HDD segment to the pipeline system after completion of the final HDD hydrostatic test.



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5.4.10 Clean up and restoration of all work areas, including removal of installation aids and backfilling of entry and exit holes.

- 5.5 Contractor shall comply with the requirements of all permits issued by Federal and/or State Regulatory Agencies.
- 5.6 Contractor shall for the duration of the Work, assign the necessary qualified and experienced personnel, equipment, work areas, craftsmen, supervision, tools, and all other materials and supplies to meet Project milestones. Key personnel shall be identified in Contractor's bid proposal. A qualified HDD Superintendent, approved by Company, shall directly supervise construction at all times. At no time shall other work preempt Work being performed for Company, without Company written consent. Contractor shall not reassign key project personnel and/or equipment or vessels from Work being performed for Company without Company written consent.
- 5.7 Contractor shall work such hours, including extra shifts and overtime, necessary to meet the Contract Schedule specifically including the field coordination necessary to accommodate pull-back of the pipeline string fabricated and tested by others. Contractor and its Subcontractors shall accept the presence of Company Representatives on its premises, facilities and vessels for the purpose of coordination, inspection, monitoring, and review of any aspect of the Work.
- 5.8 All vessels and equipment required to perform the Work in State waters will be required to meet the "Zero Discharge" requirements. Contractor shall develop plans and procedures unique to onshore and offshore construction as designated by regulatory bodies.
- 5.9 All Contractor and equipment must stay within the designated right-of-way, access roads, and workspace as shown in the construction drawings. No work is allowed outside of the right-of-way and workspace. The Contractor shall set up all necessary equipment, personnel and materials, set up work areas on the entry and exit sides of the crossing, and prepare the sites for construction. The Company will mark the construction workspace and sensitive area boundaries. The Contractor shall not go outside the provided workspace or disturb any sensitive area. The Contractor shall meet the requirements and/or stipulations of each landowner in accordance with the Right-of-Way (ROW) Line List.
- 5.10 If additional workspace is required for an onshore worksite, Contractor shall prepare a written request including drawings that describe the extent of the workspace requested and a compelling argument that clearly demonstrates the need for the additional workspace. Any expense associated with acquiring additional workspace shall be the responsibility of the Contractor. The Contractor is advised that the acquisition of additional workspace will be subject to review by the various permitting agencies. The Company will make an effort to acquire the requested workspace; however, the Company cannot guarantee the timely approval of the request.
- 5.11 All access roads and routes, both public and private, shall be prepared and maintained by the Contractor. The Contractor shall restore access roads to their original condition. This work shall meet with the approval of the applicable land owner(s) and/or agencies.
- 5.12 Environmental concerns addressed within this section include those actions necessary to execute the Work, including reduction of impacts to the surrounding water and land, regulatory impacts, and general public impacts.



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5.12.1 Dewatering, including storm water, shall be completed per the Storm Water Pollution Prevention Plan (SWPPP).

5.12.2 All trash, removed vegetation, and waste shall be removed from the site and disposed of in a manner acceptable to the Company.

5.13 Waste cuttings and drilling fluids shall be disposed of by Contractor at a Company approved disposal site. The construction areas will be checked a minimum of twice daily for signs of unplanned leaks or seeps. A written record shall be maintained by the Contractor of all inspections and submitted with his daily report to the Company Representative.

5.14 Refueling and Equipment Maintenance

5.14.1 Both the Pipeline Installation Contractor and the HDD Subcontractor shall satisfy the requirements of appropriate regulatory agencies by providing a means to contain, monitor, and abate turbidity (if required) in the marine environment while performing HDD's, including to the maximum possible extent, the capture and containment of any drilling mud/fluids that may escape the HDD holes.

5.14.2 Contractor shall provide all appropriate means to suppress the sound level at onshore residential and business areas to a level that will not disturb the occupants of those areas. These noise suppression means shall include but shall not be limited to sound -reducing engine exhaust systems, enclosing the engines and equipment in tents, and temporary acoustic walls between the occupied buildings and the work site.

5.14.3 Contractor shall comply with all the environmental and erosion and sediment control requirements. An Environmental Response Team shall be formed to respond to changing environmental conditions and emergencies. Examples where an Environmental Response Team would be required include:

- A. Potential sedimentation or watercourses, wetlands, or water bodies as a result of rainfall
- B. Earthen berm failure
- C. Inadvertent discharges

5.15 A temporary work area (entry site) shall contain the directional drilling rig and other equipment, which may include pipe storage racks, mud pumps, sump/pickup pits, mud tanks, dry storage area for bentonite, supplies, offices, a crane area; and adequate parking facilities. The entry sites shall be enclosed by a 12" earthen berm to contain unplanned spills or discharges.

5.16 A temporary work area (exit site) shall contain a boring exit pit and other equipment, which may include disposal tanks (or where allowed, disposal pits), storage tanks, shaker/desander-desilter equipment, centrifuge, water cleaning equipment, bentonite storage. The exit sites shall be enclosed by a 12" earthen berm to contain unplanned spills or discharges.

5.17 Near the exit site a completely welded pipe string of the required length for the crossing in one section shall be prepared and a pipe launcher/roller system of equal length. The launcher/roller system shall be used to insert the pipe into the opened borehole during the pullback operation, without damaging the pipe coating.

5.18 Contractor shall be responsible for preparing all entry and exit holes prior to commencement of drilling operations. The holes shall be contoured to attain the design radii of curvature of the Company-approved design. All spoil resulting from the formation of the holes shall be returned to the hole after completion of

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the Work. The longitudinal and transverse profiles of the holes shall be proven to the satisfaction of the Company Representative with appropriate survey methods; diver pneumo readings shall not be accepted as an appropriate survey method in marine drills.

- 5.19 The composition of all drilling fluids proposed for use shall be submitted to Company for approval. No fluid will be approved or utilized that does not comply with permit requirements and environmental regulations.

5.19.1 The drilling fluid used shall be a mixture of freshwater, bentonite, and polymers. Any polymers used to enhance the drilling fluid shall be environmentally safe and be approved for use by the Company. The polymers that are to be used shall be submitted with the Bid. The specific composition of the proposed drilling fluids shall be submitted to the Company for approval. No fluid will be approved that does not comply with the permit requirements and environmental regulations. All fluids and materials used shall have the corresponding Material Safety Data Sheet (MSDS) information available on site.

5.19.2 The Contractor shall maximize the re-circulation of drilling fluid surface returns, with the understanding that subsea returns are typically not recoverable. Contractor shall provide solids control and fluid cleaning equipment at onshore drilling site(s). The equipment used shall be capable of processing the surface returns and produce a fluid that is suitable for reuse. The Company shall have the option of specifying standards for the equipment performance and the treatment of excess drilling fluids and spoil.

5.19.3 Disposal of excess drilling fluids is the responsibility of Contractor and shall be conducted in compliance with all environmental regulations, right-of-way and workspace agreements, and permit requirements. Drilling fluid disposal procedures proposed for use shall be submitted to Company for approval. No procedure may be used which has not been approved by Company.

- 5.20 Horizontal Directional Drilling operation will be a closed system to eliminate the discharge of water, drilling fluids, and cuttings to areas involved in the construction process other than the entry and exit pits. Contractor shall employ his best efforts to maintain full annular circulation of drilling fluids. Drilling fluid returns at locations other than the entry and exit points shall be minimized. Contractor shall provide equipment and procedures to maximize the recirculation of drilling fluid to minimize waste. In the event annular circulation is lost, Contractor shall take steps to restore circulation. If inadvertent returns of drilling fluids occur, they shall be immediately contained with barriers (i.e., hay bales, silt fences, etc.) and/or a containment pit as necessary. Drilling fluids shall be collected using pumps or if the amount of inadvertent returns is not enough to practically pump, the affected area shall be diluted with fresh water and the drilling fluid will be allowed to dry and dissipate naturally in upland areas. If surface returns exceed what can be contained as described, drilling operations shall cease until inadvertent returns are under control.

5.20.1 Contractor shall provide equipment (graders, shovel, etc.) and materials (such as ground sheets, hay bales and/or silt fences, booms, absorbent pads, etc.). Equipment shall be maintained on site and materials stockpiled and readily available for use during clean-up, erosion control, and contingencies, as necessary.

- 5.21 The Horizontal Directional Drilling operation will be a closed system to eliminate the discharge of water, drilling fluids, and cuttings to areas involved in the construction process other than the entry and exit pits. Contractor shall employ his best efforts to maintain full annular circulation of drilling fluids. Drilling fluid

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returns at locations other than the entry and exit points shall be minimized. Contractor shall provide equipment and procedures to maximize the recirculation of drilling fluid to minimize waste. In the event annular circulation is lost, Contractor shall take steps to restore circulation. If inadvertent returns of drilling fluids occur, they shall be immediately contained with barriers (i.e., hay bales, silt fences, etc.) and/or a containment pit as necessary. Drilling fluids shall be collected using pumps or if the amount of inadvertent returns is not enough to practically pump, the affected area shall be diluted with fresh water and the drilling fluid will be allowed to dry and dissipate naturally in upland areas. If surface returns exceed what can be contained as described, drilling operations shall cease until inadvertent returns are under control.

5.21.1 Contractor shall provide equipment (graders, shovel, etc.) and materials (such as ground sheets, hay bales and/or silt fences, booms, absorbent pads, etc.). Equipment shall be maintained on site and materials stockpiled and readily available for use during clean-up, erosion control, and contingencies, as necessary.

5.22 Construction Final Report

5.22.1 Contractor shall maintain a separate set of plan and profile construction drawings on site during construction. Details will be neatly marked on these drawings on a daily basis. If changes are required which cannot be marked on the drawings, the Contractor shall prepare a neat sketch complete with dimensions and notes. At the end of the job the Record As-Built Drawing will be signed by the Contractor and turned over to the Company.

5.22.2 Within ten days of completion of all Work, Contractor shall submit six copies and one reproducible of the as-built drawing, accurately depicting the location of the directionally drilled crossing entry and exit points, a plan and profile of the pipeline in grid coordinates, and the drilling mud and water disposal records.

5.23 Backfill and Site Restoration

5.23.1 The Contractor shall ensure that all trenched and excavated areas at the entry and exit sites have been restored to the approximate original contours as required by Company and/or regulatory agencies.

5.23.2 Contractor shall remove all equipment, material (fencing, pit liners, etc.), and waste from all work areas. The general work area and all other construction areas used during construction shall be restored and graded by Contractor to their original contours.

5.23.3 Fences, gates, and utilities, which were removed or altered during construction, shall be restored or replaced by Contractor.

5.23.4 Land restoration shall satisfy Company General Conditions, landowner conditions, standards and specifications, agency approved permits, and Environmental Construction Plan (ECP).

6.0 Procedures

6.1 Instrumentation and Survey

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- 6.1.1 Contractor shall at all times provide and maintain instrumentation which will accurately locate the pilot hole, measure drill string axial and torsional loads, and measure drilling fluid discharge rate and pressure. Company will have access to these instruments and their readings at all times. A log of all recorded readings shall be kept and become a part of the "As-Built" information to be supplied by Contractor.
- 6.1.2 The path of the pilot hole shall be monitored during drilling by taking downhole survey readings at intervals not to exceed 30 feet. These readings shall be used to calculate the horizontal and vertical coordinates of the downhole probe as it progresses along the pilot hole. Recorded data and calculations from downhole surveys shall include, but not be limited to, the following items.
- A. Course Length. The distance between two downhole surveys as measured along the drilled path.
 - B. Measured Distance. The total distance of a downhole survey from the entry point as measured along the drilled path; also the summation of the course lengths
 - C. Inclination. The angle at which the downhole probe is projecting from the vertical axis at a particular downhole survey point; vertically downward corresponds to zero degrees.
 - D. Azimuth. The angle at which the downhole probe is projecting in the horizontal plane at a particular downhole survey point; magnetic north corresponds to zero degrees.
 - E. Station. The horizontal position of a downhole survey measured from an established horizontal control system.
 - F. Elevation. The vertical position of a downhole survey measured from an established vertical control system.
 - G. Right. The distance of a downhole survey from the design path reference line; positive values indicate right of the reference line while negative values indicate left of the reference line.
- 6.1.3 Additional data that shall be recorded is listed below:
- A. Bit of Probe
The distance from the drilling bit (leading edge) to the downhole probe.
 - B. Heading
The magnetic line azimuth to which the drilled path reference line corresponds.
 - C. Rig Setback
The distance from the drill bit when first placed on the drilling rig as measured from the staked entry point.
 - D. BHA Length
The length of the Bottom-Hole Assembly



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6.1.4 The Contractor shall provide the necessary HDD equipment including a wireline magnetic guidance system supplemented by the Tru-Tracker System (or Company approved equivalent as applicable for marine HDD operations) and readout instrumentation. The Contractor shall provide HDD operators experienced in the operation of the above equipment. At the beginning of the drill, the course azimuth shall be verified and adjusted as needed.

6.1.5 Contractor shall monitor the position of the drill string with precise downhole survey instruments and verified with surface location equipment, i.e., tru-tracker or equal. Contractor shall compute the position in the X, Y, and Z axis relative to ground surface from down-hole survey data a minimum of once per length of each drilling pipe (approximately 30 ft. interval). Deviations between the recorded position of the drill string and the plan and profile drawing shall be documented and immediately brought to the attention of the Company.

6.2 Pilot Drill Hole Tolerances

6.2.1 Contractor shall provide and maintain instrumentation that will accurately measure drilling fluid discharge rate and pressure. Company shall have access to instruments and their readings at all times.

6.2.2 The Pilot hole shall be drilled along the path shown on the plan and profile drawing within Company tolerances. However, right-of-way restrictions, foreign lines, utility crossings and/or structures shall take precedence over Company tolerances. Regardless of the tolerance achieved, no pilot hole will be accepted if it will result in any, or all, of the pipeline being installed in violation of right-of-way restrictions. The entry and exit points as shown on plan and profile drawings shall be located using traditional survey methods.

6.2.3 Allowance of tolerances does not relieve Contractor from responsibility for safe operations or damage to adjacent utilities and structures.

A. The elevation along the profile shall be within plus 0 feet and minus 10 feet.

B. The horizontal alignment shall be within plus or minus 10 feet as long as the pilot hole does not come to within 10 feet of the permanent right of way.

C. The pilot hole shall penetrate the ground at the Entry Point at the exact location shown on the drawings and staked by the Company in the field.

D. The pilot hole shall exit the ground surface at the Exit Point within plus or minus 15 feet of the alignment and plus 40 feet minus 0 feet of the length as shown on the drawings.

6.2.4 If the pilot hole fails to meet with the above tolerances, the deviations will be subject to approval by the Company. If the Company does not approve the deviations, the Contractor shall drill another pilot hole, at its cost.

6.2.5 No curves will be accepted with a radius less than that shown on the construction drawings, included in the Contract Documents.

6.3 Pilot Hole Final Location

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6.3.1 The Contractor shall, upon completion of the pilot hole, provide a tabulation of the coordinates. This tabulation shall be in addition to the log of recorded readings required under "Instrumentation". The coordinates shall be referenced to the drilled entry point and shall accurately describe the location of the following:

- A. Entry and exit points
- B. Drilled profile
- C. Actual entry and exit angles
- D. Actual entry and exit radii of curvature

6.4 Reaming

Once the pilot hole has been completed, the hole must be enlarged to a suitable diameter for the pipeline. The reaming is accomplished by enlarging the hole by pulling back the reamers in successively larger diameters. The Contractor shall determine the number and sizes of the reaming passes.

6.5 Lost or Stuck Tools

Any tools or other metal objects lost downhole shall be reported to the Company Representative. Metal objects shall be fully recovered prior to pipe pullback unless specifically approved otherwise by the Company Representative. Failure to recover metal objects lost downhole shall constitute just cause for rejection of the hole. Company is not responsible for the cost of lost tools downhole.

6.6 Minimum Curve Radius

6.6.1 Curves shall be drilled according to Company-provided Construction Drawings. Curves shall be drilled at a radius equal to or greater than that shown on the plan and profile drawing.

6.6.2 The horizontal deflection shall not exceed the limits of the permanent ROW as shown on plan and profile drawing; however, in all cases, right-of-way restrictions, foreign lines, and utility crossings shall take precedence over horizontal deflection tolerance. Contractor shall provide to the Company, on demand, the data generated by the down-hole survey tools in a form suitable for independent calculation of the pilot hole profile.

6.6.3 Contractor shall conduct field measurements and shall provide to Company those as-built sketches and supporting documentation required to satisfy Company that the final overbend of the pipe string will meet the tolerances of the designed overbend.

6.7 Hole Rejection and Abandonment

In the event the drilled profile fails to meet these specifications, or metal objects are lost downhole, the Company may reject the drilling attempt. Upon notice of rejection, the Contractor shall abandon the hole. The Contractor shall submit a proposed profile and corresponding HDD Calculations (or responsible for Engineering costs) for an additional drill attempt to the Company for approval. If approved, the Contractor shall complete the crossing accordingly. No additional compensation shall be paid for failed attempts.

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6.8 Pipe Fabrication

6.8.1 The pipe string shall be fabricated in the workspace in one continuous section unless otherwise specified on a site-specific basis. Fabrication shall follow all specified Company welding and construction standards.

6.8.2 The completed prefabricated pipe section will be subject to a 4-hr preliminary hydrostatic test at a test pressure determined by the Engineer.

6.9 Pre-Reaming

Contractor shall conduct pre-reaming operations to insure that a hole sufficient to accommodate the pull section has been produced. The hole shall be pre-reamed to the minimum of: 150 percent of the outside diameter of the pull section, or twelve inches plus the outside diameter of the pull section. Any damage to the pipe resulting from inadequate pre-reaming shall be the responsibility of Contractor.

6.10 Pullback

6.10.1 Prior to pull back, the HDD Contractor shall submit the actual drilled profile to the Company for approval. Contractor shall conduct field measurements and shall provide to Company those as-built sketches and supporting documentation required to satisfy Company that the final overbend of the pipe string will meet design tolerances.

6.10.2 The pullback section shall be installed in one continuous string with no tie-in welds unless stated otherwise in the Company approved drilling plan. Once pullback operations have begun, the Contractor shall work continuously until the pipeline has been successfully installed.

6.11 Pulling Loads

6.11.1 The maximum allowable tensile load imposed on the pull section shall be equal to 85 percent of the product of the specified minimum yield strength of the pipe and the area of the pipe section. If more than one value is involved for a given pull section, the lesser shall govern.

6.11.2 Contractor shall provide and maintain instrumentation, which will accurately measure drill string axial and torsional loads. Company shall have access to instruments and their readings at all times.

6.12 Pull Section Support

The pull section shall be supported as it proceeds during pull back so that it moves freely and the pipe and corrosion coating are not damaged. During the pullback operation, Contractor shall monitor roller operation and use side booms if required to assist movement of the pipe. Situations that cause coating damage shall be corrected immediately. Contractor shall repair coating damage to Company Coating Specifications before pulling operations resume.

6.13 Torsional Stress

A swivel shall be used to connect the pull section to the reaming assembly to minimize torsional stress imposed on the section. The swivel will be load tested prior to mobilization to site. The load test will be witnessed and documented by Company representative.

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6.14 External Collapse Pressure

As applicable particularly for HDPE pipelines, the pull section shall be installed in the reamed hole in such a manner that external pressures are minimized and an appropriate counter balancing internal pressure is maintained. Any damage to the pipe resulting from external pressure during installation is the responsibility of the Contractor.

6.15 Caliper Pig/Sizing Plate

If required by Company, the completed crossing will be inspected with a caliper pig or a sizing plate to determine if any dents, buckles or ovalities are present. Any dents, buckles, or ovalities found that do not meet the criteria of the Company, must be rectified to the satisfaction of the Company Representative.

6.16 Quality Testing

The contractor shall test all welds by radiographic methods, conduct a hydrostatic test of the fabricated carrier pipe sections and inspect the coating for damage, using an electric holiday detector, prior to their placement in the drilled crossing.

7.0 Equipment and Materials

7.1 Drilling Rig

The directional drilling rig shall consist of a hydraulically powered system to rotate, push and pull hollow drill pipe into the ground at a specified angle while delivering a pressurized fluid mixture to a guidable drill/bore head. The machine shall be anchored to the ground to withstand the pulling, pushing and rotating pressure required to complete the crossing. The hydraulic power system shall be self-contained with sufficient pressure and volume to power the drilling operations. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pullback pressure during pullback operations.

7.2 Steering System

Wherever possible the drilling contractor shall provide and use a separate steering system employing a ground survey grid system, such as "TRU TRACKER" or equivalent wherever possible.

7.3 Pipe

7.3.1 Drill pipe shall be API steel drill pipe, Range 2, Premium Class or higher, Grade S-135 in a diameter sufficient for the torque and longitudinal loads and fluid capacities required for the work. Only drill pipe inspected under API's Recommended Practice Specification API RP 7G within 30 days prior to start and certified as double white band or better shall be used.

7.3.2 Carrier pipe specifications to be determined by Sunoco Pipeline L.P. Engineering.

7.4 Bentonite

Technical criteria for bentonite shall be as given in API Spec. 13A, "Specification for Oil Well Drilling Fluids Material", for fresh water drilling fluids. Any modification to the basic drilling fluid involving additives must be indicated in contractor's Drilling Plan, and a description must give of the type of material to be used.

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8.0 Industry Standards

- 8.1 American Petroleum Institute
 - Recommended Practice 7G Drill Stem Design Operating Limits
 - Recommended Practice 1102 Steel Pipelines Crossing Railroads and Highways
 - Recommended Practice 1109 Marking Liquid Petroleum Pipeline Facilities
 - Standard 1104 Welding of Pipelines and Related Facilities
- 8.2 American Railroad Engineers Association
 - Manual for Railway Engineering –Part 5 – Pipelines
- 8.3 American Society of Civil Engineers
 - ASCE MREP 89 Pipeline Crossings
- 8.4 American Society of Mechanical Engineers
 - ASME B31.4
 - ASME B31.8
- 8.5 American Society for Testing and Material Standards
 - Special Compilations: Standards Related to Trenchless Technology
- 8.6 International Standards Organization
 - ISO 13500 Drilling Fluid Materials – Specifications and Tests

End of Specification**9.0 Revision Log**

Revision No.	Revision Date	Document Authorizer	Document Reviewer	Document Author	Document Administrator	Revision Details
1	10/18/2006	Lindy Barile	Russ Todd	Russ Todd	NA	General updates and formatting.
2	09/03/2013	Lindy Barile	REI		NA	Added protection of underground facilities, plans and procedures HDD contractor responsibility, environmental, directional drilling requirements, pipe pull back and installation, final report.

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1.0 Introduction

Purpose

The purpose of this specification is to provide the requirements for the installation of pipe crossing under a roadway, railroad, or waterway. The methods used to accomplish such crossing shall be; open trench, slick bore, casing, auger boring, or directional drilling method of installation as shown on the appropriate project Engineering plans.

Scope

- 1.1.1 The specification applies to welded steel pipelines.
- 1.1.2 The specification must be utilized in conjunction with Federal, State, and Local government permitting requirements.
- 1.1.3 Railroad specifications or requirements must be fulfilled and approval obtained prior to installation.
- 1.1.4 The specification does not apply to the requirements to open trench waterways or address the environmental requirements of such crossings.
- 1.1.5 All crossings shall be as near perpendicular as possible and in no case should be less than 30 degrees.

2.0 References

Industry Practices

- 2.1.1 American Petroleum Institute, API 1102, Steel Pipeline Crossings Railroads and Highways
- 2.1.2 American Petroleum Institute, API 1104, Welding of Pipelines and Related Facilities

Codes, Standards, and Regulations

- 2.1.3 Code of Federal Regulations, Title 49, Transportation of Hazardous Liquid by Pipeline, Part 195.
- 2.1.4 Code of Federal Regulations, Title 49, Transportation of Natural or Other Gas by Pipeline, Part 192.
- 2.1.5 American Society of Mechanical Engineers, ASME B31.4,
- 2.1.6 American Society of Mechanical Engineers, ASME B31.8
- 2.1.7 Sunoco Logistics, LP, Construction Specification 0305 – Foreign Lines
- 2.1.8 Sunoco Logistics, LP, Construction Specification 0308 – Pipe Padding and Backfill
- 2.1.9 Sunoco Logistics, LP, Construction Specification 0502 – Underground Pipe Installation



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- 2.1.10 Sunoco Logistics, LP, Construction Specification 0315 – Horizontal Boring
- 2.1.11 Sunoco Logistics, LP, Construction Specification 0316 – Directionally Controlled Horizontal Drilling
- 2.1.12 Pipeline Toolbox 2006 Liquid Service – Horizontal Directional Drilling (HDD) Calculations
- 2.1.13 Pipeline Toolbox 2006 Liquid Service – Liquid Pipeline Crossing Railroad or Highway.

3.0 General – Requirements/Procedures

Permits

- 3.1.1 The Company shall procure easement permit for the railroad, roadway, or waterway crossing.
- 3.1.2 The method of installation shall be documented on the permit application and approved by the appropriate agency granting authority to conduct the crossing.
- 3.1.3 If required by the railroad, or other agency, the Contractor shall procure a separate construction permit prior to commencing any work on the crossings.
- 3.1.4 The Contractor shall perform no work on the right-of-way without the approval of the Owner's Representative
- 3.1.5 The Contractor shall notify both the Railroad and the Owner's Representative at least 14 days prior to beginning any work on the crossings.
- 3.1.6 The Contractor shall notify applicable agencies prior to beginning Roadway or Waterway crossings as set forth in the permit.
- 3.1.7 The Contractor shall be familiar with the requirements and restrictions of the easement and the permit and shall conduct the work in strict accordance with these requirements and restrictions.

Cover

- 3.1.8 The Contractor is required to assure the minimum cover from the top of the pipe to the surface meets the depths on the construction plans or by the governing regulatory body, whichever is greater.
- 3.1.9 Waterway Crossings and Other Locations

Depth of cover shall meet the requirements as provided in the Code of Federal Regulations, Department of Transportation, Parts 192 or Part 195 as applicable or greater as shown on the construction plans.

4.0 Materials

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Casings

- 4.1.1 Casing material shall be determined by Sunoco Logistics, LP Engineering and specified on the design drawings.
- 4.1.2 Material shall be obtained by the appropriate party as noted on the construction plans.
- 4.1.3 Contractor is required to weld the casing pipe sections into a continuous length.
- 4.1.4 Contractor is to assure that the casing pipe seams are staggered from joint to joint.
- 4.1.5 Contractor shall assure that the casing ends are aligned to minimize high/low prior to welding.
- 4.1.6 Welding shall be performed in accordance with the Owner's Welding Specifications.
- 4.1.7 Casing butt welds shall pass visual inspection as performed by the Company's Representative, non-destructive testing is NOT required.

Pipe

- 4.1.8 Carrier pipe material shall be determined by Sunoco Logistics, LP Engineering and to be installed per the Construction plans. The carrier pipe must meet the pressure requirements of the system in which it is to be installed. The Contractor shall not substitute material without prior approval from the Company Engineering Department.
- 4.1.9 The Contractor shall adhere to the Construction Specification - Underground Pipe Installation 0502, to assure the inspection, protection, and repair of the pipe and coating.

5.0 Execution**Horizontal Boring**

- 5.1.1 Horizontal Auger or Slick Boring installations shall adhere to the requirements of Construction Specification 0315. The below is a brief synopsis of the installation.
- 5.1.2 The auger boring shall proceed from a pit constructed for the boring equipment and workmen.
- 5.1.3 Excavation for pits and installation of shoring shall be performed in accordance with to the Construction Specification - Excavation 0303, and any additional Railroad requirements.
- 5.1.4 The location of the pits shall meet the approval of the Owner's Representative.
- 5.1.5 The hole is to be bored mechanically with or without a pilot hole. The pilot hole shall serve as the centerline of the larger hole to be bored and shall be checked for line and grade prior to commencing the larger diameter boring.
- 5.1.6 Jetting and the use of water or other fluids will not be permitted.

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- 5.1.7 Over-cutting in excess of one inch shall be remedied by pressure grounding the entire length of the casing installation

Directional Controlled Horizontal Drilling

Directional Controlled Horizontal Drilling installations shall adhere to the requirements of Construction Specification 0316.

Pipe Installation – Casing

- 5.1.8 The Contractor shall install the carrier pipe within the casing as shown on the design drawings
- 5.1.9 The carrier pipe shall be installed without any electrical contact to the casing.
- 5.1.10 The carrier pipe is to be properly coated and installed within the casing pipe.
- 5.1.11 The carrier pipe is to be fitted with PSI model "PE" Thinsulators as detailed on the design drawings. The Contractor shall furnish and place one layer of Tapecoat 40 mil polyethylene tape around the circumference of the carrier pipe under each Thinsulator.
- 5.1.12 Steel split sleeves with fiberglass shields shall be installed at the casing ends in accordance with the design drawings. The Contractor shall supply and seal the ends of the split sleeves with Denso Systems M-1 and waterproof materials.
- 5.1.13 Following the installation of the cased crossing, the Owner will install 4-wire test stations on each end of both the casing and carrier pipes. The Owner's Representative shall measure the electrical resistance between the casing and carrier pipe to determine if there is any electrical contact between the pipes. If there is any electrical contact, the Contractor shall remove the pipe from the casing, remove the contact, repair any damaged coating and reinstall the coated pipe.
- 5.1.14 Each end of the casing pipe shall be sealed in accordance with the design drawings. The annulus between the casing and carrier pipes shall be left in a dry condition. Any water found in this space shall be removed by air pressure or other means.
- 5.1.15 The carrier pipe outside of the casing shall be properly supported with sandbags of a 4:1 sand - cement mixture. The carrier pipe shall be supported at each eight foot interval, 4 sacks wide to the top of the pipe, from the end of the casing to the point where the carrier pipe rests firmly in the bottom of the ditch.

End of Specification

6.0 Revision Log



Sunoco Logistics

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Revision No.	Revision Date	Document Authorizer	Document Reviewer	Document Author	Document Administrator	Revision Details
1	10/30/2006			R. Todd	NA	
2	09/04/2013	L. Barile	REI		NA	Added CFR Title 49, Part 192 and 195 and Revision Log

**Subject:****Line Marker Installation**

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1.0 Introduction**1.1 Purpose**

The purpose of this Specification is to assure that pipelines owned, operated, or maintained by Sunoco Logistics, L.P are marked in accordance to industry requirements and guidelines.

1.2 Scope

1.2.1 This specification covers the requirements for materials, labor, supervision, and installation of pipeline location and information markers within the jurisdiction of Sunoco Logistics, L.P.'s Rights-of-Way.

1.2.2 Sunoco Logistics, L.P. or approved Contractor will generally be responsible for the installation of pipeline markers.

1.2.3 This specification is not applicable to pipelines located offshore.

1.2.4 Any deviation from this specification must be authorized and approved in advance by Engineering.

2.0 References**2.1 Industry Codes and Standards**

2.1.1 Commonwealth of Pennsylvania Department of Transportation, Design Manual Part 5 - Utility Relocation, Chapter 7, Section 7.11.C.3.

2.1.2 New York State Department of Transportation, Requirements for the Design and Construction of Underground Utility Installations Within the State Highway Right-Of-Way.

2.1.3 Michigan Gas Safety Code, Part 15, Rule 707 - Line markers for mains and transmission lines.

2.1.4 Marking Liquid Petroleum Pipeline Facilities, API 1109, Latest Edition.

2.2 Government Regulations

2.2.1 Code of Federal Regulations, Title 49, Transportation of Hazardous Liquid by Pipeline.

2.2.2 Code of Federal Regulations, Title 49, Transportation of Natural or Other Gas by Pipeline.

3.0 Definitions**3.1 Aerial Patrol or Air Patrol Marker**

A line marker used to identify a pipeline's reference location, usually a mile number, by the air patrol pilot while conducting aerial surveillance of a pipeline right-of-way.

3.2 Line Marker or Pipeline Marker

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A device used to identify the presence of a pipeline facility. This device contains certain information and employs a method of presenting information as required in the Government Regulations.

3.3 Other Markers

Any type of device used to identify the presence of a pipeline facility solely for the benefit of a pipeline operator, examples are included below.

4.0 General – Requirements/Procedures

4.1 Pipeline Marker Locations

- 4.1.1 Pipeline markers shall be located at both sides of each public road crossing, at both sides of each railroad crossing, and on each side of water crossings.
- 4.1.2 Pipeline markers shall be placed at locations where the pipeline is above ground or in other critical areas that are accessible to the public.
- 4.1.3 Pipeline markers shall be installed on both sides of a pipe span.
- 4.1.4 Pipeline markers should be placed at fence lines, property lines, and right of way boundaries.
- 4.1.5 Pipeline markers should be placed directly above the pipeline or as close as possible in order to accurately identify the location of the pipeline.
- 4.1.6 Pipeline markers shall be placed such that at any given point along the pipeline corridor such that the pipeline's location is accurately known and markers are clearly visible in both directions "line of sight", except as indicated in 4.1.7.
- 4.1.7 Pipeline markers are not required:
 - A. For Liquid Transmission pipelines located in heavily developed urban areas where local governing jurisdictions maintain current substructure records AND marking is impractical or would not serve the purpose intended.
 - B. For Gas Transmission pipelines in Class 3 or 4 locations where placement of a line marker is impractical.
 - C. For Gas Transmission pipelines located offshore, or at crossings of or under waterways and other bodies of water.
- 4.1.8 Other markings and signs, such as; road or curb painting, flush mounted identification markers, aerial markers, test stations, casing vents, buried tape or warning mesh, can be utilized in addition to the requirements above and serve as further aids in determining the location of the pipeline.

4.2 Pipeline Marker Information

- 4.2.1 Pipeline markers shall indicate the name, and telephone number (including area code) where the Operator of the pipeline can be contacted at all times.

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- 4.2.2 Pipeline markers shall contain a background of sharply contrasting colors and must be lettered at least one inch in height with an approximate stroke of one quarter inch.
- 4.2.3 Pipeline markers shall include the word "Petroleum Pipeline" or indicate the name of the hazardous liquid substance transported and include the word "Warning", "Caution" or "Danger".
- 4.2.4 Pipeline markers placed at navigable waterway crossings require, in addition to the wording in 4.2.3, the words "Do Not Dredge or Anchor" with a minimum text height of 12" with a 1-3/4" stroke.
- 4.2.5 Pipeline markers shall be constructed of durable and weather-proof material, including metal, plastic, fiberglass (carsonite), or concrete are acceptable
 - A. Metal post should be straight, sound and have a minimal diameter of 2", metal structures designed for use as post may be used.
 - B. Wood, pressure treated; straight post of 8" diameter or larger may be used, except in areas where brush and grass fires are expected.
 - C. Concrete, reinforced precast square post 4" x 4" minimum may be used, however consideration should be given to concrete spalling during freeze and thaw cycles.
- 4.2.6 Polyvinyl chloride (PVC), Polyethylene, and fiberglass may be used, however the selection must consider the resistance to ultraviolet exposure and suited for the environment where installed.
- 4.2.7 Other materials are acceptable provided the meet the guidelines established above.
- 4.2.8 For pipeline installations within the New York State Highway Right-of-Way, the maximum operating pressure in the pipeline and the depth below grade at the point of the marker location shall also be included on the marker.

4.3 Pipeline Marker Installation

- 4.3.1 When possible the signage portion of the marker should be attached to a fence, fence post, vent pipe, or other existing post to reduce the overall clutter at a site.
- 4.3.2 The buried portion of the marker should take into account the following factors to assure that the marker is sufficiently stable:
 - A. Post material, including size, shape, weight, and height of the marker assembly.
 - B. Type of soil
 - C. Depth of frost line
 - D. Exposure susceptibility to external forces such as wind, high water, livestock, wildlife, and or tidal currents.
 - E. Depth of pipeline to be marked
- 4.3.3 The bottom of the post may be modified or fitted with transverse member to inhibit unauthorized removal.

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Line Marker Installation

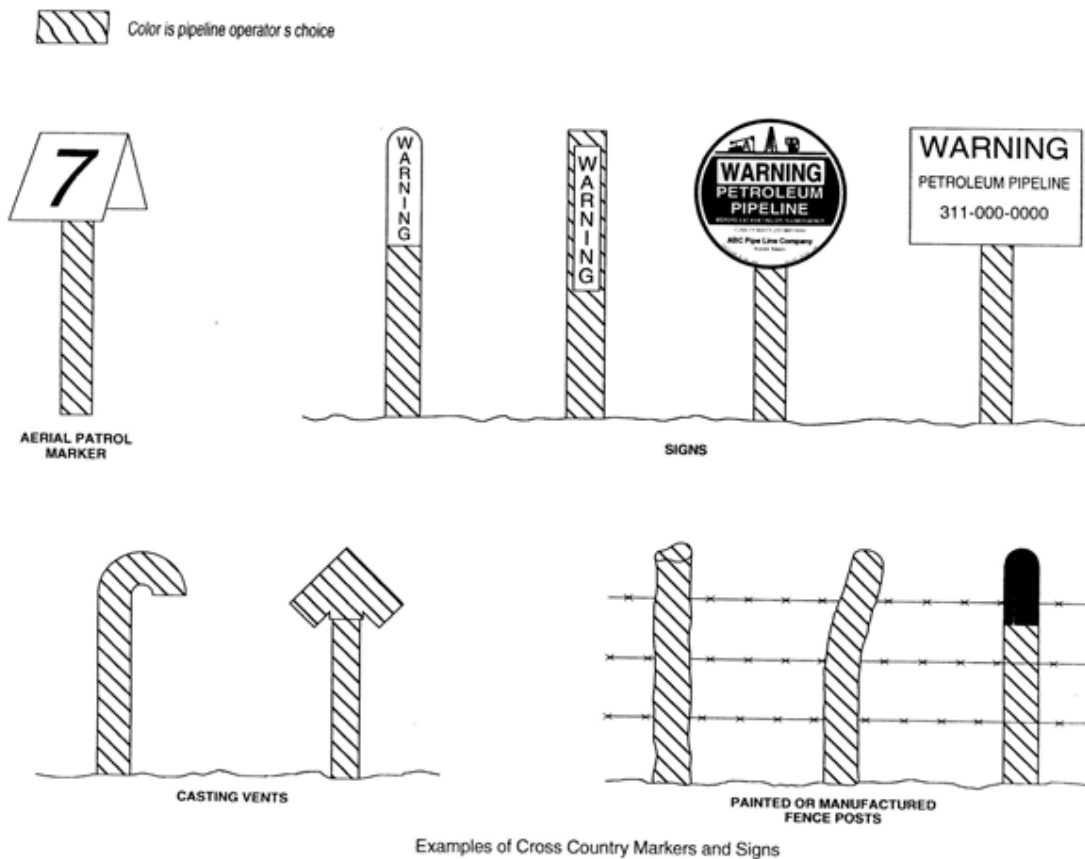
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4.3.4 Post holes shall be backfilled with compacted soil or concrete.

4.3.5 The aboveground portion should extend sufficiently above ground level to assure the marker remains visible above normal vegetation growth and snow accumulation depths. A minimum height of 4 feet is recommended.

5.0 Drawings

5.1 Typical Cross Country Markers and Signs





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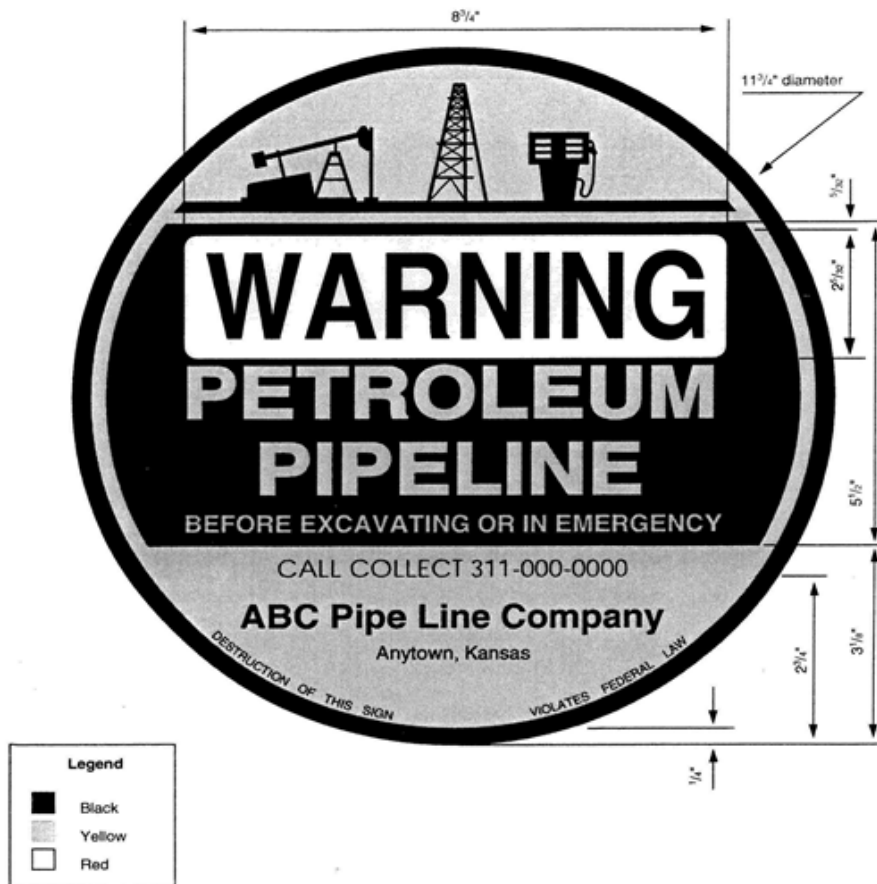
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5.2 Line Marker (Round)

API RECOMMENDED PRACTICE 1109



Notes:

1. Recommended color samples of the red and yellow to be used on this sign are available on loan from the American Petroleum Institute's Manufacturing, Distribution and Marketing Department.
2. Minor variations in letter style are acceptable provided that the minimum letter size and stroke width recommendations
3. Sign to have 4 9/32 in. holes on 11 in. b.c. at vertical and horizontal centerlines.

Line Marker



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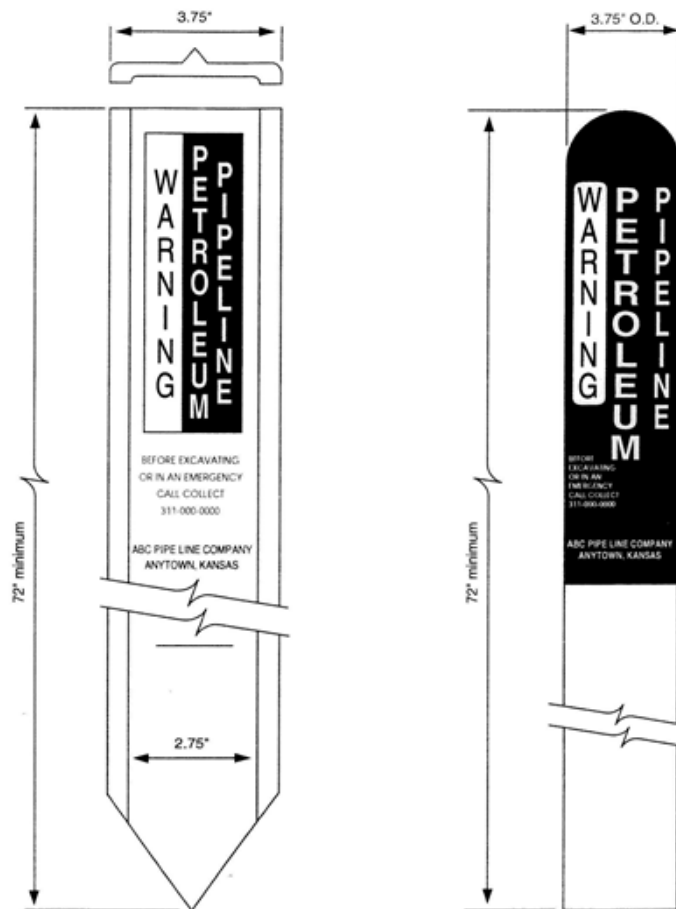
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5.3 Line Marker (Carsonite)

MARKING LIQUID PETROLEUM PIPELINE FACILITIES



Line Markers

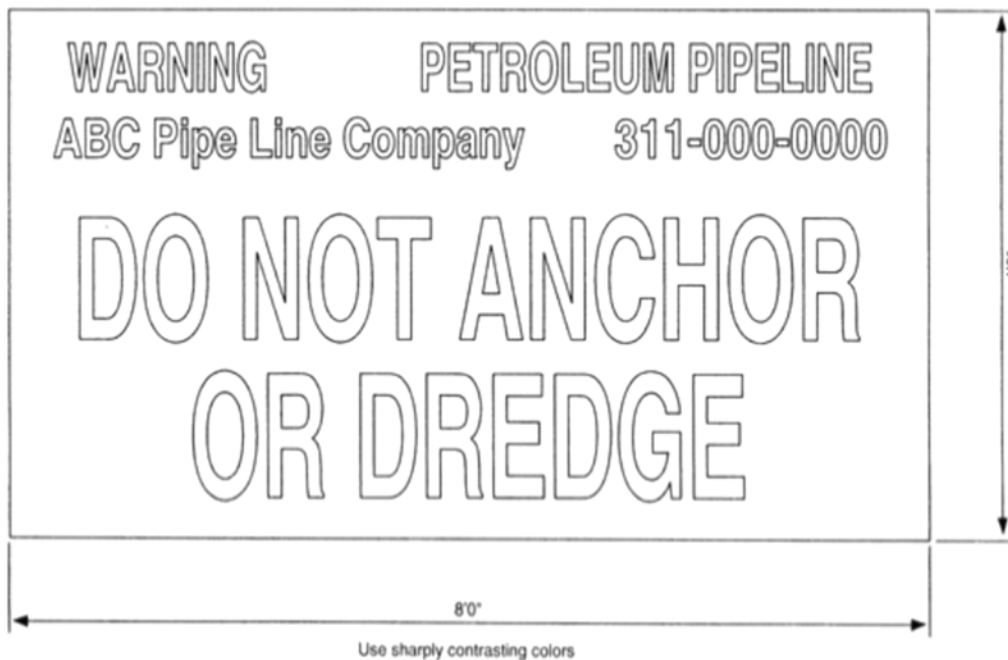


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Line Marker Installation

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Approved: Lindy Barile	Date: 9/5/13	Replaces: 0318 Rev. 1		

5.4 Pipeline Sign for Navigable Waterways



API RECOMMENDED PRACTICE 1109

Pipeline Sign for Navigable Waterways

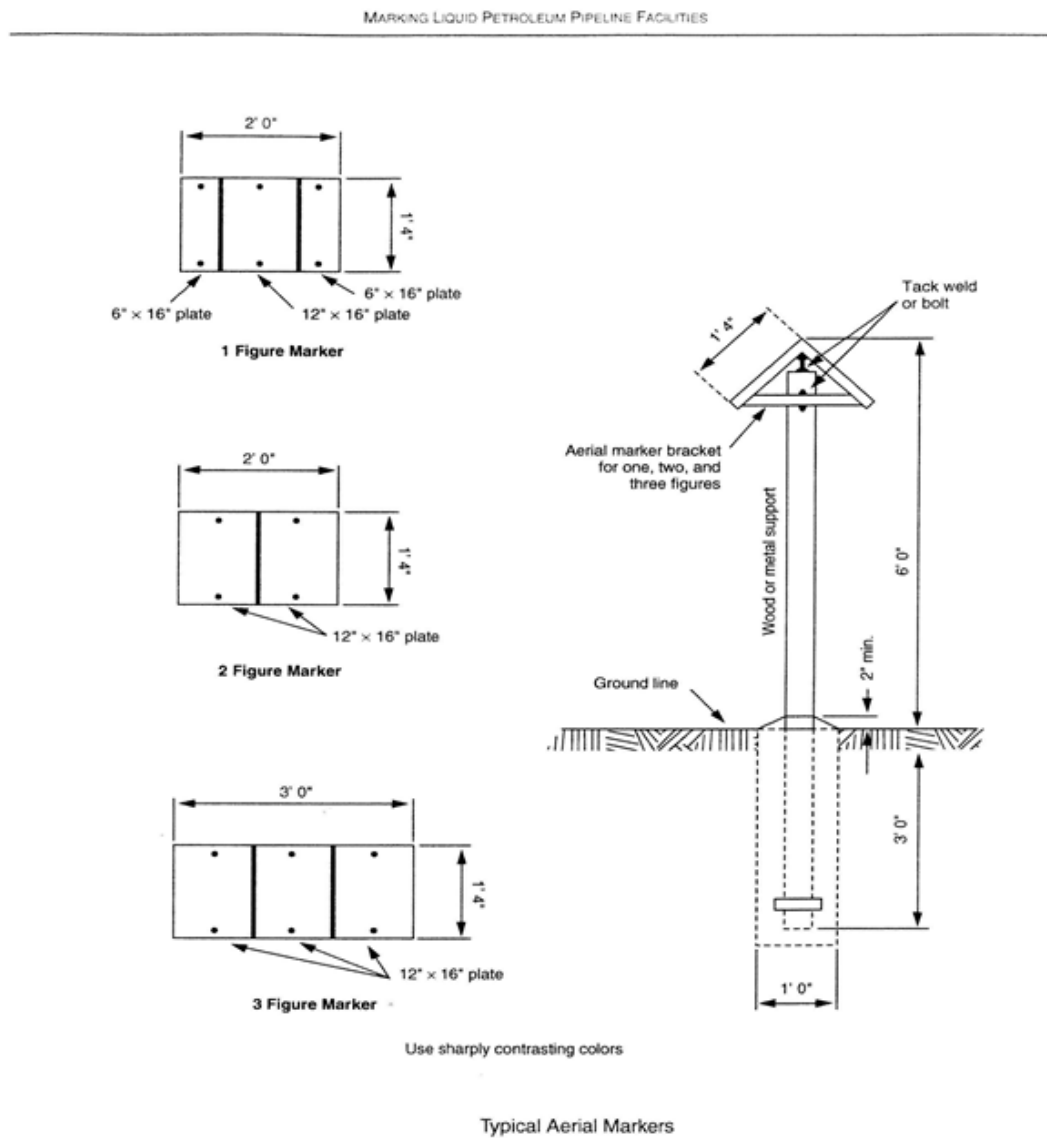


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5.5 Typical Ariel Markers



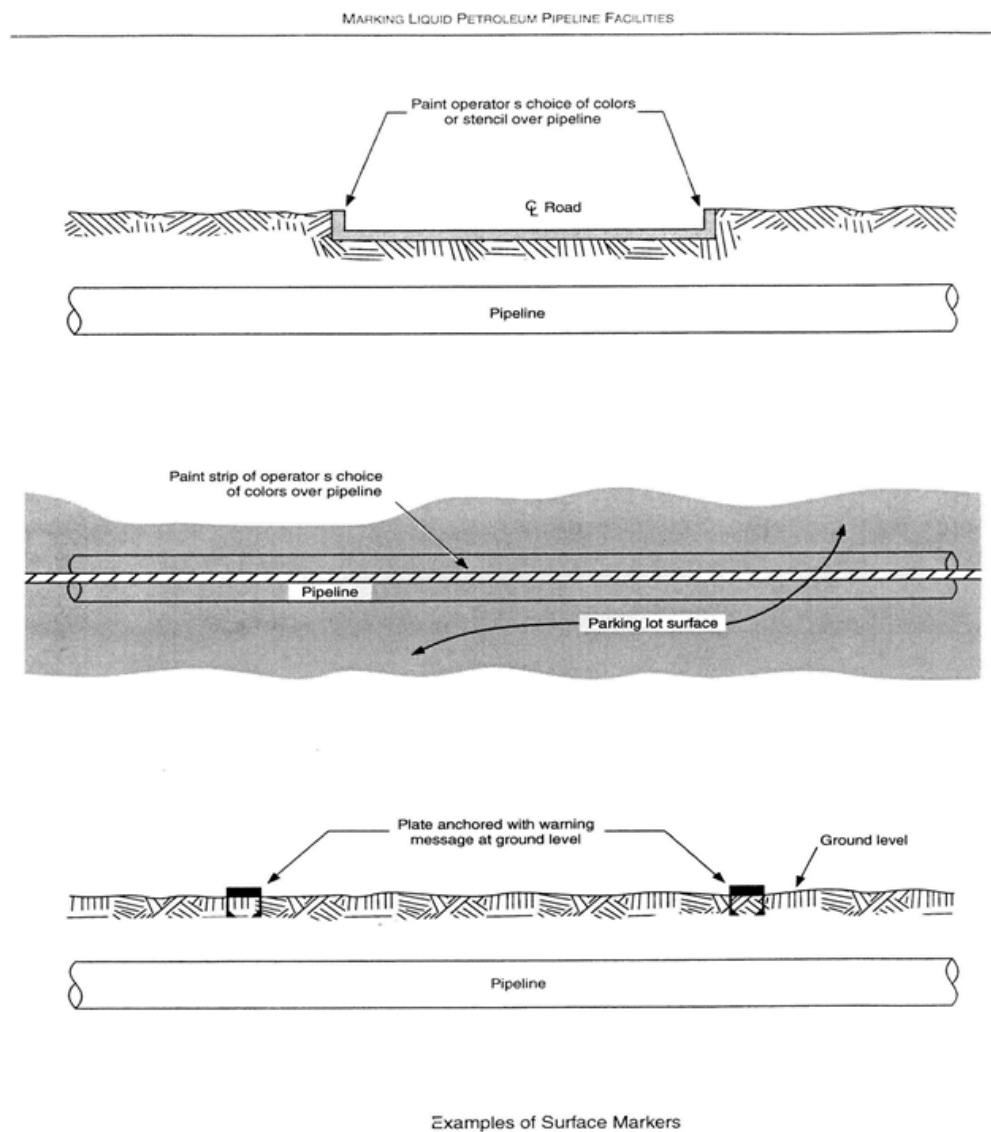


Subject:

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5.6 Example of Surface Markers



End of Specification



Sunoco Logistics

Sunoco Pipeline L.P. and Affiliates CONSTRUCTION STANDARDS

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6.0 Revision Log

Revision No.	Revision Date	Document Authorizer	Document Reviewer	Document Author	Document Administrator	Revision Details
1	06/23/2006	Lindy Barile		Russel Todd	NA	
2	09/05/2013	Lindy Barile	REI		NA	General updates

**Subject:****Blasting Specification****Prepared By:**
Charles E. Kehs [REI]**Revision:**
2**Page:**
1 of 5**Code:****Number:**
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0321 Rev. 1**TABLE OF CONTENTS**

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2 of 5**Code:****Number:**
0321**Approved:**
Lindy Barile**Date:**
9/20/13**Replaces:**
0321 Rev. 1**1.0 Introduction****1.1 Purpose**

The purpose of this procedure is to assure that blasting activities by outside parties do not adversely affect the pipeline/s owned, operated or maintained by Sunoco Pipeline L.P.

1.2 Scope

1.2.1 This procedure covers the requirements for blasting activities within 300 feet of pipeline/s owned, operated or maintained by Sunoco Pipeline L.P.

1.2.2 Approved contractors will be responsible for monitoring seismic activity during blasting operations.

2.0 References**2.1 Practices**

2.1.1 Sunoco Pipeline L.P., General Engineering Restrictions for Construction Near Pipeline Right of Way

2.2 Industry Codes and Standards

2.2.1 U.S. Bureau of Mines Report of Investigations 8507 – Structure Response and Damage Produced by Ground Vibration From surface Mine Blasting.

2.2.2 U.S. Bureau of Mines Report of Investigations 9523 – Surface Mine Blasting Near Pressurized Transmission Pipelines

2.3 Government Regulations

2.3.1 DOT Part 195 Transportation of Hazardous Liquids by Pipeline

2.3.2 Pennsylvania Bulletin – 25 Chapters 210, & 211

2.3.3 New Jersey – N.J.S.A. 21:1A-128 et. seq. Explosives and Fireworks

3.0 Definitions**3.1 Blast**

The detonation of explosives to break rock.

3.2 Blaster

3.3 A qualified person in charge of a blast. Also, a person (blaster-in-charge) who has passed a test, approved by OSM, which certifies his or her qualifications to supervise blasting activities.

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3.4 Blast Initiation Procedure

A procedure for the detonation of a high explosive by means of a cap, a mechanical device, or other means.

3.5 Burden

The distance from an explosive charge to the nearest free or open face. Technically, there may be an apparent burden and a true burden, the latter being measured in the direction in which displacement of broken rock will occur following firing of the explosive charge. Also, the amount of material to be blasted by a given hole, given in tons or cubic yards.

3.6 Delay Basting

The practice of initiating individual explosive charges/decks, boreholes or rows of boreholes at predetermined time intervals using delay detonators, as compared to instantaneous blasting where all holes are fired simultaneously. There are basically two intervals millisecond and long period (delay times on the order of seconds).

3.7 ISSE

International Society of Explosives Engineers.

3.8 OSM

Office of Surface Mining

3.9 Particle Velocity

A measure of ground vibration. Describes the velocity at which a particle of ground vibrates when excited by a seismic wave.

3.10 Seismograph

An instrument designed to measure and record the intensity, peak particle velocities, frequencies, direction and duration of vibrations in the ground.

3.11 USBM RI-8507: United States Bureau of Mines Report of Investigations

8507, blasting criteria based on studies of blast produced ground vibrations and their effects on surrounding structures. Determined safe levels and appropriate measurement techniques.

3.12 USBM RI-9523: United States Bureau of Mines Report of Investigations

9523, Surface Mine Blasting Near Pressurized Transmission Pipelines.

4.0 General – Requirements

- 4.1** Any outside party contemplating blasting operations within 300 feet of Sunoco Pipeline L.P. (SPLP) 's owned, operated or maintained pipeline/s shall submit a plan to SPLP's representative for approval by SPLP's Engineering Department. This plan must include size of holes, depth, distance to the pipeline/s, spacing, burden, soil types and amounts of explosives on any one delay period, depth of blast area, and depth of overburden, if any.



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- 4.2 The blasting operations must be conducted using a drilling pattern and blast initiation procedure that will provide the greatest relief possible in a direction away from the pipeline/s, as to keep the resulting vibration and actual ground movement to the lowest possible level.
- 4.2.1 If the outside party anticipates using explosives within 200 feet of SPLP's pipeline/s, test blasts, monitored by a seismograph placed over the pipeline/s measuring and recording the intensity, peak particle velocities, frequencies, direction and duration of vibrations in the ground must be conducted.
- 4.2.2 An SPLP representative must be on site to witness the test blast and all subsequent blasting within 300 feet of the pipeline/s. A reproducible file or print out of the results must be provided to SPLP's on site representative.
- 4.2.3 A maximum of one pound per delay charge shall be used during the initial test blast.
- 4.3 Subsequent test blasts may be made if the seismograph readings indicate the blasting can be safely conducted. The peak particle velocity of any one component of the three-component seismograph reading must not exceed the criteria established by USBM RI-8507 for safe levels of blasting vibration for houses using a combination of velocity and displacement as shown in Appendix B - Blasting Requirements Chart, USBM RI8507 rev 2.
- 4.4 Routine blasting may continue after test blasts, with the allowable charge per delay based on the seismograph vibration recordings of the blasts. All blasting shall be continuously monitored by a seismograph placed over the pipeline/s to ensure the recorded peak particle velocity components do not exceed the criteria established by USBM RI 8507 for safe levels of blasting vibration for houses using a combination of velocity and displacement as shown in Appendix B - Blasting Requirements Chart, USBM RI8507 rev 2.
- 4.5 Seismographs should conform to the Performance Specifications for Blasting Seismographs as developed by the Society of Explosives Engineers. Readings over the pipeline/s are to be recorded and the results submitted to the SPLP's Representative.
- 4.6 No blasting shall be conducted closer than 50 feet to SPLP's pipeline/s unless a consulting firm that specializes in underground blasting is hired to provide calculations showing anticipated impact loads on the pipeline/s, conduct the seismograph survey, and certify the results.
- 4.7 Firms which conduct the seismographic surveys shall be approved by the Owner's Engineering Department prior to the commencement of any blasting operations.
- 4.8 Blasting to comply with all Federal, State and Local codes, regulations and requirements.
- 4.9 A copy of all Federal, State and Local permits to be submitted with the blasting plan.

5.0 Procedures

- 5.1 Prior to blasting activities SPLP Engineering or designee will prepare a blasting folder and input blast data into PipeBLAST© (see Appendix B for the appropriate percentage of SMYS) to determine if the blasting plan is acceptable for specific pipelines listed.
- 5.2 Communicate the results to the appropriate Company Representative.

Subject:

Blasting Specification

Prepared By: Charles E. Kehs [REI]	Revision: 2	Page: 5 of 5	Code:	Number: 0321
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- 5.3 If approved by SPLP Engineering and prior to blasting activities beginning, the onsite SPLP representative shall call the control center and indicate blasting is about to take place, identify which pipeline segment/s will be affected and an approximate station number.
- 5.4 Control center will monitor the pipeline/s until the SPLP field representative advises the blasting operations are finished and the pipeline/s has/have not been affected.
- 5.5 The SPLP field representative will obtain a copy or reproducible file of the seismic readings for each blast, to be forwarded to SPLP's Operations department once blasting operations are complete.
- 5.6 If the seismic readings are above the safe limits for blasting vibrations as shown on Appendix B, stop all blasting operations. Call the control center, who will monitor the affected pipeline/s and have Engineering review the seismograph readings and perform a leak survey if required.
- 5.7 If the seismic readings are off the high end/top of the chart of blasting vibrations as shown on Appendix B, stop all blasting operations. Call the control center, who will shut down the pipeline/s and have Engineering review the seismograph readings immediately. Perform a leak survey immediately.
- 5.8 The SPLP field representative must perform a leak survey of the affected area each day, document results and inform control center that blasting is complete.
- 5.9 Engineering or designee will complete blasting folder checklist, assemble documentation and file.

6.0 Appendixes

- 6.1 Blasting Specification 321, Appendix A – Blasting Limits, Pipeline SMYS
- 6.2 Blasting Specification 321, Appendix B – Blasting Requirements Chart, USBM RI8507
- 6.3 Blasting Specification 321, Appendix C – Performance Specifications for Blasting Seismographs
- 6.4 Blasting Specification 321, Appendix D – Blasting Folder Checklist

End of Specification

7.0 Revision Log

Revision No.	Revision Date	Document Authorizer	Document Reviewer	Document Author	Document Administrator	Revision Details
1	06/09/2006			C. Kehs	NA	
2	09/20/2013	Lindy Barile	REI		NA	General Updates

Appendix – A

Blasting Limits Pipeline SMYS

Blasting Specification 0321

When blasting operations are to be performed within three hundred (300) feet of the following pipeline segments, use fifty (50) percent of SMYS when inputting data into PipeBlast®.

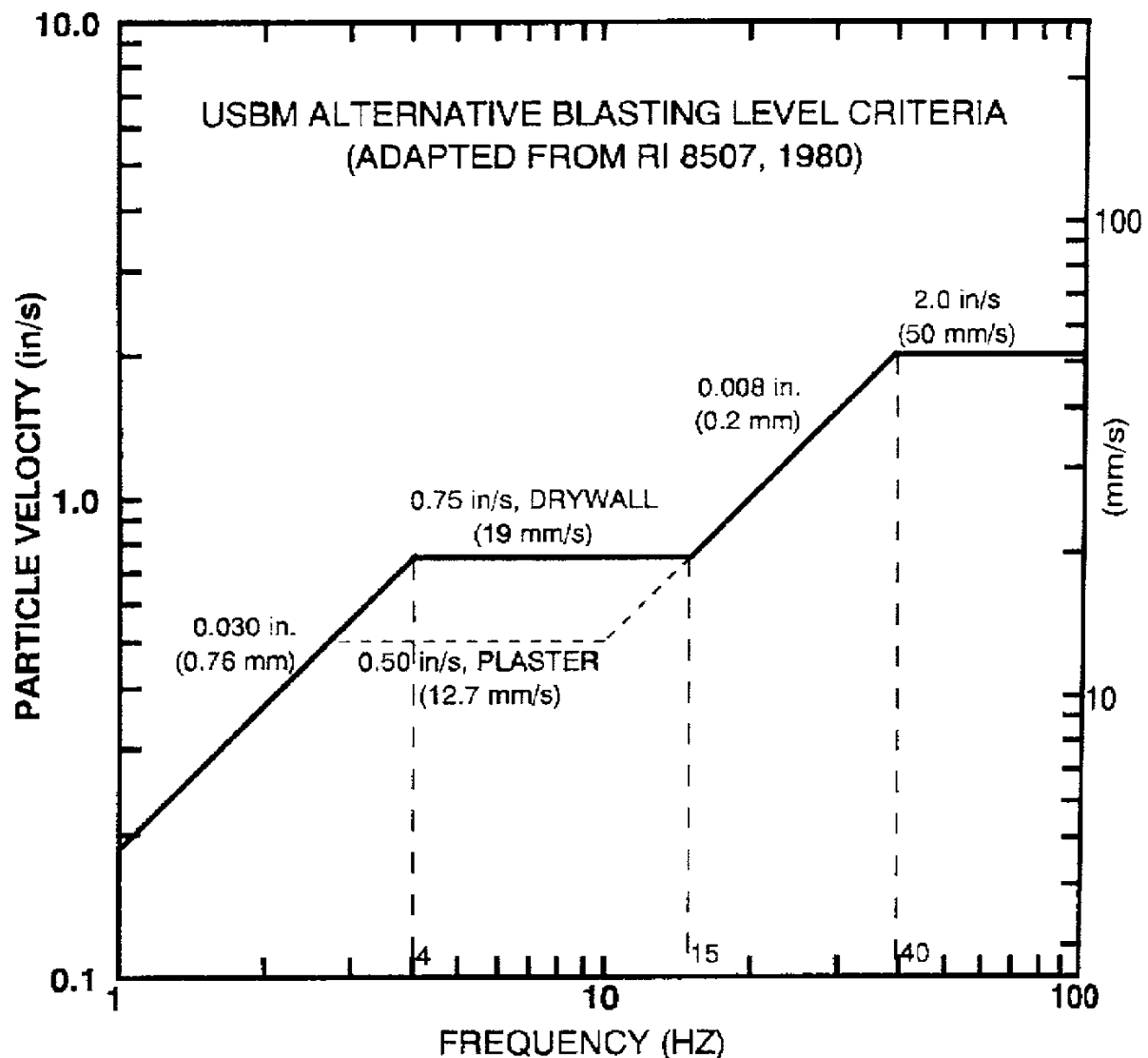
Pipe ID	Official Name	Description (names from various lists)
11000	PTBR-MNTL-8	8" Point Breeze-Montello
11003	TWIN-ICED-8A	8" Malevrn to Icedale Section ONLY
11008	MHRF-PH4T-4	4"/6" 4N
12008	MNTL-BEJT-8	8" Montello-Berne Jct.
12113	BEJT-TAMA-6	6" Berne Jct.-Tamaqua
12114	TAMA-KING-6	6" Tamaqua-Kingston
13000	TOLE-INKS-8B	8" Toledo-Inkster (Sarnia)
13001	INKS-SARN-8	8" Inkster-Sarnia
13004	INKS-JNJt-8	8" Inkster-Joan Jct.
13008	MLJT-INKS-6	6" DSPL (Millard-Inkster)
13009	TOLE-INKS-8A	8" Toledo-Inkster (Rouge)
13011	TOLE-BRJT-8	8" Transfer Line (Toledo-Brown Jct.)
13016	HUDS-AKRO-6	6" Hudson-Akron Spur
13017	ALJT-ALLE-6	6" Allegheny Spur
13020	ALLE-INJT-6	6" Pitt Oil Spur
13022	VAJT-VANP-6	6" Vanport Spur
13023	BRJT-CDJT-8	8" Transfer Line (Brown Jct-Cedar Pt)
13024	TOLE-MLJT-6	6"/8" DSPL (Millard-Toledo)

Blasting Specifacaton 321, Appendix B

BLASTING REQUIREMENTS CHART

Before blasting begins call Control Center and inform the EAOC or CCS that blasting is to take place, indicate which pipeline segments will be effected and an approximate station number. Inform the EAOC or CCS when the blasting is completed. Call each day during blasting operations within 300 ft. of the pipeline.

IF THE SEISMOGRAPH READINGS ARE OFF THE HIGH END/TOP OF THE CHART CALL CONTROL CENTER AND INFORM THE EAOC OR CCS TO SHITDOWN THE PIPE INF/S AND HAVE ENGINEERING



Source: United States Bureau of Mines Report of Investigation 8507 Figure B-1

"Structure Response and Damage Produced by Ground Vibration from Surface Mine Blasting."

Blasting Specification 321Appendix C, Performance Specifications for Blasting Seismographs

Contractor shall ensure that the Performance Specifications for Blasting Seismographs are in accordance to the most recent publications of “International Society of Explosive Engineers”.

Blasting Specification 321Appendix D, Blasting Folder Checklist

Information Supplied by Contractor

- ☐ Blasting Permit (DEP issues in PA)
 - County / Township
 - Location of Blast
 - Distance to Pipeline
 - Maximum Peak Particle Acceleration
- ☐ Blaster's License/Qualifications
- ☐ Blast Plan / Loading Information
 - Pattern / Number and Location of Bore Holes
 - Diameter and Depth of Bore Holes
 - Delay Intervals and Holes per Delay
 - Number of Blasts/Holes per/day
 - Explosives to be Used
 - Maximum Pounds per Delay
- ☐ Vibration Monitoring
 - Company Information (name of contact person)
 - Seismograph Annual Calibration records
 - Monitoring Equipment / Seismograph Calibration

These items must be available and the pipeline segment identified prior to the blasting activities.

Information Supplied by SPLP Inspector

- ☐ Seismograph Tapes
- ☐ Leak Survey Results
- ☐ Blasting Report

If recorded peak particle velocity components exceeded the criteria established by USBM RI-8507 for safe levels of blasting vibration for houses using a combination of velocity and displacement as shown on USBM RI-8507 Figure B-1, include pipeline integrity calculations.



Sunoco Logistics

Sunoco Pipeline L.P. and Affiliates CONSTRUCTION STANDARDS

Subject:

Galvanizing Structural Steel Plate

Prepared By:
Sankar Raj Devarpiran [REI]

Revision:
2

Page:
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Number:
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Lindy Barile

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8/29/13

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**Subject:****Galvanizing Structural Steel Plate**

Prepared By: Sankar Raj Devarpiran [REI]	Revision: 2	Page: 2 of 4	Code:	Number: 0403
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1.0 Introduction

1.1 Scope

This specification covers requirements for galvanizing structural steel and steel fabrications.

2.0 References

The Following documents are referenced herein and are considered a part of this specification. The latest edition upon date of issuance of a contract shall apply.

2.1 American Society for Testing and Materials (ASTM)

ASTM A6	Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM A123	Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 143	Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement
ASTM A 153	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A384	Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies
ASTM A385	Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)
ASTM A780	Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM B695	Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
ASTM E376	Standard Practice for Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Testing Methods

2.2 Process Industry Practices

PIP STS05120 Structural and Miscellaneous Steel Fabrication Specification

**Subject:****Galvanizing Structural Steel Plate**

Prepared By: Sankar Raj Devarpiran [REI]	Revision: 2	Page: 3 of 4	Code:	Number: 0403
Approved: Lindy Barile	Date: 8/29/13	Replaces: 0403 Rev. 1		

3.0 General Requirements

- 3.1 All materials, except ASTM A490 bolts, ASTM A490M bolts, and crane rails, shall be galvanized, unless otherwise noted in the contract documents.
- 3.2 Galvanizing of steel shapes, plates, and hardware shall be in accordance with the following ASTM specifications:
 - 3.2.1 Steel shapes and plates - ASTM A123
 - 3.2.2 ASTM A325 bolts and corresponding nuts and washers –ASTM B695 (or ASTM A153, when approved by the Owner's Representative)
 - 3.2.3 ASTM A36 threaded rod, ASTM A307 bolts, and corresponding nuts and washers - ASTM A153 or ASTM B695

4.0 General Fabrication

- 4.1 It shall be the Contractor's responsibility to safeguard against embrittlement and warpage per ASTM A143 and ASTM A384. Fabrication details shall meet the requirements of ASTM A385 to allow for the creation of high-quality zinc coatings.
- 4.2 Whenever practical, cutting, drilling, and welding shall be performed before galvanizing. The Contractor shall remove weld slag before galvanizing.
- 4.3 The edges of tightly contacting surfaces shall be completely seal welded.
- 4.4 Vent holes shall be provided for piping or tubular assemblies as required by ASTM A385.
- 4.5 Potential problems that require a modification in design shall be brought to the attention of the Owner's Representative by the Contractor before proceeding.

5.0 Galvanizing of Steel Hardware

- 5.1 Nuts shall be tapped oversize in accordance with ASTM A563.
- 5.2 Nut threads shall be retapped after hot-dip galvanizing to provide a proper fit.
- 5.3 Direct tension indicators, if used, shall be mechanically galvanized by the manufacturer according to the requirements of Class 50 of ASTM B695 or better.

6.0 Inspection of Galvanized Steel

The Owner's Representative reserves the right to inspect and reject all galvanized steel in accordance with ASTM A123 and ASTM E376.

Subject:

Galvanizing Structural Steel Plate

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7.0 Repair of Galvanized Steel

- 7.1 Any damage to galvanizing shall be repaired in accordance with ASTM A780.
- 7.2 Before repair of damaged galvanized coating, the exposed substrate metal shall be cleaned to bright metal and free of all visual rust, oil, or grease. Any non-adhered galvanizing shall be removed to the extent that the surrounding galvanizing is integral and adherent.
- 7.3 When surface defects exceed 2% of a member's area, the defects shall be repaired by redipping the member in the zinc bath.
- 7.4 Cold repair using an organic zinc-rich coating is allowed if the total damaged area is less than 1% of the total coated area of the member being repaired and no single repair is greater than 2 square inches (1,300 mm²) or 12-inches (300-mm) long. The dry film thickness shall be 2 mils to 3 mils (0.05 mm to 0.08 mm) and contain a minimum of 65% zinc dust by weight.
- 7.5 Hot repairs shall be made in the shop if any of the following conditions exist:
 - 7.5.1 Total damaged area is greater than 1%, but less than 2%, of the total coated area of the member being repaired.
 - 7.5.2 Any single repair is 2 square inches or more in area.
 - 7.5.3 Any single repair is 12-inches long or more.
- 7.6 Hot repairs shall be made using zinc alloy rod or powder manufactured for the repair of galvanized steel.
- 7.7 Flux, heavy ash, or heavy dross inclusions shall be removed by brushing, grinding, or filing as required.
- 7.8 Galvanized steel that has been rejected shall be stripped, regalvanized, and submitted again for inspection.
- 7.9 Correction of excessive warpage (that exceeds ASTM A6 criteria) shall be by press straightening when possible. The application of localized heating to straighten must be approved by the engineer of record.
- 7.10 If galvanized tension control bolts are used, all bare steel surfaces (i.e., bolt ends) shall be repair galvanized per this section.

End of Specification

8.0 Revision Log

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1	09/26/2006			Sankar Raj Devarpiran	NA	
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**Subject:****Structural Steel****Prepared By:**
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**Subject:****Structural Steel**

Prepared By: Sankar Raj Devarpiran [REI]	Revision: 2	Page: 2 of 12	Code:	Number: 0404
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1.0 Introduction**1.1 Purpose**

This Specification covers requirements for the design, fabrication and erection of structural steel.

1.2 Scope

- 1.2.1 Structural steel includes hot-rolled steel elements that provide the primary framing system of buildings, pipe racks, large equipment support structures, the main framing of platforms and mezzanines, and similar structures.
- 1.2.2 The scope of this Specification includes beams, girders, columns, primary structural bracing components, crane runways and monorail beams.

2.0 References

- 2.1 All work shall comply with the latest editions of AISC Specification for Structural Steel Buildings, AWS Structural Welding Code AWS D1.1, AISC Code of Standard Practice for Steel Buildings and Bridges and the requirements herein. Where other specifications, standards, or codes are referred to herein, the latest editions are intended.
- 2.2 The following documents are referenced herein and are considered a part of this specification. The latest edition upon date of issuance of a contract shall apply.
 - 2.2.1 American Institute of Steel Construction (AISC) Specification for Structural Steel Buildings
 - 2.2.2 AISC Manual of Steel Construction
 - 2.2.3 American Society for Testing and Materials (ASTM)
 - ASTM A6 Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
 - ASTM A-36 Standard Specification for Carbon Structural Steel
 - ASTM A-53 Specification for Steel, Black and Hot – Dipped, Zinc-Coated, Welded and Seamless Pipe.
 - ASTM A-123 Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - ASTM A-153 Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware
 - ASTM A-283 Specification for Low and Intermediate Tensile Strength Carbon Steel Plates



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ASTM A-307	Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength
ASTM A-325	Specification for Structural Steel Bolts, Steel, Heat Treated, 120/105 ksi minimum tensile strength
ASTM A-385	Standard Practice for Providing High-Quality Zinc Coatings (Hot Dip)
ASTM A-500	Specifications for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A-501	Specification for Hot-Formed, Welded and Seamless Carbon Steel Standard Tubing
ASTM A-563	Specification for Carbon and Alloy Steel Nuts
ASTM A-1011/A1011M	Specification for High Strength, Low Alloy Colombian - Vanadium Steel
ASTM A-958	Standard Specification for Steel Casting, Carbon and Alloy, with Tensile Requirements, Chemical Requirements Similar to Standard Wrought Grades
ASTM A-992	Standard Specification for Structural Steel Shapes
ASTM A-570	Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High Strength Low Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM B-695	Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
ASTM F-436	Specification for Hardened Steel Washers
ASTM F-959	Specification for Compressible-Washer-Type Direct Tension Indicator for use with Structural Fasteners
ASTM F-1554	Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

2.2.4 American Welding Society (AWS)

AWS D.1.1 Structural Welding Code - Steel

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2.2.5 American Nation Standards Institute (ANSI)

ANSI (ASME) B18.23.1 - Standard for Beveled Washers

ANSI (ASME) 18.22.1 - Standard for Plain Washers

2.2.6 Process Industry Practices

PIP STS05120 Structural and Miscellaneous Steel Fabrication Specification

PIP STC01015 Structural Design Criteria

PIP STS05130 Structural and Miscellaneous Steel Erection Specification

2.2.7 Sunoco Pipeline Construction Standards

Spec 1100 Painting of Tanks, Pipe, Equipment, and Steel Structures

Spec 403 Galvanizing Structural Steel

Spec 405 Other Steel and Metal Fabrications

3.0 Materials**3.1 General Requirements**

3.1.1 Materials shall comply with the requirements of the drawings, the referenced standards, applicable codes and this Specification. Structural steel shall conform to ASTM Specification A36, "Structural Steel", as a minimum.

3.1.2 Steel Checkered plate shall be as per ASTM A786 / A786M, Pattern 4 or 5. Plate shall have a minimum thickness of 1/4 in.

3.1.3 Steel grating and stair treads shall be galvanized non-skid type. Stair treads to be punched and slotted for bolting to stringers. Galvanizing shall conform to SPL Specification 403.

3.1.4 Steel ladder rungs shall be ASTM A36 as a minimum.

3.1.5 Steel pipe for stressed structural applications shall be weldable quality seamless or electric welded (straight seam) conforming to ASTM A53 Type E or S, Grade B or ASTM A106 Grade B.

3.1.6 All machine bolts and hex nuts shall be ASTM A307 Gr. A and high strength structural bolts and nuts shall be ASTM A325 type 1, unless type 3 is specified by the Owner's project engineer. In corrosive atmospheres, type 3 is recommended.

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3.2 Specification Requirements

Unless otherwise specified in writing, all material shall be of new stock that meets or exceeds the requirements of the following standards and specifications:

Wide Flange Sections	ASTM A-992
Other Structural Steel Shapes	ASTM A-36
Sheet and Strip	ASTM A-1011
Pipe	ASTM A-53, Grade B, Type E or S or A 106 GrB
Steel Castings	ASTM A-958
Steel Forgings	ASTM A-668, Class C, CH, E or F
Common (Machine) Bolts	ASTM A-307 bolts shall be used only in secondary connections – girts, purlins, framed openings in walls, etc.
High Strength Bolts	ASTM A-325, Type 1 or 3, All bolts used in primary structural connections (beams, girders, columns, bracing) shall be A-325 or equal.
Heavy Hex Nuts	ASTM A 563 Gr DH
Hardened Washers	ASTM F436
Direct Tension Indicator Washer	ASTM F959
Anchor Rods	ASTM F-1554 Grade 36
Plain Washers	ANSI B 18.22.1, Type A or B
Beveled Washers	ANSI/ASME B 18.23.1
Weld Filler Metal	AWS D1.1, low hydrogen electrode with 58-ksi minimum yield strength and 70-ksi minimum tensile strength.

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3.3 Grating Materials

- 3.3.1 All bars grating shall be welded and serrated with semi-circular serrations formed by punching, as follows:

Description	Minimum, inch	Maximum, inch
Radius of Punch	1/8	7/32
Depth of Cutout	3/32	11/64
Punch Center-to-Center	7/16	1/2

- 3.3.2 Grating shall be manufactured to ASTM A569/A569M, galvanized to SPL specification 403 and NAAMM MBG 531.

- 3.3.3 Unless otherwise specified, the grating shall conform to the standard marking system W-19-4 STEEL.

- 3.3.4 Acceptable manufacturers include but are not limited to:

1. IKG Borden Grating Type W/B
2. Gary Type GW
3. Blaw-Knox Electroforged
4. Klemp KW-19-4

- 3.3.5 All expanded metal grating shall be fabricated such that the walking surface shall provide slip resistance in all directions.

- 3.3.6 Grating shall be pre-galvanized before punching unless other finish is specified by the Company.

- 3.3.7 Approved gratings are:

1. U.S. Gypsum Serrated Grip Strut Grating
2. U.S. Gypsum Heavy Duty Grip Strut Safety Grating

- 3.3.8 Bar and expanded metal grating stair treads shall be fabricated to the above specifications. Each tread and the edge of the platform at the top of the stairs shall be furnished with a non-skid, cast abrasive nosing. Nosing shall be installed after painting or galvanizing.

- 3.3.9 No substitutions shall be made in material or in size or weight of member unless authorized by the Company in writing.

4.0 Design Criteria

- 4.1 All design loads shall be computed in accordance with PIP STC01015, Structural Design Criteria, but not less than required by the building code adopted by the local jurisdiction. Loads listed below are based on Allowable Stress Design (ASD) unless noted otherwise.

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- 4.2 The live load (including snow if applicable) on a structure shall be the greatest load produced by the intended use of an area and shall have the following minimum values:
- 4.2.1 Working Areas
1. 100 psf.
 2. Areas serving such items are tubular units and manholes and areas where a heavy concentration or maintenance equipment may be necessary during erection or during a shutdown are to be considered working areas.
- 4.2.2 Storage Area
1. Light – 150 psf.
 2. Heavy – 250 psf.
 3. Areas specifically designed for storage purposes.
 4. Heavy live load includes small equipment.
- 4.2.3 Access Areas
1. 75 psf.
 2. Areas not covered by the foregoing, such as connecting walkways and operating platforms, are to be considered as access areas.
- 4.2.4 Roof Areas
1. 20 psf or snow load, whichever is greater.
 2. Flat or pitched roofs not used for storage, work or access areas.
 3. The load shall be applied to the horizontal projection or roof areas.
- 4.3 The minimum design wind pressure shall conform to PIP STC01015.
- 4.4 Every portion of a structure shall be designed to resist the effects of the following combination of loads. Wind and seismic loads shall not be considered to occur simultaneously.
- 4.4.1 Operating
- The structural, equipment, and the piping dead loads; the design live load; and the equipment and piping contents and other applicable loads combined with maximum wind or seismic loads.
- 4.4.2 Test
- The structural, equipment and the piping dead loads; the design live load; and the equipment and piping fluid test load, plus a 50 percent of the wind load.
- 4.4.3 Empty Equipment
- The structural, equipment and piping dead loads combined with maximum wind or seismic loads.

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4.5 In the design of pipe bridges and main pipe rack structures the following apply:

- 4.5.1 Pipe support levels shall be designed for 40 psf. (Equivalent to un-insulated 8-inch diameter pipes filled with water spaced at 15 inches on center) Where unusually large pipes, valves, etc. occur, this assumption shall be checked against the actual loading and increased locally as required.
- 4.5.2 Conduit / cable tray level shall be designed for not less than 20 psf for each level of cable tray supported. Verify design loadings with cable tray capacity and intended fill volume.
- 4.5.3 Wind loading on pipes shall be as per PIP STC01015.
- 4.5.4 In addition to pipe and conduit loads, an allowance for snow and ice shall be added over the area of the pipe bridge/rack, one-half load on top level and the balance distributed equally to lower levels. Full allowances shall be added to a single level rack.

Total snow and ice loads shall be equivalent to snow loads give in Section 4.1.

5.0 Connections, Joints, and Fasteners

5.1 Limitations on Bolted and Welded Connections

- 5.1.1 A minimum of (2) A-325 high strength bolts shall be used for bolting columns, girders, primary beams (including trolley beams), and bracing members unless otherwise specified. Machine bolts shall be used only for secondary bolted connections and access platforms unless indicated otherwise on design drawings.
- 5.1.2 The allowable unit tension and shear stress for high strength bolted connections shall conform with AISC Manual Table J3.2 with threads not excluded from the shear plane. Connections shall be designated as Bearing Type N connections, except as required for components of the Lateral Force Resisting System (LFRS).
- 5.1.3 Connections for permanent floor plates shall be welded.

6.0 Welding

- 6.1 All welding shall be performed in accordance with welding procedures approved by the Owner's Representative.
- 6.2 Welding and welding procedures shall be in accordance with AWS D1.1. The written weld procedures and any code required qualification test records shall be submitted to Owner for approval. Procedures other than those pre-qualified shall be qualified by tests as specified in of AWS D1.1.
- 6.3 Welding shall be performed only by welders, operators, and tackers who are currently qualified in accordance with AWS D1.1. The welder qualification test records shall be made available to the Owner's Representative.
- 6.4 Wind velocities shall not exceed 5 miles per hour in the weld area for gas-shielded processes and 20 miles per hour for self-shielded electrodes.

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- 6.5 Carbon content (product analysis) shall be limited to 0.35% for forging intended for welding.
- 6.6 Weld-through primers shall not be used unless approved in writing by the Owner's Representative / Welding Inspector.

7.0 Fabrication

- 7.1 Connections shall be as indicated on the project drawings and as specified herein.
- 7.2 The Owner's design drawings may indicate member loading, forces or end reactions, based upon which the Contractor should provide connection designs. If design loads, forces or end reactions are not provided, the connections shall be designed for one half of the total allowable uniform load, for the appropriate beam section and span, as listed in Maximum Total Uniform Load Tables, Part 3, of the AISC Manual of Steel Construction.
- 7.3 Bolted beam connections shall consist of at least 2 bolts vertical. Single angle beam connections or shear tabs shall not be permitted unless specified on the Owner's design drawings.
- 7.4 For bracing connections (axial loading), design drawings will normally indicate the axial load value which Contractor should use as the basis of end connection design. Where design drawings do not indicate such loading values, bolted brace connections shall consist of at least two bolts. Design of bracing end connections shall include due consideration of eccentricity of the connection and shear lag in the brace.
- 7.5 Shop connections shall be welded unless approved otherwise.
- 7.6 Where galvanized construction is required ASTM A325 bolts and DTI washers shall be mechanically galvanized in accordance with ASTM B695, Class 50 or better.
- 7.7 All field connections shall be made with high strength bolts conforming to ASTM A-325 friction type, unless otherwise shown or approved. "Turn-of-nut", "calibrated wrench", or "load indicating washer methods may be used for bolt tightening. Temporary erection bolts shall be removed and replaced with high-strength bolts. For floor framing, miscellaneous steel, girts and purlins and where called for on the design drawings, standard bolt conforming to ASTM A-307 shall be used.
- 7.8 Bolt lengths shall comply with criteria outlined in AISC RCSC Specification for Structural Joints Using High-Strength Bolts.
- 7.9 Holes for bolted connections shall be 1/16 inch larger than the nominal diameter of the bolt. The holes may be punched if the material thickness does not exceed the bolt diameter plus 1/8 inch. Heavier material requires the holes be drilled, or sub-punched/sub-drilled and the holes reamed. Burning or torching bolt holes is not permitted. See the AISC specification for additional information.
- 7.10 Shop assembly shall be as complete as possible in order to minimize the field connections, and consistent with the feasibility and economy of handling and shipping the fabricated assemblies.
- 7.11 All angles and clips shall be bolted or welded in place and all holes shall be punched for bolted field erection or for fit-up prior to welding for welded field erection.

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- 7.12 If seal welding is specified, it should be made 1/8-inch continuous fillet weld around the perimeter of the plate. If required to minimize distortion due to heat, intermittent welds may be applied around the perimeter first, then the gaps filled afterwards. Subsequent welds shall overlap previous welds to assure a continuous seal.

8.0 Surface Preparation and Coating

- 8.1 Prior to coating, all material surfaces except those stated above shall be prepared by blast cleaning in accordance with SPL spec 1100.
- 8.2 On the same day the surface is sandblasted, a primer coating in accordance with SPL Spec1100 shall be applied. The minimum dry film thickness shall be in accordance with the above reference drawing, except the minimum dry film thickness on surfaces inaccessible for painting after assembly shall be 4 mils minimum. This includes surfaces under concrete fireproofing.
- 8.3 Material specified to be galvanized shall be hot dip galvanized after fabrication on the same day the surface is sandblasted or pickled. Galvanizing shall occur before assembly by bolting. Galvanizing procedures shall be in accordance with ASTM A-123, A-153, and A-385.
- 8.4 Machine-finished surfaces shall be protected against corrosion by rust inhibiting coating which can be easily removed prior to erection or which has characteristics that make removal prior to erection unnecessary.
- 8.5 If high strength bolting is used, contact surfaces of members to be joined by friction-type connections must be left unpainted.
- 8.6 No material shall be loaded for shipment until the shop coat of coating is thoroughly dry.

9.0 Platforms, Stairway, Ladders, Ramps, and Handrails

- 9.1 Platforms shall be furnished as indicated on the design drawings and specified in the Contract documents.
- 9.2 Platform support structures and framing members shall comply with the provisions of this Specification. Platform floor plate, grating, railings, toe boards, stairs and ladders shall comply with SPLP Specification 405.

10.0 Marking for Erection

- 10.1 All fabricated steel sections shall be match-marked for field assembly with designating numbers or letters corresponding to the piece marks on the fabrication and field erection drawings.
- 10.2 All tagging of bundles of bagged items shall be with cloth tags and waterproof ink, or with tags of pressed metal.
- 10.3 Markings of large items shall be welded or stamped to be legible when received at the site or painted on the item with an indelible "paint stick" marker of a sharp contrasting color to that of the primer color.

11.0 Inspection

- 11.1 Contractor shall employ qualified individuals to perform inspections and quality control functions during the course of the fabrication and field erection. Inspections shall include, but are not limited to, the following:

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- 11.1.1 Verification of conformance of materials with this specification and the drawings. The limits of acceptability and repair of surface imperfections for structural steel shall be in accordance with ASTM A-6.
- 11.1.2 Inspection of high strength bolted connections shall be in accordance with AISC Specification for Structural Joints Using High-Strength Bolts.
- 11.1.3 Verification of welding procedures, welding operations, and welder and tacker certificates of qualification shall be in accordance with this specification and AWS D1.1.
- 11.1.4 Periodic and/or continuous inspection of welds as required to verify and document that all welds satisfy the requirements of AWS D1.1 and this Specification.
- 11.1.5 Inspection of shop-welded shear connector studs shall be in accordance with AWS D1.1
- 11.1.6 Inspection of surface preparation and shop coating to verify that it conforms with this Specification.

12.0 Shipping and Delivery

- 12.1 It shall be the Contractor's responsibility to provide adequate packing, crating, blocking and / or bracing to prevent damage to the fabricated material while loading, in transit and while unloading.
- 12.2 When galvanized material is specified, the delivery of fabricated steel and grating to the galvanizer after fabrication and to the construction site after galvanizing shall be the responsibility of the Contractor.
- 12.3 Shipping Papers: Each load of fabricated steel delivered to the jobsite (including shipments from the galvanizer) must be accompanied by a shipping list, identifying each piece on that shipment by piece mark numbers, along with the ship order numbers (or area number on multiple unit projects), and the weight of each piece.
- 12.4 Shipments arriving at jobsite without proper shipping list and mark numbers on the fabricated pieces may be unloaded if requested by the Contractor, but will not be received until the Contractor has visited the site and properly identified all of the components.
- 12.5 All required field erection fasteners for a shop order should be delivered prior to, or with the first delivery of that shop order, and should be accompanied with a packing list giving description, size, quantities, and proper identification as to where they are to be used in the construction.

End of Specification



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13.0 Revision Log

Revision No.	Revision Date	Document Authorizer	Document Reviewer	Document Author	Document Administrator	Revision Details
1	09/07/2006			Sankar Raj Devarpiran	NA	
2	08/30/2013	Lindy Barile	REI		NA	General updates

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0405 Rev. 1**1.0 Introduction****1.1 Scope**

- 1.1.1 The work covered by this specification consists of furnishing all labor, materials including connection material, equipment, and incidentals, and performing all operations required to furnish, fabricate, deliver, and erect (or install), all miscellaneous steel and metal fabrications.
- 1.1.2 This work shall be performed in accordance with the construction drawings, this specification, governing local building codes, and other codes, specifications, and standards listed in Section 2.0 of this specification.

2.0 References

The publications listed below form part of this specification.

Each publication shall be the latest revision and addendum in effect on the date of contract in which this specification is adopted in Contract Documents, unless noted otherwise.

- 2.1 AISC (American Institute of Steel Construction)
 - 2.1.1 Specification for Structural Steel Buildings
 - 2.1.2 Specification for Structural Joints Using High Strength Bolts (RCSC)
 - 2.1.3 Manual of Steel Construction
 - 2.1.4 Code of Standard Practice for Steel Buildings and Bridges
- 2.2 ANSI (American National Standard Institute)
 - 2.2.1 ANSI B18.2.1 Square and Hex Bolts and Screws
 - 2.2.2 ANSI B18.2.2 Square and Hex Nuts
 - 2.2.3 ANSI B27.2 Washers
 - 2.2.4 ANSI A10.13 Safety requirements for Steel Erection
 - 2.2.5 ANSI / NAAMM MGB-531 Metal Bar Grating Manual
 - 2.2.6 ANSI A14.3 Ladders – Fixed – Safety Requirements
- 2.3 ASTM (American Society for Testing and Materials)
 - 2.3.1 ASTM A36 Specification for Carbon Structural Steel



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|--------|-------------|---|
| 2.3.2 | ASTM A53 | Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless |
| 2.3.3 | ASTM A123 | Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products |
| 2.3.4 | ASTM A153 | Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware |
| 2.3.5 | ASTM A234 | Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service |
| 2.3.6 | ASTM A307 | Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength |
| 2.3.7 | ASTM A325 | Specification for Structural Steel Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength |
| 2.3.8 | ASTM A500 | Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes |
| 2.3.9 | ASTM A501 | Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing |
| 2.3.10 | ASTM A563 | Specification for Carbon and Alloy Steel Nuts |
| 2.3.11 | ASTM A615 | Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement |
| 2.3.12 | ASTM A-786 | Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates |
| 2.3.13 | ASTM A780 | Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings |
| 2.3.14 | ASTM A-992 | Standard Specification for Structural Steel Shapes |
| 2.3.15 | ASTM A-1011 | Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High Strength Low Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength |
| 2.3.16 | ASTM F-436 | Standard Specification for Hardened Steel Washers |
| 2.3.17 | ASTM F844 | Washers, Steel, Plain, (Flat), Un-hardened for General Use |
| 2.3.18 | ASTM F-1554 | Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength |

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2.4 AWS (American Welding Society)

2.4.1 AWS A5.1 Carbon Steel Electrodes

2.4.2 AWS D1.1 Structural Welding Code – Steel

2.5 Government Regulations

2.5.1 FS FF-S-325 Shield Expansion, Nail Expansion, and Nail Driving Screw (Devices, Anchoring Masonry)

2.5.2 OSHA 29 CFE Part 1910 Regulations for General Industry

2.5.3 OSHA 29 CFR Part 1926 Regulations for Construction

2.6 SSPC (Society for Protective Coatings)

2.7 Process Industry Practices

2.7.1 PIP STS05120 Structural and Miscellaneous Steel Fabrication Specification

2.7.2 PIP STF05530 Grating Fabrication Details

2.7.3 PIP STC01015 Structural Design Criteria

2.7.4 PIP STS05130 Structural and Miscellaneous Steel Erection Specification

2.8 Sunoco Pipeline Company Standards

2.8.1 Spec 1101 Painting

2.8.2 Spec 403 Galvanizing Structural Steel

2.8.3 Spec 404 Structural Steel

3.0 Requirements

The work includes, but is not limited to, the following items:

- Cold formed steel products
- Floor plate
- Grating
- Ladders and Ladder Cages
- Masonry Lintels
- Pipe Guards
- Stairs
- Ships ladders
- Catwalks

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- Railings (Guards, Guardrails)
- Handrails
- Trench and pit covers
- Channel door frames
- Corner guards
- Edge and curb angles
- Ceiling channels
- Miscellaneous metals

4.0 Submittals

4.1 Safety Plan

4.1.1 Safety Program

1. The Contractor shall submit a safety program for review by the Company engineer. The safety program shall address the safety measures that the Contractor shall use during steel erection work. The safety program shall comply with the requirements of the contract documents; AISC Code of Standard Practice for Steel Buildings and Bridges; applicable portions of OSHA 29 CFR Part 1910 and Part 1926; and any other applicable federal, state, or local requirements.
2. The Contractor's safety program shall provide a detailed description of how the Contractor will prevent injury to all personnel affected by the Contractor's operations. The safety program shall include an effective system for initial orientation and education in safety and accident prevention, as well as appropriate records to document compliance. At a minimum, the safety program shall place particular emphasis on the following aspects:
 - A. Fall Prevention
 - B. Ground-level preassembly to minimize elevated erection
 - C. Hole Covers and opening barriers
 - D. Access control to incomplete areas of erection
 - E. Lifting plans and hoisting procedures

4.1.2 Assembly Lift Plan

1. Contractor is responsible for assuring that all preassemblies that are not specifically shown or noted on the design drawings to be preassembled before lifting will maintain structural integrity during lifting.
2. A written assembly lift plan shall be prepared for assemblies larger than 50 feet in one direction, larger than 2,000 square feet in the plan area, greater than 50 tons, or when required by the contract documents. The assembly lift plan shall demonstrate that the proposed lift shall be performed safely and that the assemblies being lifted will remain free from distortion or undue bending, and will maintain structural integrity during the lift.

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3. The assembly lift plan shall contain detailed data on the extent of the lifted assembly, its weights, the structural calculations that prove structural stability of the assembled components during lifting operations, verification of the capacity capabilities of any cranes utilized in the lift, location and positioning of the cranes, and a description of the riggings to be utilized.
4. Review of the assembly lift plan by the Owner does no relieve the Contractor of responsibility required for the safe erection and /or lifting of any component, structural assembly, or any other item under the control of the Contractor.

4.2 Shop Drawings

- 4.2.1 Contractor shall prepare shop and erection drawings detailing all items required to be furnished.
- 4.2.2 Prepare shop drawings in conformance with current AISC guidelines for steel detailing. Shop drawings shall provide complete information required for accurate fabrication and field assembly. Information shown shall include, but is not limited to, the following:
 1. Material specification
 2. Size and cut lengths of members and connectors
 3. Location, type, and size of connections
 4. All welds (field and shop), including size, type, and location
 5. Bolt sizes, types, location, and spacing
 6. Surface finish of all members (paint including type galvanize or no finish)
 7. Temporary erection bolt or bracing materials and locations
 8. List of materials shipped loose
- 4.2.3 Erection drawings designations shall be coordinated with shop identification of the steel components.
- 4.2.4 Contractor's shop drawings and erection drawings shall include reference to design drawing number and Purchase Order number.
- 4.2.5 Submit 2 copies of each shop and erection drawing for the Owner's Representative review after it has been checked by Contractor. Submittals shall be in accordance with the schedule specified elsewhere. The Owner's Representative shall return the drawings not checked by the Contractor without the Owner's review and shall require re-submission of the documents by the Contractor.
- 4.2.6 The Owner's Representative reserves the right to reject any work that does not meet the requirements of this Specification at any time. Any rejected work will require replacement by the Contractor.



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4.2.7 If the Contractor's drawings are found to be consistent with the design drawings and this specification, and are satisfactory to the Owner's Representative, they shall be marked "Approved"; one (1) copy as marked shall be returned to the Contractor.

4.2.8 If the Contractor's drawings are not consistent and satisfactory as above, one (1) copy shall be marked to indicate the required changes and returned to the Contractor. The Contractor shall then make the corrections indicated and as otherwise required, then submit revised drawings for review as specified herein.

4.2.9 The Owner Representative's review shall cover compliance with the design drawings and construction specifications, general arrangement of the principal and auxiliary members, and configuration of the connections. Any errors in general or detail dimensions for all items shall remain the responsibility of the Contractor.

4.2.10 Any fabrication or other work done in advance of receipt of the construction drawings marked "Approved" shall be entirely at the Contractor's sole risk.

4.2.11 The Contractor shall furnish to the Owner's Representative, two (2) sets of prints of the final corrected approved drawings.

4.3 Samples

The Contractor shall submit samples of items requested on contract documents to the Owner's Representative for approval.

4.4 Certifications

4.4.1 Submit certified MTRs (mill test reports) for all steel to be used in the work. Such mill test reports shall show that the steel is in conformance with this specification.

4.4.2 Submit copy of each pre-qualified welding procedure intended to be used in the work prior to start of welding.

4.4.3 Submit a certificate of qualification for each welder, welding operator and tacker employed on the work.

4.4.4 Submit inspection and Quality Control Reports to the Owner's Representative on the same day the inspections are performed. Each report shall have a definite statement indicating compliance or non-compliance with the Specifications.

4.4.5 Submit Manufacturer's certification stating conformity of the welding filler materials with this specification shall be submitted to the Owner's Representative upon request.

4.4.6 Submit Manufacturer's certification stating conformity of bolts, nuts, and washers with this specification to the Owner's Representative upon request. High strength bolting materials shall be U.S. origin raw material.



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4.5 Quality Assurance

- 4.5.1 Contractor shall be solely responsible for the quality control of all the Contractor-supplied materials, installations, and workmanship.
- 4.5.2 Contractor shall maintain a complete up-to-date set of erection drawings at the jobsite.
- 4.5.3 The fabricator shall have no less than 5 year's experience in the fabrication of steel and metal fabrications,. Submit a written description of fabrication ability, including facility shop personnel, quality assurance and control procedures, and a list of similar completed work.
- 4.5.4 The erector shall have no less than 5 year's experience in the erection of steel and metal fabrications. Submit a written description of erection experience, ability, including facility personnel, quality assurance and control procedures, and a list of similar completed work.
- 4.5.5 Welding procedures and personnel shall be qualified in accordance with the requirements of AWS. D1.1 prior to commencement of work.
- 4.5.6 All materials shall be new, in good condition at the time of fabrication and of such other properties to satisfy the requirements of this specification.
- 4.5.7 Owner inspector/engineer shall have the right to inspect all materials, installations, and workmanship supplied by the Contractor and shall have an unrestricted right of access to the Contractor's work areas.
- 4.5.8 Owner inspector/engineer may reject any improper, inferior, defective, or unsuitable materials, installations, and workmanship of the Contractor. Any rejected materials, installations, and workmanship shall be repaired or replaced by the Contractor in accordance with Owner's instruction at no additional cost to the Owner.

4.6 Delivery, Storage, and Handling

- 4.6.1 Load and unload steel and metal fabrications using equipment and procedures necessary to handle the assemblies without damage or distortion to the assemblies. Any surfaces or assemblies damaged shall be repaired or replaced to meet the Owner Representative's approval.
- 4.6.2 Unless otherwise required by the Owner, all material shall be inspected by the Contractor immediately after receipt to ensure that the materials are no damaged, that all items on the packing list have been supplied, and that all documentation has been received.
- 4.6.3 Steel and metal fabrications shall be delivered to the job site as needed to meet the work schedule.
- 4.6.4 Store material 12 inches off the ground or slab by use of wood blocking or other material furnished by the Contractor and approved by the Owner's Representative.

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4.7 Site Conditions

- 4.7.1 The Contractor shall note that certain portions of the work are to be completed prior to completion of other work to allow for subsequent work to proceed.
- 4.7.2 Contractor shall sequence steel and metal fabrications installation and properly protect equipment to prevent contamination or damage in adjacent areas.

5.0 Materials**5.1 Requirements and Specifications**

- 5.1.1 Material requirements that are not listed below shall be in accordance with Specification 404, Structural Steel.

1. Pipe Railings & Handrail - ASTM A53, Type S, Grade B, Schedule 40
2. Brackets for Handrails - Julius Blum #378 or approved equal
3. Grating - All bars grating shall be welded and serrated with semi-circular serrations formed by punching, as follows:

	<u>Minimum</u>	<u>Maximum</u>
Radius of Punch	1/8"	7/32"
Depth of Cutout	3/32"	11/64"
Punch Center-to-Center	7/16"	1/2"

Grating shall be ASTM A1011 material, manufactured to NAAMM MBG 531 and galvanized to SPLP Specification 403. Grating shall be pre-galvanized before punching unless other finish is specified by the Owner.

Unless otherwise specified, the grating shall conform to the standard marking system W-19-4 STEEL. Clear space between bearing bars shall not exceed one inch. If not specified on the drawings, the minimum bearing bar size shall be 1-1/2" x 3/16".

Acceptable manufacturers include, but are not limited to:

Harsco Industrial IKG Type WB
AMICO 19-W-4

4. Expanded Metal - All expanded metal grating shall be fabricated such that the walking surface shall provide slip-resistance in all directions.



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5. Serrated Plank Grating - Unless noted otherwise, serrated plank grating shall be "Grip Strut", 14 gauge galvanized steel, minimum 2 inches deep and not more than 12 inches wide.

Approved gratings are:

McNichols Grip Strut Plank Grating
Cooper B-line Grip Strut Safety Grating

6. Checkered Floor Plate - ASTM A786
7. Bar and plank grating stair treads shall be fabricated to the above specifications. Stair treads shall be a non-skid type grating. Stair treads shall be bolted unless welding is approved by the Owner's project engineer. Each tread and the edge of the platform at the top of the stairs shall be furnished with a non-skid, cast abrasive nosing. Nosing shall be installed after painting or galvanizing.
8. Tread Nosings - Nosings shall be integral with treads and landings.
9. Type 120, 3 inch wide, as manufactured by Wooster Products, Inc., or an approved equal.
10. Platform Framing and Stair Stingers: - ASTM A36 and per Specification 404.
11. Expansion Anchors - Wedge-expansion stud type shall meet requirements of FS A-A-1923, Type 4, for concrete expansion anchors or an approved equal, and shall be certified adequate for the intended applications.

Approved Expansion Anchors are:

Trubolt wedge anchor by ITW Redhead
Power-Stud wedge anchor by Powers Fasteners

Submit product technical data and ICC ES Evaluation Report for proposed anchors.

6.0 Execution

6.1 Design and Detailing

6.1.1 Stairways and Ramps

1. Stairways shall be installed within the angle with the horizontal of 30 to 43 degrees. The rise and tread width shall be uniform throughout any flight of stairs. Rise dimension shall not exceed 8 inches. Where possible, exposed tread dimension (nosing-to-nosing) should be 12 inches, and not less than 10 inches in any case. Nosings should overlap the tread surface below by one inch.
2. Intermediate landings or platforms shall be provided where the stairways vertical height exceeds 12 ft. Per OSHA 1910, stairways and landings shall have a minimum width of 22 inches, 36 inches preferred; and intermediate landings shall be a minimum of 30 inches measured in the direction of travel.

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3. Differences in platform elevations 12 in. or less require no intermediate step.
4. Ramps shall be installed with an angle to the horizontal not exceeding 7 degrees. Good design is one foot vertical in 8 feet horizontal, and as flat as 1 in 12. The ramp surface shall be a non-skid type grating.

6.1.2 Railings and Handrails

1. Per OSHA 1910, railings shall be provided on stairways with four or more risers.
2. Top rail of railings (guardrails) shall not be less than 42 in. in height from walking surface with an intermediate railing located between walkway level and the top railing. Higher railing shall be used at certain locations to provide protection for persons climbing short lengths of uncaged ladders located near the edge of a platform.
3. Railing posts shall be spaced not more than 6 ft. center-to-center. Railings shall not be framed into concrete columns or fireproof steel columns.
4. A stair railing shall be of construction similar to a standard railing but the vertical height shall be not more than 34 in. nor less than 30 in. from upper surface of top rail to surface of tread, in line with face or riser at forward edge of tread.
5. Where the nature of the operation requires the railing be frequently removed, use removable type railing.
6. Railings are not required around pits or other openings when they are so constructed that the top of the pit or opening is 42 in. above walkway level.
7. Toe board is required with all railings for walkway levels which are 4 ft. or more above floor or ground level and along the edges of all other openings in walks, floors, and ground level where safety of people is involved. Toe boards shall be flat bar 4 inches by ¼ inch. Toe boards shall extend all around the platform perimeter and all openings, including the edge of platforms adjacent to columns and vessels. Toe boards shall be omitted only at passages and access to top of ladder and top of stairs.

6.1.3 Dissimilar Materials

In all cases where dissimilar metals such as aluminum, steel, and copper would join or be in contact, the metals shall be kept separated by suitable non-conducting gasket, or tape, or by painting the contact surface with a bitumastic from being damaged during installation, or from showing on permanently exposed surface.

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0405 Rev. 1**7.0 Products****7.1 Materials**

All Materials shall be in accordance with specification 404, Structural steel and the above sections.

7.2 Fabrication**7.2.1 Handrails and Railings (Guards)**

1. Comply with local governing codes; fabricate from pipe as detailed, with closed ends, heated and bent smoothly without distortion. Return ends of wall mounted hand rails to wall.
2. Provide smooth continuous transition around turns and bends, Miter, weld, and grind smooth where exposed.
3. Load - Railings must withstand a concentrated 200 pound load in any direction with a top rail height of 42 inches.

7.2.2 Toe Boards

Provide bar 4 inches by 1/4 inch at platform handrails. The gap between toe board and floor plate, both horizontally and vertical, shall not exceed 1/4 inch. All ends of toe boards shall be welded to railing posts or similarly secured.

7.2.3 Balusters and Posts

Fabricate from pipe. Refer to design drawings for maximum spacing.

7.2.4 Removable Railings

Removable Railings shall be used only where it is not feasible to provide a sliding gate or other device the can be moved/replaced with exposing personnel to a fall hazard. When in place, removable railings shall be secure such that inadvertent removal is not possible. Provide means of securing by pins, threaded fasteners or similar means that are removable with common tools and will remain functional in the environment where installed.

7.2.5 Channel Door Frames

Fabricate from standard shapes with bent strap anchors at 16 inch o.c. for frames in masonry walls, and clip angles at toe frame drilled for anchoring to slab.

7.2.6 Pipe Guards (Bollards)

Pipe 6 inches in diameter by 7 feet long, Schedule 40 or heavier, placed 3' - 6" deep in concrete and filled with concrete, unless shown otherwise on the Drawings.

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7.2.7 Grating Assemblies

1. Fabricate from rolled steel shapes and grating as shown in the drawings, providing for bolted connections unless otherwise shown and approved on shop drawings.
2. Grating shall be removable unless otherwise specified on the design drawings. All removable sections shall be limited to a maximum weight of 300 pounds.
3. Grating shall be secured to the supporting steel beams by welding or fasteners as specified on the design drawings.
4. Two connections per panel shall be used at each edge end support and one connection at all interior supports with a minimum of four (4) per panel. When welded, grating shall be fastened by 3/16-inch filled welds 1-1/2 inches long at intervals not exceeding 18 inches at edge supports, or with a minimum of four welds per panel. Grating shall be welded at 18-inch centers over intermediate members. Removable grating panels shall be fastened to support members by "U" shape clips
5. Ends of grating panels shall typically occur over supports.
6. Notching of bearing bars at supports to maintain elevation is not permitted.
7. Openings dimensioned on the design drawing shall be cut in the shop. Openings not defined on the drawings shall be cut in the field.
8. All grating panel ends shall be banded with flat bar not less than 1/8-inch thick and matching the depth of the grating bearing bars, welded to the end of each bearing bar top and bottom. Shop-cut openings in grating shall be similarly banded. Field-cut openings shall be banded if the opening is larger than 12 inches in any dimension, and as otherwise required by Owner's Representative.

7.2.8 Floor Plate Assemblies

1. Fabricate from rolled steel shapes and floor plate as shown on the Drawings, providing for bolted connections unless shown or approved otherwise.
2. Where shown removable on the Drawings, plate shall be fastened with 3/8-inch diameter galvanized steel countersunk flathead bolts at intervals not exceeding 18 inches on-center
3. Joints in floor plates shall typically occur over supports. Both panels at joints shall be fastened as described above.
4. Openings dimensioned on the design drawings shall be provided during shop fabrication. Openings not defined on the drawings shall be cut in the field.

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5. Drain holes shall be provided for each 20 square feet of area, with a minimum of one (1) hole per panel span between supports, located within one foot of the center of the space between supports. Drain holes shall be 9/16-inch diameter.

7.2.9 Ladders

1. Ladders shall be fabricated to comply with OSHA and ANSI A-14.3 requirements.
2. Ladder cage hoops and assemblies shall be welded. Ladder connections to structure shall be bolted.

- 7.2.10 Construct steel frame assemblies of channels, plates, rolled section or combinations thereof sizes shown. Accurately cut square, miter, butt or cope, and full-weld joints. Grind welds smooth that shall be exposed in finished work.

- 7.2.11 Galvanize fabrications, where noted, in accordance with SPLP Specification 0403.

8.0 Installation**8.1 Preparation**

- 8.1.1 Existing conditions and work in place, upon which the erection or installation of other steel and metal fabrications is dependent shall be examined. Defects which may influence completion and performance of the work shall have been corrected in accordance with the applicable specification.
- 8.1.2 The erection or installation shall not proceed until such correction has been made. Commencement of erection or installation shall be construed as work in place acceptable for satisfying the requirements of this specification.

8.2 Erect and install fabrications plumb and square in accordance with shop drawings.**8.2.1 Handrails**

Weld in accordance with AWS D1.1, or bolt, as indicated on the design drawings.

8.2.2 Channel Door Frames, Lintels, Ceiling Channels, Corner Guards

Install during erection of the associated wall or ceiling.

8.2.3 Ladders, Steel Stairs, Floor Plate Assemblies, Grating Assemblies

Install with approved anchors, securely bolted.

8.2.4 Pipe Guard (Bollards)

Install in (4) feet deep by (2) feet diameter concrete unless shown otherwise. Pitch concrete away from pipe guards.



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End of Specification

9.0 Revision Log

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1	10/31/2007			Raj Devarpiran	NA	
2	08/30/2013	Lindy Barile	REI		NA	General Updates



Sunoco Logistics

Sunoco Pipeline L.P. and Affiliates CONSTRUCTION STANDARDS

Subject:

Reinforced Steel Fabrication

Prepared By: Sankar Raj Devarpiran [REI]	Revision: 2	Page: 1 of 4	Code:	Number: 0406
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1.0 Introduction**1.1 Scope**

- 1.1.1 This specification prescribes the material, detailing, fabrication and marking for shipment of reinforcing steel to be used in reinforced concrete construction.
- 1.1.2 The Contractor who is responsible for the placement of reinforcement and concrete, shall also be responsible for providing wire mesh, tie wire, chairs, and anchor rods, unless otherwise noted in the Construction Contract and illustrated on the design drawings.

2.0 References

The publications listed below form part of this specification.

Each publication shall be the latest revision and addendum in effect on the date this specification is issued for construction unless noted otherwise.

2.1 ACI (American Concrete Institute)

- ACI SP-66 Detailing Manual
- ACI 315 Details and Detailing of Concrete Reinforcement (Par of SP-66)
- ACI 318 Building Code Requirements for Structural Concrete

2.2 ASTM (American Society for Testing and Materials)

- ASTM A615 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
- ASTM A706 Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
- ASTM A1064 Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
- ASTM F1554 Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

2.3 AWS (American Welding Society)

- AWS D1.4 Structural Welding Code – Reinforcing Steel

2.4 Government Regulations

- OSHA 29 CFR Part 1926 Safety and Health Regulations for Construction

2.5 Process Industry Standards

- PIP STS03001 Plain and Reinforced Concrete Specification

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- 2.6 Sunoco Pipeline Company Standards
Spec 404 Structural Steel

3.0 Material

- 3.1 Reinforcing bars shall conform to ASTM A615 (S1) "Standard Specification For Deformed and Carbon-Steel Bars for Concrete reinforcement." Unless otherwise noted on the construction drawings, all bars shall be Grade 60.
- 3.2 Standard design shall employ the use of deformed bars, having lugs or protrusions, to assist in preventing longitudinal movement of the bar relative to the surrounding concrete.
- 3.3 Bar sizes shall be designated by numbers as adopted by the American Concrete Institute and are nominally the bar diameter in eighths of an inch. Deformed bars may range in size from #3 (3/8" diameter) to #18 (2 1/4" diameter).
- 3.4 Reinforcing bars that are to be welded shall conform to AWS D1.4 "Structural Welding Code - Reinforcing Steel."
- 3.5 Welded wire fabric shall conform to ASTM A1064 "Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- 3.6 All reinforcing shall be uncoated, unless otherwise specified on the drawings.
- 3.7 Tie wire shall be black annealed wire, 16 gage minimum.

4.0 Fabrication Drawings

- 4.1 When reinforcing steel is shop fabricated, the Contractor shall prepare complete detail and placement drawings. A review of the shop drawings by the Owner's Project Engineer prior to fabrication is **not required**, unless otherwise specified in the Purchase Order.
- 4.2 Two (2) complete sets of shop drawings shall accompany the steel to the job site and shall be adequately packaged to arrive in good condition.

5.0 Details of Reinforcement

- 5.1 Reinforcement placing drawings and bending schedules shall be prepared in accordance with ACI-SP-66.
- 5.2 All general details of construction and workmanship shall be as specified by the latest editions of ACI 318, Building Code Requirements for Structural Concrete, and ACI 315, Details and Detailing of Concrete Reinforcement
- 5.3 Refer to ACI 315 and ACI 318 for specific requirements governing rebar details such as bend radii, standard hook dimensions, and splice dimensions.
- 5.4 Closed stirrups, #3 minimum spaced at 18 inch centers shall be provided for all beams and joints with top steel where no stirrups are called for on the design drawings.
- 5.5 Two (2) longitudinal carrier bars, #4 minimum without hooks, shall be provided in the top corners of all concrete beams if there are stirrups and no top bars are shown on the design drawings.

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- 5.6 Reinforcing bars shall be spliced only at locations indicated on the design drawings. Welded splices are not allowed, unless approved by the Owner's Engineer. Mechanical splice devices are permitted, subject to approval by the Owner's Engineer.

6.0 Marking for Shipment

- 6.1 When shop fabricated, each bundle of reinforcing steel shall be tagged with weather resistant metal tags. Such tags shall indicate drawing number, release number, mark number, bar quantity, and bar size.
- 6.2 Each bundle of straight bars shall be tagged to indicate bar quantity, bar size, bar length and the mark number corresponding to the location in the construction the bars are intended to be placed.
- 6.3 Each bundle of bent bars shall be tagged with the mark number corresponding to the appropriate placement drawings and the location in the construction the bars are intended to be placed.

End of Specification**7.0 Revision Log**

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1	01/31/2008			Sankar Raj Devarpiran	NA	
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**Sunoco Pipeline L.P. and Affiliates
CONSTRUCTION STANDARDS****Subject:****Coating of Underground Steel Pipe**

Prepared By: R. Todd [REI]	Revision: 2	Page: 1 of 11	Code:	Number: 0502
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Coating of Underground Steel Pipe

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1.0 Introduction

- 1.1 This specification prescribes the requirements for pipeline coating repairs related to pipeline construction or field construction projects. The specification identifies the materials, surface preparation, application, inspection, , and handling procedures for externally coated pipe, weld joints, fittings, valves, and flanges that are be buried for protection against corrosion.

This specification does not apply to Factory Applied Coatings at the mill.

The requirements in this specification supplement those given in project drawings, codes, and other specifications referenced in the project Contract or on the Drawings. Where conflict exists, the more stringent requirement shall govern.

The field coating system will be defined by the Owner or the Owner's Engineering representative.

All deviations to this specification and the other references or applicable standards, specifications, or codes shall require written approval of the Owner's Representative. It shall be the Contractor's responsibility to obtain written clarification from Owner. Any suspected errors or omissions in this specification shall be immediately brought to the attention of the Owner in writing.

- 1.2 This specification also prescribes the minimum requirements for inspection and testing of the coated pipelines and defines areas of responsibility for the Contractor and the Owner.

- 1.3 Work Not Included

Trenching, forming (of trench) trenching equipment, installation of pipe, welding or any other work of equipment required other than to specifically apply coat and wrap materials are not included. Refer to Contract scope of work and other Owner specifications for related construction requirements.

- 1.4 Terminology

- 1.4.1 TGF3

Acronym for Tar Glass Felt, 3 applications of coal tar coating.

- 1.4.2 Jeeping

Electronically testing a coating for defects or holidays, such as voids or thin spots.

- 1.4.3 Holiday Testing

Same as jeeping.

- 1.4.4 Manufacturer Reference

Items specified or referenced by manufacturer and figure number are not intended to exclude approved substitute items offered by other manufacturers. Products of reputable manufacturers and of comparable type, quality, and characteristics may be submitted for the Owner's Engineer acceptance.

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2.0 References

The publications listed below form part of this specification. Each publication shall be the latest revision and addendum in effect on the date this specification is issued for construction unless noted otherwise. Except as modified by the requirements specified herein or the details of the drawings, Work included in this specification shall conform to the applicable provisions of these publications.

- 2.1 ASTM (American Society for Testing and Materials)
 - ASTM B499 Standard Test Method for Measurement of Coating Thicknesses by the Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metals
 - ASTM D149 Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strengths of Solid Electrical Insulating Materials at Commercial Power Frequencies
 - ASTM D638 Standard Test Method for Tensile Properties of Plastics
 - ASTM D1000 Standard Test Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications
 - ASTM D1002 Standard Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal)
 - ASTM D1044 Standard Test Method for Resistance of Transparent Plastics to Surface Abrasion
 - ASTM D2200 Standard Practice for Use of Pictorial Surface Preparation Standards and Guides for Painting Steel Surfaces
 - ASTM D2370 Standard Test Method for Tensile Properties of Organic Coatings
 - ASTM D4417 Standard Test Method for Field Measurement of Surface Profile of Blast Cleaned Steel
 - ASTM D7091 Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals
 - ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials
 - ASTM G6 Standard Test Method Abrasion Resistance of Pipeline Coatings
 - ASTM G8 Standard Test Methods for Cathodic Disbonding of Pipeline Coatings
 - ASTM G12 Standard Test Method for Nondestructive Measurement of Film Thickness of Pipeline Coatings on Steel
 - ASTM G14 Standard Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test)
 - ASTM G62 Standard Test Method for Holiday Detection in Pipeline Coatings.
- 2.2 SSPC (Society for Protective Coatings)

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SSPC-Vis 1	Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
SSPC-Vis 3	Guide and Reference Photographs for Steel Surfaces Prepared by Hand and Power Tool Cleaning
SSPC-PA 2	Procedure for Determining Conformance to Dry Coating Thickness Requirements
SSPC-SP 1	Solvent Cleaning
SSPC-SP 2	Hand Tool Cleaning
SSPC-SP 3	Power Tool Cleaning
SSPC-SP 6	Commercial Blast Cleaning
SSPC-SP 10	Near-White Blast Cleaning

2.3 ISO (International Organization for Standardization)

ISO 21809	Petroleum and Natural Gas Industries -- External Coatings for Buried or Submerged Pipelines used in Pipeline Transportation Systems
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2.4 Sunoco Logistics Corrosion Control Manual

3.0 General Requirements

3.1 Surface Preparation and Cleaning

- 3.1.1 When required blast cleaning shall be performed using manufacturing recommendations for approved abrasive that has sharp, hard, cutting edges. The abrasive shall be properly graded, dry, and of a quality to produce the specified anchor pattern (surface profile).
- 3.1.2 Compressed air shall be clean, dry, and free of oil. Compressed air supply shall have effective moisture and oil trap/filter devices.
- 3.1.3 When hand or power tool cleaning is required follow manufacturer recommendations for surface preparation requirements.

4.0 Coating Systems for New Constructions

The following outlines the primary coating and coating repair systems used by Sunoco Logistics for Field Applied Coatings on piping, weld joints (girth welds), fittings and irregular shapes.

4.1 Liquid Epoxy

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- 4.1.1 Refer to the Sunoco Logistics, Coating Matrix for compatibility restrictions related to the use of the Liquid Epoxy system. Sunoco Logistics approved liquid epoxy systems are:
 - 1. Specialty Polymer Coatings – SPC 2888, SPC 3888, SPC 6888 from Specialty Polymer Coatings, Angleton, TX (281-332-6948)
 - 2. Covalence Powercrete R95, from Durabond, Export, PA (724-327-0782).
- 4.1.2 Refer to Project design specifications or Sunoco Logistics specific requirements for the coating system being used.
- 4.1.3 Surfaces shall be prepped and cleaned in accordance with coating manufacture, typically SSPC-SP10.
- 4.1.4 Weld spatter, slag, sharp edges, burrs, and slivers shall be removed from the surfaces by filing, wire brushing, or sanding prior to surface preparation of the SSPC-SP cleaning.
- 4.1.5 Overlapping of a minimum of 1 inch is required on either side of the application area or coating repair area.
- 4.1.6 Coating application shall be per manufacturer requirements.
- 4.1.7 The coating requirements of irregular shapes shall be defined by the project specifications.
- 4.1.8 Application temperature and coating cure time before handling or backfilling shall be per manufacturer specifications.
- 4.1.9 Inspection shall be per section 5.0 of this specification.

4.2 Tape Wrap Coating

- 4.2.1 Refer to the Sunoco Logistics, Coating Matrix for compatibility restrictions related to the use of the Tape Wrap Coating system. Sunoco Logistics approved Tape Wrap systems are
 - 1. Tape Coat M50, from Tapecoat, Evanston, IL (847-866-8500)
 - 2. Tape Coat M50, form Hi-Tek Systems, North Wales, PA (215-699-5585)
 - 3. Primer Base Coat, Tape Coat, Omniprime
- 4.2.2 Tape wrapping components (primer, inner wrap, outer wrap) shall all be from the same manufacturer.
- 4.2.3 All pipe that will be tape coated in the field shall be coated as indicated on the Design Drawings and/or Contract/Purchase Order.
- 4.2.4 Coating of all fittings, test station wire leads, bends and repairs to direct bury pipeline shall be two layers of spiral wrapped, tape wrap, 4" or 6" wide using primer as specified by the manufacturer.
- 4.2.5 The Owner will provide all factory applied coating. The Contractor shall supply all tape wrap, primer, and other field coating materials as required by the project specifications.

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- 4.2.6 The Contractor shall apply the tape wrap system in accordance with the Manufacturer's published application procedures.
- 4.2.7 Surface preparation shall be SSPC-SP6, commercial blast (minimum).
- 4.2.8 Sunoco Logistics requires the use of primer base coat in all cases. Application thickness defined in manufacturer specifications.
- 4.2.9 Unless specified otherwise in the project design package, tape wrap shall be applied in a spiral wrap pattern only with an overlap of 1 inch (minimum) over existing coating, and with a 50% overlap pattern of the tape wrap to obtain a 100 mil final tape wrap thickness.
- 4.2.10 The tape width for hand applied applications shall not exceed 6 inches.
- 4.2.11 Cold weather application of tape wrap will be restricted to pipe temperatures above 30 ☐ F. Application at temperatures below 30 degrees may be allowed, subject to approval of the manufacturers application procedure by the Owner's Representative.
- 4.2.12 Fittings and bends shall be coated and wrapped with tape wrap. Apply inner tape wrap spirally and overlap 50 percent of the tape width, resulting in double -layer coverage. Tension on the tape shall be such that the tape conforms well with and adheres to all surfaces of the fitting.
- 4.2.13 Irregular shapes, such as valves, corners around couplings, flanges, and other irregular shapes shall be coated with brush-applied coal tar mastic.
- 4.2.14 Tape wrapping shall be held to a minimum. For complicated shapes, tape wrapping shall be performed using tape not exceeding four (4) inches in width. Use of tape wider than 4 inches, at fittings and locations other than weld joints, is subject to approval of the Owner's Representative.

4.3 Wax Tape Wrap Coating

- 4.3.1 Refer to the Sunoco Logistics, Coating Matrix for compatibility restrictions related to the use of the Wax Tape Wrap Coating system. Sunoco Logistics approved Wax Tape Wrap systems are:
 1. Trenton #2 Wax Tape and Wax Tape Primer, from Trenton Corp, Ann Arbor, MI (734-424-3600)
 2. Tape wrapping components shall all be from the same manufacturer.
 3. All pipe that will be tape coated in the field shall be coated as indicated on the Design Drawings and/or Contract/Purchase Order.
 4. Surface preparation shall be SSPC-SP2, Hand Tool Cleaning or SSPC-SP3, Power Tool Cleaning.
 5. Primer requirements and thickness per manufacturer specifications.
 6. Coating of all fittings, test station wire leads, bends and repairs to direct bury pipeline shall be two layers of spiral wrapped, wax tape 4" or 6" wide using primer as specified by the manufacturer.
 7. The Owner will provide all factory applied coating. The Contractor shall supply all wax tape wrap and primer.



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8. Fittings and bends shall be coated and wrapped with wax tape wrap. Apply inner tape wrap spirally and overlap 50 percent of the tape width, resulting in double -layer coverage. Tension on the tape shall be such that the tape conforms well with and adheres to all surfaces of the fitting.
9. Irregular shapes, such as valves, corners around couplings, flanges, and other irregular shapes shall be coated with brush-applied coal tar mastic.
10. Wax tape wrapping shall be held to a minimum. For complicated shapes, tape wrapping shall be performed using tape not exceeding four (4) inches in width. Use of tape wider than 4 inches, at fittings and locations other than weld joints, is subject to approval of the Owner's Representative.

5.0 Inspection and Testing

5.1 Shop Applied Coating Inspection

- 5.1.1 The Coating Contractor (Applicator) shall visually inspect the coating and confirm the integrity of the coating, by electrically testing the coating for defects, prior to shipment or storage, regardless of whether the Purchaser (Owner) undertakes any independent inspection or testing.
- 5.1.2 Visual inspection shall verify the pipe coating system is free of surface blisters, craters, pinholes, and that the pipe is properly coated and wrapped in accordance with these Specifications.
- 5.1.3 The pipe coating shall be 100 percent tested using an electric holiday tester.
- 5.1.4 The holiday detector shall be set to acceptable voltages as stipulated by the manufacturer's recommendations and specified in the purchase Contract. The detector rate of travel shall be as required to reliably detect defects without damaging the coating or the pipe.
- 5.1.5 All voids, pinholes, and defects shall be clearly marked during inspection and testing, and repaired per the requirements of this Specification.
- 5.1.6 Inspection of FBE coatings shall be performed when the temperature of the coating is less than 100°C (212°F). Use of Temple sticks for temperature determination is PROHIBITED.
- 5.1.7 No holidays shall be permitted in the finished FBE coating. FBE coating with holidays shall be repaired by patching in conformance with Sunoco Logistic specifications SP-04-0004, Factory Applied Fusion Bonded Epoxy, provided that the number of holidays does not exceed the following:
 1. For pipe smaller than 14-inch OD, ≤ 1.0 average holidays per 3 feet of pipe length, determined by dividing the total number of holidays by 3 times the total pipe length for the individual pipe joint tested.
 2. For pipe 14-inch OD or larger, 0.7 per 10 square feet of pipe exterior surface, determined by dividing the total number of holidays by 10 times the total outside surface area for the individual pipe tested.



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5.1.8 Where the quantity of holidays in FBE coating exceeds the applicable limit specified, or where the area of an individual holiday is equal to or greater than 40 in², the affected pipe shall be stripped and re-coated in conformance with the requirements of these specifications.

5.1.9 The Contractor (Applicator) shall provide preparation, testing, and evaluation of test ring samples of FBE-coated pipe. The minimum test frequency shall be one test ring per pipe diameter and specified wall thickness every working shift (to a maximum of 12 hours). The end of the pipe from which the test ring is cut shall be re-beveled in conformance with applicable API 5L Specifications.

5.1.10 Residual magnetism levels shall not exceed those specified in the Sunoco Logistics Welding.

5.2 Field Applied Coating Inspection

5.2.1 All pipe coating systems shall be visually inspected after final placement of the piping system components, and after all connections and field coatings are complete.

5.2.2 A final visual and holiday inspection shall be completed just prior to lowering the piping system into the excavation. The Contractor and Owners representative shall perform.

1. A 100 percent visual inspection of all coated and wrapped surfaces shall be performed and;
2. a 100 percent electrical test for holidays and defects using Owner-approved detection equipment. Owner accepted holiday testing equipment are Tinker & Razor model APS, or SPY model 725, or equivalent.
- 3.
4. The detector shall be set to the voltage as specified by the coating and testing equipment manufacturers, and as defined by the project specifications. The following voltage levels (100 – 125 volts/mil of coating thickness) can be used as general guideline for testing if not specified in the project design.

5.2.3 The detector voltage shall not exceed that which is just necessary to cause sparking to the pipe from the detector electrode as it is moved across the coated pipe.

5.2.4 The detector rate of travel shall be as required to reliably detect defects without damaging the coating or the pipe, and as specified in NACE.

5.2.5 All holidays and defects shall be marked for repair. Pipe joints with indication of holiday repairs in excess of one holiday per ten (10) square feet of coated surfaces shall be reevaluated for overall coating integrity and may, at the option of Owner's Representative, be replaced with a joint having a coating of acceptable integrity.

5.3 Holiday Detector Voltage Settings for New Coating Applications

5.3.1 Warning: Holiday Detectors can be ineffective or cause damage to coating if the voltage setting is improper for the coating type and/or coating thickness. Contact the Corrosion Control Group for guidance in the proper voltage setting for the coating system being tested.

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5.3.2 The following settings have been proven effective, and can be used as a guideline.

1. General: 100 to 125 Volts per mil (0.001") of coating thickness
2. Pritec (50 mil): 15,000 to 17,000 Volts
3. Raychem HTLP60 Heat Shrink Sleeve: 15,000 to 17,000 Volts
4. Tapecoat H50 with 50% overlap (100 mil): 15,000 to 17,000 Volts
Tapecoat M50 with 50% overlap (100 mil): 12,000 to 15,000 Volts
5. Liquid Epoxy coatings: Powercrete R95, Powercrete, SPC 2888, SPC 3888, SPC 6888
60 mil: 6,000 to 7,500 Volts
50 mil: 5,000 to 6,200 Volts
40 mil: 4,000 to 5,000 Volts
30 mil: 3,000 to 3,800 Volts
20 mil: 2,000 to 2,500 Volts
6. FBE (12 to 14 mil): 1,200 to 1,500 Volts
7. Wax Tape Coating: Visual inspection only

5.3.3 Portable Holiday Detectors

1. APS by Tinker & Rasor (626-287-5259)
2. SPY by Pipeline Inspection Company (713-681-5837)
 - A. Use full circle plated steel springs in sizes for common pipelines
 - B. Voltage meter by SPY, model PJM

6.0 Repairs

6.1 Repair of Factory Applied Fusion Bonded Epoxy

6.1.1 Liquid Epoxy Repair System

1. The pipe to be repaired shall be cleaned to remove all dirt, scale, rust, damaged or disbonded coating and other foreign material. Areas repaired before surface oxidation or rusting occurs may be prepared by hand filing or sanding disc. Abrasive blasting will be required in areas that have oxidized or rusted to ensure the adhesion surface has been restored to the pipe. The edges of the original coating shall be "feathered out" and abraded around the area to be coated, a minimum of 1 inch, and all dust wiped off before applying the patch coating.
2. The repair shall be in accordance with the liquid epoxy manufacturer's application guidelines, and section 4.1 above.
3. Repairs with liquid epoxy will not be performed when ambient temperature is 13oC (55oF) or below unless the liquid epoxy manufacturer's application guidelines provide a procedure for application and cure under this minimum temperature limit.
4. Repair coating shall be applied to attain a uniform minimum thickness at least equivalent to the existing coating.

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5. The patch compound shall completely cover the prepared area including the abraded surface of the existing coating.
6. The patched coated areas shall be allowed to completely cure prior to handling according to the manufacturer's specifications
7. Completely cured liquid epoxy coating repairs shall be inspected in accordance with section 5.0 above.

6.1.2 Tape Wrap Repair System

1. The pipe to be repaired shall be cleaned to remove all dirt, scale, rust, damaged or disbanded coating and other foreign material. Areas repaired before surface oxidation or rusting occurs may be prepared by hand filing or sanding disc. Abrasive blasting will be required in areas that have oxidized or rusted to ensure the adhesion surface has been restored to the pipe. The edges of the original coating shall be "feathered out" and abraded around the area to be coated, a minimum of 1 inch, and all dust wiped off before applying the patch coating.
2. Tape Wrap shall be spiral wound a minimum of 1 inch on either side of the repair area.
3. Follow details outlined in section 4.2 above additional requirements on repairs.
4. Completely cured tape wrap repairs shall be inspected in accordance with section 5.0 above.

6.1.3 Wax Tape Wrap Repair System

1. The pipe to be repaired shall be cleaned to remove all dirt, scale, rust, damaged or disbanded coating and other foreign material. Areas repaired before surface oxidation or rusting occurs may be prepared by hand filing or sanding disc. Abrasive blasting will be required in areas that have oxidized or rusted to ensure the adhesion surface has been restored to the pipe. The edges of the original coating shall be "feathered out" and abraded around the area to be coated, a minimum of 1 inch, and all dust wiped off before applying the patch coating.
2. Wax Tape Wrap shall be spiral wound a minimum of 1 inch on either side of the repair area.
3. Follow details outlined in section 4.3 above additional requirements on repairs.
4. Completely cured Wax Tape Wrap repairs shall be inspected in accordance with section 5.0 above.

7.0 Storage, Handling, and Shipping

Reference Sunoco Logistics standard, SP-04-0004 Factory Applied Fusion Bonded Coating for guidance on handle FBE coated pipe.

- 7.1 Coated pipe shall be handled in a manner that prevents damage to the pipe and coating.

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- 7.2 Pipe that is damaged during handling and storage shall be repaired in conformance with the requirements of this standard. All costs of damage repair shall be the responsibility of the Contractor.
- 7.3 Coated pipe shall have full encirclement separators around each length. Separators shall be sized and located on the pipe as required to prevent damage to the coating.
- 7.4 Joints shall always be lifted and carried in a manner to prevent pipe ends and coating from damage. Dragging, sliding, or rolling coated pipes shall not be permitted.
- 7.5 Lifts shall be done using padded slings and forks. Slings and forks shall not be placed in areas of coating repairs, field applied coated fittings, or at coated girth welds.
- 7.6 Joints shall be placed on padded wooden skids, earth mounds that are free from rocks, or other approved methods of coating protection when stringing.

End of Specification**8.0 Revision Log**

Revision No.	Revision Date	Document Authorizer	Document Reviewer	Document Author	Document Administrator	Revision Details
1	10/23/06	Lindy Barile		R.Todd		updates
2	09/30/2013	Lindy Barile	Carl Allebach, REI	LJB		Document review and update



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1.0 Introduction**1.1 Purpose**

This specification provides guidance in the installation of mechanical piping systems. The specification is to be used in conjunction with project specific construction plans to assure successful implementation and completion.

1.2 Scope

- 1.2.1 The specification covers piping that is connected to machinery or equipment in petroleum or chemical processing facilities, and provides
- 1.2.2 Guidelines for pipe and fitting material storage and handling.
- 1.2.3 Guidelines for unloading and stacking of pipe.
- 1.2.4 Initial requirements for field installation of mechanical equipment and associated piping and appurtenances.
- 1.2.5 The minimum requirements for flanged, bolted and welded connections.
- 1.2.6 Conflicts between this specification and the construction drawings shall be resolved, in writing, with the Owner's Representative, prior to construction.

2.0 References**2.1 Process Industry Practices**

- American Petroleum Institute, API Recommended Practice 686, Machinery Installation and Installation Design, Chapter 6 – Piping

2.2 Industry Codes, Standards, and Regulations

- Code of Federal Regulations, Title 49, Transportation of Hazardous Liquid by Pipeline, Part 195.
- Code of Federal Regulations, Title 49, Transportation of Natural or Other Gas by Pipeline, Part 192.
- American Society of Mechanical Engineers, ASME B31.4.
- American Society of Mechanical Engineers, ASME B31.8.

2.3 Sunoco Standards

- Sunoco Logistics Construction Specification 0308, "Pipe Padding and Backfill".
- Sunoco Logistics, LP, Specification SP-04-0004, Factory Applied Fusion Bonded (FBE) Coating.
- Sunoco Logistics, LP, Construction Specification 0505, "Machinery Alignment Procedure."



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- Sunoco Logistics, LP, Construction Specification 0508, "Grouting of Machinery."
- Sunoco Logistics, LP, Construction Specification 0800, "Welding Requirements for Non-DOT Facilities."
- Sunoco Logistics, LP, Construction Specification 0801, "Welding Requirements for DOT Facilities."
- Sunoco Logistics, LP, Construction Specification 0502, "Underground Pipe Installation."
- Sunoco Logistics, LP, Hydrotesting Procedure, PR-11-0004.
- Sunoco Logistics, LP, Flange Bolting Procedure, PR-11-0038.

3.0 General – Requirements/Procedure

3.1 Material Receipt

- 3.1.1 The Contractor and Owner's representative shall verify receipt and inspect all material for damages incurred during shipment and properly document deficiencies.
- 3.1.2 The Contractor shall unload pipe, fittings, and equipment and assumes responsibility for handling and storage until the project is completed.
- 3.1.3 All material transfer shall be documented on the proper material transfer forms and both the Contractor and Owner's Representative shall sign each transfer form and a copy of each will be furnished to the Contractor.
- 3.1.4 Contractor supplied material remains the responsibility of the Contractor until the final acceptance of the completed work by the Owner's Representative.

3.2 Material Storage

- 3.2.1 The storage location of materials shall be mutually agreed upon by the Owners Representative and Contractor. Typical storage of pipe and fittings will be on or near the construction site, unless unfavorable conditions exist.
- 3.2.2 The Contractor shall store material and equipment that could be damaged by exposure to the elements inside a suitable shelter until required to be installed.
- 3.2.3 Liner material shall be stored in a dry location in a manner to prevent damage and telescoping of the rolls and to limit exposure to sunlight.
- 3.2.4 The Owner may warehouse certain delicate, critical, or other material at a Company Owned warehouse as it deems necessary. The Contractor is responsible for the safe handling and transportation of such material to the construction site, when required.
- 3.2.5 The contractor is responsible for preparing all storage/stockpile sites for unloading, stockpiling, and placement of pipe and material.

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3.2.6 The Contractor is responsible to clean and restore all stockpile/storage sites to the satisfaction of the Owner. Work shall not be considered satisfactory until approved by the Owner's representative.

3.2.7 Upon project completion the Contractor is responsible for loading, transporting, and unloading of material to an Owner's facility as directed by the Owner's representative.

3.3 Material Handling

3.3.1 The Contractor shall handle pipe and material in a manner to avoid damage.

1. The dropping, dragging, or skidding of pipe is not permitted.
2. Caliper hooks and forklifts used shall be properly padded with belting material, brake lining, plastic, or other approved padding material. End hooks may be used for unloading and loading pipe. End hooks shall be made of malleable iron or other approved non-brass material and shall be faced with belting material, brake lining plastic, or other approved material. Each shall be properly shaped and sized to engage at least one-eighth of the pipe's inside circumference and with a width of three (3) inches for single joints and six (6) inches for double joints. Rivets or other metallic fasteners used to hold the protective facing shall be suitable countersunk. Slings used for pipe handling shall be of such length that the angle formed between each leg of the sling and the pipe is a minimum of 30 degrees.

3.3.2 The Contractor is responsible to replace and/or repair all material at their expense for defects created as a result of unloading, storage, handling, or negligence.

3.3.3 Necessary repairs that are not a result of the Contractors unloading, storage, handling, or negligence, shall be reimbursed according to the unit prices in the Contractor's proposal.

1. Repairs shall be performed at the discretion of the Owner, and the Contractor shall sign the Owner's Daily Progress Report provided for this purpose.
2. Daily Progress Reports will be used by the Owner to verify the Contractors invoice for additional compensation.

3.3.4 Stocking Pipe

1. The height of the stockpile shall not exceed 8 tiers of bare pipe.
2. A minimum of 10 feet shall be maintained between adjacent stockpiles.
3. Timber supports shall be utilized to protect the pipe from damage due to uneven terrain and load distribution, and to minimize corrosion.
 - A. The Contractor is responsible for supplying/furnishing all timber supports
 - B. Timber supports shall be a minimum of 6 inches wide.
 - C. Every third pipe joint shall be blocked with one 6 inch wide block, nailed to each support timber, to prevent the movement of pipe.



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4. For single joints, a minimum of three supports are necessary. For double joints a minimum of six supports are necessary.
5. Supports shall be placed near the ends of the joints and shall not exceed spacing intervals greater than 10 feet measured along the pipe.

3.3.5 Damaged pipe shall be placed on a separate stockpile, clearly marked and visible for subsequent inspection.

4.0 Execution**4.1 Equipment Installation**

- 4.1.1 Remove all packaging, supports, bracing, etc. installed to prevent damage during shipment, storage, and placement.
- 4.1.2 Check machinery for correct rotation and freedom of moving parts before operating.
- 4.1.3 Install temporary strainers immediately upstream, and prior to operating pump units when new construction activities may have caused slag or other debris to be in the pipeline components.
- 4.1.4 Check foundation bolts for proper location.
- 4.1.5 Prepare areas which will be covered by grout and clean bottom surface of equipment.
- 4.1.6 Follow manufacturer's guidelines and/or construction drawings for proper mounting and installation.
- 4.1.7 Carefully level equipment, where applicable, to correct elevation, being careful to distribute loads on wedges or jackscrews as evenly as experienced judgment will permit.
- 4.1.8 When the installation is level, install nuts on bolts and tighten only sufficiently to prevent movement during grouting.
- 4.1.9 For Machinery Alignment, refer to Sunoco Logistics, LP, Construction Specification 0505.
- 4.1.10 For Grouting of Machinery, refer to Sunoco Logistics, LP, Construction Specification 0508.

4.2 Piping

- 4.2.1 All piping and equipment shall be thoroughly swabbed clean of all dust, refuse, welding spatter, etc., prior to tie-in or final bolting.
- 4.2.2 All piping supports shall be checked for location before equipment is piped up. Temporary supports and travel stops, if used, shall be removed, and proper permanent supports installed before job closure, or equipment start-up if inspection and engineering deems necessary.
- 4.2.3 Where required pipe supports shall have fiberglass (FRP) spacer installed per the manufacturers' procedures to avoid all metal to metal contact.



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- 4.2.4 All buried piping shall be coated and comply with the requirements of Sunoco Logistics, LP, Construction Specification, 0502 – “Underground Pipe Installation”.
- 4.2.5 Welding on suction and discharge lines shall be completed before equipment is piped up.
- 4.2.6 All open ends shall be securely closed at the end of each day's work and such closures shall not be removed until the work resumes.
- 4.2.7 Drain and safe all piping as required for completion of the work. Install sheetblanks and / or blind flanges on lines as necessary.
- 4.2.8 If lamination, split ends or other pipe defects are found, that length of pipe containing the defect shall be cropped, repaired or removed at the direction of the Owner's Representative.
- 4.2.9 The Contractor shall insure code and owner inspections are completed and all pressure testing in accordance with Owner's Pressure Testing Specification (PR-11-0004), and the SPL inspector must be completely satisfied with the performance and results of the test before work will be approved.

4.3 Connections**4.3.1 Flanged Connections**

1. Follow Sunoco Logistics Flange Bolting Procedure, PR-11-0038
2. The Contractor shall insure that all flange faces are parallel and correctly centered prior to final bolting. Force will not be permitted in attaining alignment and a flexitallic gasket of proper size and thickness shall be installed in each.
3. Stud bolts shall be tightened in diagonal sequence and shall be centered with equal threads visible on both sides. Bolts shall be uniformly tightened to produce a leak proof joint but shall not be tightened excessively so as to cause yield or permanent set. A torque wrench should be used for bolt tightening. (Reference PR-11-0038).
- 3-4. Buried flanged connections are not permitted unless approved by engineering.

4.3.2 Threaded Connections

1. The Contractor shall provide all necessary pipe cutters and threading equipment to make required threaded lengths. Damaged threads shall be cut off and the pipe re-threaded at no expense to the Owner.
2. The Contractor shall properly align all threaded joints. Pipe entering unions shall be true to centerline so unions do not have to be forced for makeup. Threaded pipe shall not project through fittings to cause interference with valves or other operating mechanisms.
3. Buried threaded connections are not allowed.
4. Close nipples shall not be used unless absolutely necessary and approved by the Owner's Representative.
5. Pipe wrenches shall not excessively scar the pipe.



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4.3.3 Welded Connections

Refer to Sunoco Logistics, LP, Construction Specification 0800 or 0801, or Welding Manual as appropriate.

End of Specifications

5.0 Revision Log

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Subject:

Protection of Equipment During Construction

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Sankar Raj Devarpiran [REI]

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1.0 Introduction

1.1 Scope

- 1.1.1 This specification covers requirements for the care and protection of mechanical equipment stored outdoors which shall include, but not be limited to, pumps, motors, fans, and instrumentation units by Equipment Suppliers and Contractors during construction.
- 1.1.2 This specification is applicable to short term, job site protection while in field storage, after installation, and during the period prior to commissioning.

2.0 References

The publications listed below form part of this specification. Each publication shall be the latest revision and addendum in effect on the date this specification is issued for construction, unless noted otherwise.

- American Petroleum Institute - API Recommended Practice 686
- Process Industry Practice - PIP REIE 686

3.0 Responsibilities

- 3.1 The Contractor is responsible for the unloading, security and care of materials furnished by both the Contractor and the Owner. These materials must be received, handled, and stored in accordance with all of the manufacturer's recommendations, this specification, and/or as indicated by the Owner. In cases where the manufacturer's requirements or recommendations differs from the instructions provided in this document, the owner's project engineer shall be consulted to determine which takes precedence.
- 3.2 The contractor is expected to provide whatever security measures are necessary to ensure that all materials remain on site, regardless of the location of the storage location. If anything becomes lost, stolen or damaged, it shall be the Contractor's responsibility to replace the material at their cost with the duplicate material (same manufacturer and model number). All costs associated with this material replacement, including shipping costs, etc., shall be entirely borne by the Contractor.

4.0 Jobsite Receiving and Inspection

Upon arrival of the machinery or portions thereof at the jobsite:

- 4.1 Visually inspect components for physical damage or contamination by opening packages and crates. Hermetically sealed containers should not be opened, but visually inspected for damage and the hermetic seal maintained.
- 4.2 Verify that shipping protection has been applied and is still in effect.
- 4.3 Verify that shop inspection has been completed and that the vendor has supplied the purchase order documentation and packing lists.
- 4.4 Verify that loose components and separate packages match the packing lists.

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- 4.5 Verify that special handling instructions are provided and carried out.
- 4.6 Verify proper identification of the components.
- 4.7 Perform visual inspection of components for compliance with project requirements.
- 4.8 Inspect carbon steel or other ferrous flange faces for damage and coat with type A, B, or D preservative, unless prohibited by process application (see 4.8.1). Reinstall protective covers. Where car seals on inspection covers or flanges have been specified, inspect the car seals for integrity (see 4.8.2).
 - 4.8.1 Preservative types are described in Appendix A. Final selection of the preservative depends on the type of storage (indoor, outdoor, sheltered), weather conditions, and atmospheric corrosion potential. Equipment data sheets and manufacturer's instructions shall be reviewed to determine if there are specific preservative requirements. Refer to the notes in Appendix A for additional details.
 - 4.8.2 Use caution with soft-gasket flanges. Soft gaskets may absorb water and corrode carbon steel flanges.
- 4.9 Verify that plugs and caps are in place, desiccants are unsaturated, and equipment is lubricated, as required. Nonmetallic (such as plastic) plugs and caps shall not be used.
- 4.10 Inspect grout surfaces for proper factory blasting and coating.
- 4.11 Tapped openings in the stuffing boxes and gland plates shall be closed and sealed with pipe plugs. Plug material shall be of the same or better than seal gland plate metallurgy. As a minimum, the plugs shall be stainless steel.
- 4.12 When specified, impact-measuring devices shall be inspected to determine if the equipment has been exposed to any excessive shock loads. Where required, the manufacturing representative shall be present.
- 4.13 Record all inspections. (Refer to Appendix B, Machinery Receiving & Protection Checklist)
- 4.14 Report any damage to the shipping company and vendor immediately. Ensure that any claim forms required by the shipper or vendor are completed.

5.0 General Instructions – Jobsite Protection

- 5.1 Manufacturer's or vendor's recommendations for storage and protective care shall be reviewed by owner's project engineer and shall be strictly followed when transmitted to the field. If the manufacturer's recommendations are not available, the information included in this recommended practice shall be used as a minimum acceptable guide.
- 5.2 Review the procurement / shipping documents to determine if the equipment had been prepared for a predetermined storage period. In such cases, redundant preparation procedures would be postponed until the initial time period runs out.
 - 5.2.1 It is recommended that where machines are to be partially or completely disassembled for storage preservation or inspection by the contractor or user, the vendor's service representative should be on site to ensure the accuracy of the work and the preservation of the warranty.

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- 5.3 Records documenting the following information are to be kept by field material control personnel using the forms referenced:
 - 5.3.1 Conditions of equipment and materials upon arrival at the jobsite, before and after unloading. Use the checklist in Appendix B.
 - 5.3.2 Maintenance and storage procedures followed, and dates maintenance was performed. See forms provided in Appendix B.
- 5.4 All equipment and material shall be stored free from direct ground contact and away from areas subject to ponding water. As a minimum, laydown areas shall be graveled areas.
- 5.5 For outdoor storage, even cross-cut timber with at least a 10 centimeter x 10 centimeter (4 inch x 4 inch nominal) cross section, laid flat and level, shall be used for laydown. Equipment weight shall be considered when selecting timber size. Warped timber or telephone poles are not acceptable. Timbers shall be placed perpendicular to major support structures and shall be full width of the skid or baseplate.
- 5.6 Indoor storage should be used whenever possible.
- 5.7 Temporary protective coverings shall allow free air circulation to prevent humidity condensation and collection of water.
- 5.8 The contractor shall attempt to preserve and maintain the integrity of the delivery packaging whenever appropriate. Replace packaging material after inspection. Review the integrity of control boxes and panels with respect to weather protection. Store indoors if required.
- 5.9 All carbon and low alloy steel shall be protected from any contact with corrosive atmospheres or wet atmospheres so as to prevent rust formation.
- 5.10 Painted surfaces shall not require additional protection but shall be examined periodically for signs of rusting. Touch up, using the manufacturer's recommended methods and materials, shall be performed within a practical and reasonable period of time.
- 5.11 All items with machined surfaces shall be stored so that the machined surfaces can be examined periodically (monthly) for signs of rust. These surfaces shall be coated with a manufacturers approved protective coating to prevent rust.
- 5.12 Any special parts and tools for construction purposes that accompany vendor shipments shall be tagged, protected, and stored per the vendor's and/or user's recommendations. All tags must be stainless steel and wired to the special part or tool. Paper tags are not permitted.
- 5.13 Keep the storage area and equipment clean by providing physical protection and covering when work operations such as concrete chipping, sanding, painting, and rigging are performed in the area. Stainless steel shall be protected from weld splatter and grinding dust of low alloy steel.
- 5.14 The contractor shall ensure that all preservative and storage lubricants are suitable for the specific application.
- 5.15 All equipment cavities, cooling passages, mechanical seals, positive displacement pump plunger cavities, and so forth, shall be drained of all water to prevent damage due to freezing temperature.
- 5.16 Dirt, ice, salt, and other foreign matter shall be removed as soon as possible after arrival on site.

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5.17 Unless stated differently in subsequent sections on specific equipment, the following shall apply:

5.17.1 Oil-lubricated bearing housings, seal housings, stuffing boxes, hydraulic equipment, and gear cases shall be fogged and approximately one-fourth filled with a manufacturer approved preservative oil. All openings shall then be closed and sealed tightly.

5.17.2 When specified by the owner, every other month the condition of the preservative oil shall be checked by measuring the total acid number (TAN) of the oil. If the TAN is less than 0.2, the oil shall be replaced with fresh oil. The date when checked and the TAN shall be recorded in the inspection records. Check with the oil supplier to determine if it needs to be heated for replacement.

5.17.3 All externally exposed, bare carbon steel or cast iron surfaces including shafts and couplings (except elastomeric components) shall be coated with type A, B, or D preservative. All machined surfaces shall be coated with type A, B, or D preservative. All exposed machined surfaces shall also be wrapped with waxed cloth (see 5.17.3.1).

1. Moisture can be held under waxed cloth if not tightly sealed. Periodic inspections under the cloth may be warranted.

5.17.4 Verify that grease-lubricated bearings have been greased by the manufacturer with the specified grease. Some grease is not compatible when mixed.

6.0 Lubricants and Preservatives

6.1 The table and notes in Appendix A describe some of the physical characteristics, application methods, and life expectancies of preservative types A, B, C, and D that are referred to in this practice. Final selection types shall be approved by the equipment manufacturer and owner's project engineer.

6.2 Care shall be taken to ensure the compatibility of the preservative with elastomeric parts, seals, gaskets, and so forth.

6.3 All lubricant and preservative Material Safety Data Sheets (MSDSs) shall be available, and associated hazards reviewed with all personnel handling and using these materials.

6.4 The term desiccant shall mean silica gel or any other approved water absorbing material. All desiccants shall have prior approval from the manufacturer or the user designated representative. Check desiccant monthly. Replacements shall be approved by the user.

6.5 Preservatives shall not be used on surfaces where prohibited by process application.

7.0 Bolts

7.1 All loose assembly bolts, nuts, and fasteners shall be packaged, identified, and stored in a sheltered area.

7.2 Type B or type C preservative shall be applied to the threaded portion of all anchor bolts, washers, and nuts that are not galvanized or plated.

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8.0 Spare Parts, Special Tools, and Miscellaneous Loose Items

- 8.1 Items purchased as spare parts shall be tagged and handed over to the owner's designated machinery representative upon receipt and completion of jobsite receiving inspection per 3.1
- 8.2 Storage and protective maintenance of miscellaneous loose items shall be as directed by the manufacturer.
- 8.3 Extra drawings, manuals, records or electronic files shipped with the equipment shall be saved and handed over to the user.
- 8.4 Special tools shall be kept by the contractor until work has been completed, and then turned over to the owner's designated machinery representative.

9.0 Auxiliary Piping for Rotation Equipment

The following applies to auxiliary piping that is shipped loose for field assembly:

- 9.1 Pipe Components

Carbon steel pipe components that will require long-term storage outdoors during the construction period (or stainless steel in a saltwater atmosphere) shall be coated externally and internally with thinned type B or a type C preservative, unless prohibited by process application.
- 9.2 Flanges
 - 9.2.1 Flanges received bolted face-to-face need not be separated for inspection; however, the face-to-face crevice shall be coated with type A, B, or D preservative prior to outdoor storage.
 - 9.2.2 After inspection of loose flanges, flange gasket surfaces shall be coated with type A, B, or D preservative prior to outdoor storage. Flanges for pre-fabricated piping and lube oil systems shall be gasketed and covered with 5-millimeter (3/16-inch) metal covers.
 - 1. Temporary gaskets can usually be made from service sheet gasket material.
 - 9.2.3 Care shall be taken to protect gasket surfaces of loose flanges from damage during handling and storage.
 - 9.2.4 Flanges to be stored outdoors for periods exceeding six months or in corrosive atmospheres (saltwater air, industrial, and so forth) shall be coated externally and internally with thinned type B preservative.
 - 9.2.5 Preservatives shall be removed from all surfaces with a suitable solvent prior to installation of the components.
- 9.3 Valves
 - 9.3.1 Whenever possible, valves shall be stored indoors or under cover.

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- 9.3.2 All machined surfaces such as valve stems (including threads), packing glands, and bonnet bolts shall receive a heavy coat of appropriate grease or equivalent for atmospheric corrosion protection.
- 9.3.3 Valve flange gasket surfaces shall be coated with type A, B, or D preservative prior to reinstalling protective covers after internal inspection.
- 9.3.4 Protective covers shall be made of a weatherproof material and of such construction to provide a watertight seal. Plastic plugs and flange covers are not permitted.
- 9.3.5 All ball valve internals shall be coated prior to reinstalling protective covers after internal inspection.
- 9.3.6 All ball valves shall be protected and stored in the open position.
- 9.3.7 Multiple turn, metal-seated valves shall be stored in the closed position to minimize the length of stem exposed. Multiple turn, soft-seated valves shall be stored one turn from the closed position. Valves shall be stored with valve openings horizontal to prevent water accumulation.
- 9.3.8 All valves shall be stored above grade on a well-drained, hard surface.
- 9.3.9 Periodic (at least once per month) checks shall be made to ensure that protective procedures are effective. If deterioration is observed, the user shall be notified so that appropriate corrective action can be initiated.
- 9.3.10 Packing inhibitors are usually effective for only six months. Valves with packing that are stored for longer periods shall be checked and protected against stem corrosion if necessary.
- 9.3.11 Preservatives shall be removed with solvent from all surfaces prior to installation of valves.
- 9.3.12 All ring joint flanges shall be examined when received and the condition recorded. Spot checks for corrosion shall be made monthly while in storage.

10.0 Fans and Blowers

The following procedure shall be used for receiving and protecting fans and blowers:

- 10.1 Coat exposed machined surfaces and shaft extension with type A, B, or D preservative.
- 10.2 Fill bearing housing to bottom of shaft with the manufacturer's recommended oil.
- 10.3 Mark shaft and rotate 2-1/4 revolutions weekly, record protective activity in the inspection records. Shaft rotation must be accomplished with a strap wrench or other non-marring device.
- 10.4 Preservatives shall be removed with solvent from all surfaces prior to installation of fans and blowers.
- 10.5 Install weatherproof protective covers of such construction to provide a watertight seal on all openings. Plastic plugs and flange covers are not permitted.

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11.0 Pumps

The following procedure shall be used for receiving and protecting pumps during the storage and installation period at the jobsite:

- Coat coupling parts, except elastomeric parts and flexible stainless steel discs, with type A, B, or D preservative.
- Shipping covers shall be removed, flange gasket surfaces inspected, and internals checked for cleanliness. Coat flange surfaces with type A, B, or D preservative.
- Tag all loosely shipped items (such as couplings, oilers, and seal system components, if loose) with the pump identification number and store in a covered area.

11.1 Centrifugal Pumps

- 11.1.1 Install weatherproof protective covers of such construction to provide a watertight seal on all openings. Plastic plugs and flange covers are not permitted.
- 11.1.2 Fill bearing housings to the bottom of shaft with the manufacturer's recommended oil.
- 11.1.3 For cast iron, carbon steel, and low alloy pumps, fill the pump casing with type C preservative and rotate to coat the internals.
- 11.1.4 Mark shaft and rotate 2-1/4 revolutions weekly, record protective activity in the inspection records. Shaft rotation must be accomplished with a strap wrench or other non-marring device.
- 11.1.5 Type D preservative shall be removed with solvent from all surfaces with solvent prior to installation of pump.
- 11.1.6 Fill the piping loop for the barrier fluid of a dual seal pump with a process compatible fluid if it contains any carbon steel components.

11.2 Vertically Suspended Pumps

- 11.2.1 Apply type C preservative to shaft journals at sleeve bearings and to thrust bearing disc.
- 11.2.2 Fill bearing housings to the bottom of shaft with vendor recommended oil.
- 11.2.3 Coat the bowl assembly with type A, B, or D preservative and close both ends.
- 11.2.4 Coat barrel flange, discharge head flanges, stuffing box, and all other machined surfaces with type A, B, or D preservative.
- 11.2.5 Install weatherproof protective covers of such construction to provide a watertight seal on all openings. Plastic plugs and flange covers are not permitted.
- 11.2.6 Type D preservative shall be removed with solvent from all surfaces prior to installation of pump.

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0504 Rev. 1**11.3 Reciprocating Pumps**

- 11.3.1 Remove pistons and rods, if recommended by the manufacturer; coat with type A, B, or D preservative; tag each part with the equipment number; and store in covered area.
- 11.3.2 Remove rod packing, if recommended by the vendor; tag; and store in covered area.
- 11.3.3 Remove suction and discharge valves; dip in type A, B, or D preservative; wrap in waxed cloth; tag; and store in covered area.
- 11.3.4 Fill crankcase with type C preservative to the recommended level.
- 11.3.5 Coat cylinder wall and distance piece wall with type C preservative.
- 11.3.6 Type D preservative shall be removed with solvent from all surfaces prior to installation of pump.

12.0 Motors

The following procedure shall be used for receiving and protecting electrical motors during the installation period at the jobsite. Specific storage instructions are normally provided by all motor manufacturers. Failure to follow these instructions may void the warranty. The procedures that follow must be adhered to, provided they do not invalidate the manufacturer's warranty:

12.1 Receiving Inspection of Motors

After receipt at site but prior to any motor being stored or installed, the following shall be performed:

- 12.1.1 An insulation resistance-to-ground test shall be made and recorded. This log will show the dates of the test and the insulation resistance value.
- 12.1.2 Oil levels shall be inspected. An inspection shall be made for any evidence of oil leakage.
- 12.1.3 Shafts shall be rotated and checked for freedom of movement.

12.2 Storage

- 12.2.1 Fill bearing housing with recommended oil if not factory lubricated or the level is low.
- 12.2.2 Rotate the shaft manually until the lubricant is evenly distributed to wearing surfaces. Rotate 2-1/4 revolutions weekly thereafter. Shaft rotation must be accomplished with a strap wrench or other non-marring device.
- 12.2.3 Coat shaft with type A, B, or D preservative.
- 12.2.4 Wrap shaft seal areas with waxed cloth.
- 12.2.5 Apply type A, B, or D preservative to baseplate and motor case feet.

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12.2.6 Store motors indoors when possible. A motor is suitable for outdoor storage if the enclosure type is TEFC, TENV, or explosion proof. Motors without space heaters shall not be stored outdoors without user's approval unless provisions are made by the installer to supply an adequate source of heat to the motor to protect it from moisture. If unable to store indoors, motors shall be stored in their operating position on a well-drained hard surface.

12.2.7 When a space heater is provided by the manufacturer, it shall be connected, energized, and operated continuously until the motor becomes operational.

1. Proper warning signs must be installed to prevent injury or electrical shock to personnel.

12.2.8 Preservatives shall be removed with solvent from all surfaces prior to installation of motor, using caution to not have solvent contact the windings.

12.3 Testing

Insulation resistance of all motors shall be tested upon receipt, just prior to installation, and just prior to startup and shall be recorded in the inspection records. The test voltage levels and the insulation resistance shall be per the manufacturer's instructions. If the megger readings do not meet the manufacturer's requirements, winding dry out may be required. Dry out the stator per the motor manufacturer's instructions. Other methods may be harmful to the windings.

13.0 Instrumentation on Package Machinery

13.1 All instruments shall be inspected by qualified personnel for compliance to purchase specifications, proper tagging, and shipping damage.

13.2 After inspection, instruments are to be replaced in their original factory boxes, properly tagged, and stored on shelves in a dry enclosed area.

13.3 For instruments or control panels that have been pre-mounted on the machinery package that cannot be stored in a dry, enclosed area, the user and manufacturer shall be consulted.

13.3.1 Removal and indoor storage of pre-mounted instruments and control panels may be required if such devices cannot be protected from rain, humidity, temperature, or dusty conditions. Explosion-proof enclosures are not necessarily weatherproof enclosures. Open conduit connections can allow entrance of moisture. This subject should have been addressed during the procurement or shop inspection stage, but is sometimes overlooked.

13.4 Electronic Instruments

13.4.1 Electronic instruments shall be stored in a dust free room between 8°C and 45°C (45°F and 110°F).

13.4.2 If humidity is excessive, seal and store the instruments in plastic wrap, place in a box with desiccant outside the plastic wrapping, and store indoors. Take care that the desiccant does not contact any wiring, terminals, or electronic parts.

13.4.3 The manufacturer's recommendations shall be reviewed to determine if climate-controlled storage facilities are required.

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13.5 Pneumatic Instruments

Storage in a dry enclosed area is sufficient for pneumatic instruments.

13.6 Instrument Cases

13.6.1 Instrument cases with electronic parts, relays, and so forth, shall always be opened and checked by qualified personnel, unless shop inspections have been made and documented.

13.6.2 If the instrument case is in a weatherproof housing, reseal and store the instrument in a room between 8°C and 45°C (45°F and 110°F).

13.6.3 In an explosion-proof housing, store in boxes with desiccant.

13.6.4 If covers need to remain left open and unsealed, place the boxes in an indoor storage environment.

13.7 Local Control Panels

13.7.1 Open packaging enough to identify the control panel, reseal, and place in a dry enclosed area between 8°C and 45°C (45°F and 110°F).

13.7.2 When in a high-humidity area, put desiccant inside packaging before resealing.

13.8 Dial Thermometers, Pressure Gauges, and Gauge Glasses

Protect against physical damage from construction activities, or remove, tag, and store in a dry enclosed area. Process connections shall be capped or plugged with metal caps/plugs until the instruments are reinstalled.

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14.0 Appendixes

14.1 Appendix A – Characteristics of Conventional Storage Preservatives

14.1.1 Table A-1- Storage Preservation

Storage Condition and Severity	Outdoor storage, general exposure to elements	Indoor Storage Under Severe Conditions, or Outdoor storage (partial shelter) under moderate conditions, or outdoor storage with exposure to elements for short term only	Indoor Storage under moderate conditions	Outdoor storage with exposure to elements under the most severe conditions
	A	B	C	D
Product and Typical Characteristics	Firm coating, resistant to abrasion	Soft coating (self-healing)	Thin Oily Film	Asphaltic film, needs removal before part is used
Density Kg/m ³ at 15.6° C	868.5	923.7	876.9	922.5
Lb/gal at 60° F	7.25	7.71	7.32	7.7
Viscosity cSt at 40° C	--	--	14	149
cSt at 100° C	--	--	3.3	--
SSU at 100° F	24.8	33.1	79	800
SSU at 100° F	--	--	37.4	--
Flash Point °C	279	260	166	38
°F	535	500	330	100
Melting or Pour Point °C	73	66	-4	--
°F	164	151	+25	--
Unworked Penetration At 25°C (77°F)	75	245	--	--
Film Thickness, mil	1.6	1.6	0.9	3.0
Approximate Coverage m ² /liter	26	26	44	11
sq ft/gal	1000	1000	1800	450
Non-volatiles, %	99	99	--	55
Methods of application/ temperature, °C	Dip/85 brush swab/60-71	Dip/77 Swab/18-27	Roller coat, brush, mist	Spray, dip, or brush/ambient



Sunoco Pipeline L.P. and Affiliates CONSTRUCTION STANDARDS

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Maximum time until
inspection and
possible reapplication
under condition:

Mild
Moderate
Severe

Extended
1-3 years
6-12 Months

Extended
1-3 years
6-12 Months

6-12 Months
1-6 Months
Not Recommended

Extended
1-3 Years
6-12 Months

Refer to PIP REIE 686 for notes on above table.

14.2 Appendix B – Machinery Receiving and Protection Checklist

Project No:	Equip. Tag No.:	Report No.:
Prepared By:	Storage Location:	Date:
Equipment Description:		

		Initials	Date
	Job site receiving and Inspection		
1.	Visual inspection for physical damage or contamination		
	Comments (Before unloading)		
	Comments (After unloading)		
2.	Shipping protection intact?		
3.	Have offsite (shop) inspections been made?		
4.	Loose components/packages match packing lists?		
5.	Are special handling instructions required (and carried out)?		
6.	Components properly identified?		
7.	Do components comply with project requirements?		
8.	Flange faces undamaged and properly coated?		
9.	Plugs/caps in place, desiccants unsaturated, and equipment lubricated?		
10.	Grout Surfaces clean and coated?		
11.	Tapped openings in stuffing boxes and gland plates sealed?		
12.	Impact measuring devices inspected?		
13.	Damage reports completed and issued to shipper/vendor?		
	General Instructions – Jobsite Protection		
14.	Are manufacturer's recommendations for storage and protection available?		
	Note: If so, the manufacturer's recommendations take precedence, but continue to follow this checklist for items not covered by manufacturer		

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15.	Equipment/material free of ground contact? Lay down area graveled as a minimum		
16.	For outdoor storage, is equipment on timber?		
17.	Protective coverings allow free air circulation and prevent collection of water? Note: Reuse delivery packaging, if possible.		
18.	Carbon and low alloy steel protected from corrosive or wet atmospheres?		
19.	Special parts and tools tagged and handed over to owner?		
20.	Equipment protected from construction operations such as chipping, sanding, painting, rigging, welding, and so forth.		
21.	For periodic rotation of equipment, are shipping blocks, desiccant bags, and protective plastic clear of moving parts? Is equipment properly lubricated for rotation?		
22.	Have proper preservatives been selected?		
23.	All cavities, cooling passages, and so forth, drained of water to prevent freezing?		
24.	Dirt, ice, and salt removed?		
25.	Unless stated differently in subsequent sections on specific equipment, the following applies		
26.	Oil lubed bearing housings, seal housings, stuffing boxes, hydraulic equipment, and gear cases fogged and 1/4 filled with approved oil?		
27.	When specified, measure and record TAN number		
28.	Exposed carbon steel coated with type A, B, or D preservative? Machined surfaces coated with type A, B, or D and wrapped with waxed cloth?		
29.	Grease lubed bearings greased by the manufacturer?		
	Lubricants and Preservatives		
30.	Are selected preservatives compatible with elastomeric parts, seals, gaskets, and so forth?		
31.	MSDSs on file and hazards reviewed?		
	Bolts		
32.	Loose bolts, nuts, and fasteners identified and stored in sheltered area?		
33.	Preservative applied to non-galvanized or plated items?		
	Spare Parts		
34.	Spare parts inventoried and issued to User upon receipt?		
	Auxiliary Piping For Rotating Equipment		
35.	Pipe components coated internally and externally for long-term storage?		
36.	Flanges inspected and coated?		
37.	Valves inspected and coated? Ball valves in open position? Gate and globe valves in closed position and stored horizontal?		
	Fans and Blowers		
38.	Have all exposed low alloy surfaces and shafts been coated with preservative?		
39.	Bearing housing oil level correct?		
40.	Weatherproof covers installed?		
	Pumps—General		
41.	Coupling parts, except elastomers, coated?		

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42.	Have flange surfaces been inspected and coated?		
43.	Have loose components been tagged?		
	Centrifugal Pumps		
44.	Have all openings been covered?		
45.	Have bearing brackets been filled with oil?		
46.	Have low alloy pump casings been coated?		
47.	Barrier fluid piping filled?		
	Vertical Suspended Pumps		
48.	Has preservative been applied to shaft journals at sleeve bearing and thrust disc?		
49.	Bearing brackets completely filled?		
50.	Bowl assembly, barrel flange, discharge head flanges, stuffing box, and machined surfaces coated?		
51.	Weatherproof covers installed on all openings?		
	Reciprocating Pumps		
52.	When recommended by manufacturer, have pistons and rods been removed, coated, tagged, and stored in covered area?		
53.	Has rod packing been removed and tagged, when required?		
54.	Have suction and discharge valves been removed, coated, and tagged?		
55.	Has crankcase been filled with preservative?		
56.	Have cylinder and distance piece walls been coated?		
57.	Exposed shafts coated?		
	Motors		
58.	Have motors been inspected and tagged?		
59.	Has an insulation test been made and logged? Have oil levels been checked?		
60.	Has shaft been coated?		
61.	Have seal areas been covered with waxed cloth?		
62.	Have motor baseplate or feet been coated?		
63.	Have non-weatherproof motors been stored indoors?		
64.	Have space heaters been energized? Have warning signs been posted?		
	Instrumentation		
65.	Do instruments comply with specifications, and are they properly tagged?		
66.	Are loose instruments stored in a dry enclosed area, in original factory packaging?		
67.	Can pre-mounted instruments be stored outdoors?		
68.	Are electronic instruments stored in a dry heated room?		
69.	Are pneumatic instruments stored in a dry area?		
70.	Are instrument cases and local control panels stored in a dry heated room?		
71.	Are thermometers, pressure gauges, and gauge glasses protected from physical damage?		
	VALVES		
72.	Valves properly tagged?		



Sunoco Pipeline L.P. and Affiliates CONSTRUCTION STANDARDS

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73.	Do valves meet specifications?		
74.	Are exposed surfaces protected or coated to prevent rusting?		
75.	Are weatherproof covers provided?		
76.	Are multi-turn valve stems in closed position?		
77.	Are valves stored in a way to prevent water accumulation?		

Appendix B – Machinery Receiving and Inspection Checklist

Equipment No: _____

PERIODIC SERVICES BETWEEN TIME RECEIVED AND START UP				
ITEM	INTERVAL	DATES/INITIALS		
Visual inspection that coverings and coating are intact	Monthly			
Inspection of painted surfaces	Monthly			
Inspection of machined surfaces	Monthly			
Inspect desiccant	Monthly			
Motor insulation resistance test	2 Months			
Inspect bearing housing; replace/refill as necessary	2 Months			
Check TAN of preservative oil, if specified	2 Months			
Oil Check	2 Weeks			
Rotation of shafts No. of turns _____(Note 1)	Weekly			

Note 1: Number of turns to be specified at the start of the project



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15.0 Revision Log

Revision No.	Revision Date	Document Authorizer	Document Reviewer	Document Author	Document Administrator	Revision Details
1	10/24/2006			Raj Sankar	NA	
2	09/20/2013	Lindy Barile	REI		NA	General Updates

Subject:
Pigging of Pipelines

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1.0 Introduction

1.1 Purpose

This procedure shall outline operational requirements to perform maintenance pigging work, inclusive of periodic in line cleaning, product nitrogen displacements, and in line inspection pigging for Sunoco Logistics pipeline systems.

1.2 Scope

1.2.1 This document is intended to outline basic requirements and procedures to perform normal periodic pipeline segment cleaning, product nitrogen displacement and cyclic in-line inspection by smart tool pigging.

1.2.2 This document provides guidance and required procedures to aid in pig selection and pig run speed requirements. These are considered the minimum requirements. Specific cases may be handled under other methods and procedures, but approval is required by Engineering.

2.0 Definitions

2.1 Owner

Sunoco Logistics LP and its affiliates.

2.2 Area

Sunoco Pipeline L.P. Eastern Area (SPLPEA) Operations or Sunoco Pipeline L.P. Western Area (SPLPWA) Operations.

2.3 Engineer

An individual qualified to perform, review, or approve the detailed calculations required to verify a pressure test. This would include project engineers, operations engineers, field technical advisors, and third-party consulting engineers.

2.4 Maximum Operating Pressure

The maximum pressure that an operator may operate a pipeline segment established in accordance with DOT Part 195.406.

2.5 Pipeline Pig

An independent, self-contained utility device, which is propelled through the interior of the pipeline, driven by product flow, for the purpose of cleaning or inspecting the pipeline.

2.6 Pipe or Line Pipe

A steel tube, usually cylindrical, through which a petroleum product flows from one point to another.

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2.7 Part 195

The Code of Federal Regulations Title 49 - Transportation, Part 195 - Transportation of Hazardous Liquids by Pipeline.

3.0 Trap Requirements**3.1 Permanent Traps****3.1.1 Trap Design Principles**

1. Permanent traps should be / are installed at predetermined locations typically to segment lines into manageable distances to optimize pig runs, to coincide with locations of dirt isolation transmix tankage or pump station locations.
2. Trap placement was also predicated upon tool cup wear maximum distances and maximum available in line inspection tool memory storage.
3. Consult Managers of Engineering and Integrity for approval of new trap locations.
4. Permanent traps are defined and designed as launchers or receivers.
5. Refer to Sunoco Logistics standard trap drawings for trap dimensional requirements.
6. Oversized barrel section of the traps shall be two diameters over the nominal size of the line segment, to facilitate easy loading and unloading of tools.
7. Reducer between oversized barrel and nominal shall be Eccentric in design.
8. Four 2" taps shall be installed on the four primary axis locations of the nominal pipe directly adjacent to the outlet valve, to provide access to pull tools into the trap if required.
9. Trap doors shall be TDW Clamp Ring designer equivalent.

3.1.2 Launch Traps

1. Launch traps shall be designed with longer oversized barrels to accommodate easy loading of longer cleaning or in line inspection tools, and short nominal pipe sections to minimize overall length of the trap. Reducers shall be eccentric, to aid in uniform loading while inserting tool.
2. The kicker line shall be located between 1' and 3' from the trap door, dependent upon trap diameters, to facilitate sufficient diversion of product behind tools to accomplish successful launch.
3. Trap lengths are predicated primarily upon the longest in line inspection tools on the market to allow launch of tools from varied vendors.

3.1.3 Receive Traps

1. Receive traps shall be designed in the opposite arrangement, shorter oversized barrel and longer nominal pipe sections.
This allows the cleaning device or inspection tool to be received completely into the trap downstream of the trap valve, providing sufficient nominal pipe to fully receive the tool into the trap ahead of the valve.

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2. The kicker line shall be installed 1' to 3' from the trap door to aid in bringing the tool fully into the trap as close to the trap door as possible.

3.2 Temporary Traps

- 3.2.1 Temporary traps shall be installed in line segments without existing traps, on a per project requirement basis, to facilitate cleaning, hydrotesting and in line inspection.
- 3.2.2 Temporary traps may be designed for the required use.
- 3.2.3 Cleaning and hydrotesting may require smaller traps to accommodate smaller cleaning pigs.
- 3.2.4 In line inspection of non-trap lines shall require the installation of fully dimensioned traps as prescribed in the trap standard drawing.
- 3.2.5 Additional offset piping may be required to install the trap to lines with limited accessibility or confined areas.

4.0 Maintenance Cleaning Pigging

4.1 Purpose

Use of conventional cleaning pigs in conjunction with a pigging program outlining periodic line segment cleaning runs, will help to maintain the integrity, fitness of service and optimize efficiency of the pipeline.

4.2 Cleaning Pigs

4.2.1 General

1. Refer to Table 1 in the Appendix, to specify appropriate cleaning pig required for the level of cleaning required.
2. Cleaning activities shall be performed to help ensure continuous operation and maximize pipeline efficiency.
3. Maintenance pigging shall provide accumulation and removal of debris, foreign matter, mill scale and other deposits, both liquid and solid, that may have settled out in the line segment.

4.2.2 New Construction

1. Cleaning pig(s) shall be run through new construction / relocation piping prior to tie-in.
2. The pig shall have an appropriately sized gauging plate mounted to the tool to confirm deformations have not been introduced into the line segment through construction or handling activities.
3. Upon complete passing through the line, the gauging plate shall be inspected and approved by the Construction Manager to authorize progression to tie-in phase.

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4.2.3 Lines with < 1.5 Diameter (1.5D) Bends

1. Line segments, station piping, and spur lines that contain bends with less than 1.5D bends will not pass conventional urethane cup pigs.
2. Foam, poly, or foam disc cleaning pigs shall only be permitted.
3. Cleaning in lines of this configuration shall most likely be performed in conjunction with hydrotest or displacement activities.

4.2.4 Light Cleaning

1. Periodic use of urethane poly cup pigs shall provide minimal cleaning and debris evacuation throughout the line segment to maintain optimal pipeline pumping efficiency.
2. Refer to Table 1 in the Appendix to specify appropriate cleaning tool.

4.2.5 Moderate Cleaning

1. More intensive cleaning shall be accomplished utilizing urethane cup pigs with brush and magnet sections.
2. The magnet may be integrated in the shaft or by attachment.
3. Refer to Table 1 in the Appendix to specify appropriate cleaning tool.

4.2.6 Aggressive Cleaning

1. Aggressive line cleaning can be accomplished by use of cleaning tools outfitted with urethane blades (knives).
2. Metal blades are prohibited as they may cause gouging of the interior pipe wall.
3. Refer to Table 1 in the Appendix to specify appropriate cleaning tool.

4.2.7 Chemical Cleaning

1. Chemical cleaning is prohibited.
2. Manager of Engineering approval shall be required if such cleaning is contemplated.

4.2.8 Batch

1. Batch isolation pigs are synonymous with cleaning pigs.
2. Reference is to their purpose rather than design.

4.2.9 Dirt Isolation

1. Dirt isolation from clean product tankage is imperative upon receipt of any cleaning or inspection tool. Refer to section 5.4.
2. Product flow shall be sampled ahead of pig delivery, by OQ qualified personnel.
3. Upon first show of dirt, product flow shall be diverted to transmix tankage or temporary tankage as outlined in section

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5.0 Tool Run Procedure**5.1 Planning / Scheduling**

- 5.1.1 Cleaning pig runs shall be performed with line product used as the push medium.
- 5.1.2 Maintenance cleaning runs shall be accomplished while the lines are in service.
- 5.1.3 In line inspection smart tool runs shall be accomplished while the lines are in service. Other median such as water shall be specified if a specific business or operational issue requires dedication of other drive mediums.
- 5.1.4 Nitrogen may be utilized
- 5.1.5 Scheduling shall be initiated following existing Line Request and Work Plan procedures.

5.2 Loading / Unloading Requirements

- 5.2.1 Proper grounding and bonding procedures shall be followed while draining, bleeding and evacuating product from isolated traps prior to loading or unloading tools.
- 5.2.2 Proper grounding procedures shall also be followed while physically loading the tool into the trap.
- 5.2.3 The tools shall be sufficient loaded thru the oversized into the swage or reducer of the trap barrel to provide adequate sealing in the nominal piping to launch effectively.
- 5.2.4 Air shall be vented from the trap as barrel fill commences.
- 5.2.5 Venting shall continue until solid product stream is achieved.
- 5.2.6 Pressure shall be equalized between the trap and mainline to assure pig will not be pushed backwards out of the nominal piping.
- 5.2.7 Trap door closure sealing O-rings shall be visually inspected for defects and replaced if required, prior to closing door.
- 5.2.8 Closure O-ring shall be properly lubricated prior to closing door. Closure door mating faces shall be clean and free of dirt and debris.

5.3 Tool Speed Flow Rate Requirements

- 5.3.1 Speed and backpressure control during maintenance cleaning pig runs is not critical.
- 5.3.2 The subject line segment can be operated at normal flow rate and pressure.
- 5.3.3 Flow control either by pressure or rate shall follow normal operating conditions for the subject line segment.

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5.3.4 Refer to and become acquainted with subject line segment operating characteristics prior to initiating maintenance pigging.

5.3.5 Confer and coordinate pigging activities and flow rate requirements with Product Movement scheduling department and CCS. Refer to Table 2, Section 11 Appendix.

5.4 Containment / Dirt Isolation

5.4.1 Maintenance cleaning pig runs shall be made to remove water, debris and dirt from the line prior to running other inspection tools or improve operating efficiency and quality thru periodic in line cleaning.

5.4.2 Dirt and contaminant removal and control shall improve operating efficiencies of the system line segments.

5.4.3 Water removal from the piping system shall mitigate the potential of creating a corrosion issue with water lying within the bottom of the pipe.

5.4.4 Debris and dirt removal shall assure the quality and completeness of subsequent inspection tool runs.

5.4.5 Dirt management shall also provide additional benefits of improving continuity of insulating joints by clearing embedded dirt within the joint.

5.4.6 Multiple tool runs may be required to effectively remove all line contaminants.

5.4.7 Line cleanliness shall be measured by sampling ahead of tool and the volume of dirt removed from the trap with the pig.

5.4.8 Sampling ahead of pig receipt shall be required and performed by properly trained and OQ qualified personnel.

5.5 Cleanliness Determination

5.5.1 Cleanliness shall be measured by the clarity of the product observed and the cleanliness of the pigs encountered at the time of tool unloading from the receive traps.

5.5.2 Multiple cleaning runs may be required to accomplish the required level of line cleanliness.

5.5.3 Line segment shall be considered cleaned when dirt is observed as light loose sludge consistency with no solid component.

5.6 Debris Documentation

5.6.1 A debris tracking log shall be maintained at each receive trap location.

1. The purpose of this log shall be to measure the volume of dirt encountered during maintenance cleaning work over time.

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2. Upon completion of each tool movement the log shall be updated to provide information to the operator to formulate an effective cleaning program.
3. This information shall provide the basis in determining cleaning frequency or identify potential deficiencies within the line segment, i.e. excessive gasket winding material observed, excessive dirt accumulation, etc.

5.7 Pigging Restrictions / Exceptions**5.7.1 Eastern Area: Line segment 11047_PHRF-MHRF-6-8-3N line (MHREF-PAUL) (Internally Coated)**

1. This section of line has been treated with an internal epoxy coating to mitigate internal corrosion previously identified.
 - A. Care shall be exercised to protect this coating from damage.
 - B. Proper cleaning pig selection is critical to the protection of the coating.
 - C. Poly cup, poly disc, foam disc and poly coated foam pigs are approved for use.
2. Pigs with magnet shafts or unobtrusive magnetic attachments can be utilized to collect ferrous material from the line.
3. Due to the internal pipeline coating, aggressive cleaning pigs with brushes and knives are **prohibited**, in this line segment.
4. Due to the internal coating, chemical cleaning is also **prohibited** in this section of line.

6.0 Nitrogen Purge Pigging**6.1 Purpose**

To provide an evacuated, clean, dry and inert environment to complete pipeline maintenance work.

6.2 Tool Selection

6.2.1 Refer to Table 1, Appendix 1, to select appropriate tool for nitrogen displacement use.

6.2.2 Typically, a foam disc or urethane cup pig is approved and preferred for nitrogen displacements in short sections less than 20 miles or in lines or spur lines that have never been pigged before, where line geometry information is not available, or in lines with restrictive bend radiuses less than 1.5 diameters or with known restrictive deformations.

6.2.3 Line segments longer than 20 miles in length shall utilize urethane cup tools only.

6.2.4 The tools mentioned provide adequate continual tool surface area engagement to the pipe wall thru bends to limit nitrogen bypass and slippage.

6.3 Flow Rate Requirements

6.3.1 Optimum nitrogen displacement rates shall fall between 2.0 and 4.0 mph.

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6.3.2 Flow rate requirements shall be considered during nitrogen displacement activities. Manageable flow rates shall be utilized to control nitrogen pressure build up, limit nitrogen bypass around pigs and maintain approved delivery rates.

6.3.3 Refer to Table 2, Section 11 Appendix, for speed correlation to flow rates for various diameter line segments.

6.4 Pressure Relief Requirements

6.4.1 Nitrogen pressure injection rates shall be strictly controlled and monitored.

6.4.2 At no time shall the pressure at nitrogen injection exceed the MOP of the line segment.

6.4.3 The injection pressure from the pumper unit, tube trailer or MTVU shall be controlled and regulated by means of certified pressure relief valves.

6.4.4 MOP control limits shall be researched prior to maintenance nitrogen displacements are initiated.

6.4.5 Injection pressure shall be monitored at the injection source by pressure gauge.

6.4.6 Injection pressures shall be maintained at line segment COL or less during nitrogen displacement activities.

6.5 Displacement Product Requirements

6.5.1 Distillates shall be the preferred displacement product ahead of nitrogen purges.

6.5.2 Distillate evacuation provides a vapor free atmosphere for subsequent maintenance activities, i.e. piping replacement bolting, welding activities, etc.

6.5.3 Other products may be only medium available and may be substituted, however may result in additional handling considerations and requirements such as mud packing to safe the line segment for subsequent maintenance work or temporary storage and containment problems with emission of vapors.

All factors shall be considered when planning, scheduling and authorizing the displacement product.

6.6 Safety

6.6.1 Nitrogen is a simple asphyxiate and therefore shall be handled and treated with proper planning and execution.

6.6.2 The injection vehicle shall be positioned in a location free of overhead or aboveground obstructions.

The area shall also be well ventilated.

6.6.3 The pumper unit or nitrogen delivery vehicle of choice also contains potential exposures to hot and cold surfaces, appropriate PPE shall be required and utilized at all times for those conditions.

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All personnel shall maintain adequate clearance from these surfaces outside the safety taped zone. Only authorized personnel are allowed within the zone for operational activities.

- 6.6.4 A safety area around the active nitrogen supply unit and injection point shall be established and taped off with appropriate *Caution and Nitrogen In Use tape*.

6.7 Nitrogen Venting Requirements

- 6.7.1 Upon the receipt of the displacement pig(s) and completion of the initial mainline displacement, nitrogen shall be vented from the line thru the frac tanks, at each refinery, and other blow down vents positioned at valve sites throughout the mainline system.

- 6.7.2 Mainline blow down sites shall utilize 10' long standpipes attached to 2" NPT valves and fittings on the line.

1. The standpipes shall be equipped with mufflers to control venting rate and limit noise.
2. High-pressure mufflers shall be utilized with line pressure greater than 150 psi and low-pressure mufflers utilized when line pressure is less than 150 psi.

- 6.7.3 As an alternate, mainline blow down sites may be hosed to and vented thru vacuum trucks.

Vac trucks hose shall meet pressure requirements of the venting gas and pipeline system, shall be properly grounded and top hatch opened to atmosphere.

- 6.7.4 Nitrogen shall be vented until zero pressure and static ambient equilibrium is achieved.

- 6.7.5 Safety consideration

1. Nitrogen is a simple asphyxiate.
2. Be certain to isolate the tank venting location away from pedestrian traffic.

- 6.7.6 Oxygen levels shall be monitored continuously at all locations, during the nitrogen venting process.

- 6.7.7 Refinery nitrogen venting procedures shall be followed when completing work within refinery battery.

- 6.7.8 A safety zone shall be taped off with danger / caution tape, to limit pedestrian traffic around the venting location.

6.8 Product Delivery Requirements

- 6.8.1 Product delivery location and alignment is critical during nitrogen displacements.

- 6.8.2 Confirmation of product delivery directly downstream of the nitrogen purge pig shall be isolated to a non-floating roof tank and from other piping processes.

7.0 Frac Tank Requirements

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7.1 Purpose

- 7.1.1 Frac tanks shall be utilized as temporary product storage units during pig runs or nitrogen purges.
- 7.1.2 Frac tanks shall be utilized to provide temporary isolation and collection of dirt accumulated during maintenance pigging.
- 7.1.3 Frac tanks may be installed at delivery locations to provide additional temporary product storage and dirt isolation in lieu of available transmix tankage.
- 7.1.4 Frac tanks shall be utilized to protect clean tankage from accumulated line segment contaminants.
- 7.1.5 During nitrogen purges, in addition to isolating dirt, the frac tank may be utilized to isolate bypassed nitrogen from floating roof tanks.

7.2 Types / Uses

- 7.2.1 Frac tanks are available in various styles and containment sizes.

Consult the tank vendor for spec sheets to specify appropriate tank to meet project operational and volume requirements.
- 7.2.2 The most commercially available frac tank size is 500 bbls (21,000 gals).

7.3 Frac Tank Connections

- 7.3.1 Frac tanks shall be attached to the pipeline via welded steel piping, typically 4" dia.
- 7.3.2 The welded steel piping shall be complete with appropriate valves and check valves to properly isolate the tank from line pressure and or gravity drain from the tank back to the line.
- 7.3.3 Appropriate valve class sizing shall be considered by the engineer or supervisor prior to installation, to meet or exceed MOP requirements of the line segment of project.

7.4 Venting Procedure

- 7.4.1 Frac tanks may be utilized during nitrogen displacement pigging to isolate nitrogen from active floating roof tankage.
- 7.4.2 Nitrogen may be vented through frac tanks to receive pigs into delivery traps or from the line upon approach of the batch separation cleaning pig.
- 7.4.3 Frac tanks should be sited in a well-ventilated area away from inhabited structures, electrical equipment, overhead power lines, roadways, product storage tanks or other ignition sources or utilities.
- 7.4.4 Frac tank top hatches shall be properly secured in the open position during venting activities.

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7.4.5 Venting shall be monitored from a safe location a minimum of 25' from the nitrogen discharge location.

7.4.6 A minimum 25' safety zone shall be taped off around the venting tank.

1. Blue nitrogen tape shall be utilized to demarcate the zone.
2. No entry shall be permitted inside the zone, unless operationally required and nitrogen venting discontinued and isolated.

7.4.7 Minimum two man "buddy system" venting teams are required during venting activities.

8.0 Displacement Product Refill Requirements**8.1 Purpose**

- 8.1.1 Upon completion of the displaced section tie-ins and removal of all Lockout and Tagout devices, the pipeline shall be refilled with the appropriate petroleum product.
- 8.1.2 Refill shall proceed by launching a batch pig, pushed by product from the origin location, displacing the air from the line ahead of the pig.
- 8.1.3 Air shall be displaced into a frac tank or vacuum truck at the destination location of the pipeline segment. Intermediate venting sites may be utilized on longer displacements.
- 8.1.4 The refill pig will be received into the destination delivery location trap, completing the refill of the line system.
- 8.1.5 The air vent location, frac tank or vac truck, shall be opened to receive and vent air as the refill progresses, providing an open path for the product movement.
- 8.1.6 Upon receipt of pigs to the receive trap at the destination location, excess product / nitrogen will be taken into the frac tank until the pigs are received and refill complete.
- 8.1.7 Collected product from the Frac tank or Vac truck will be offloaded into predetermined terminal location.

8.2 Air and Residual Nitrogen Venting

- 8.2.1 Air and residual nitrogen shall be vented from the line during displacement refill activities.
- 8.2.2 A batch cleaning pig shall be launched by the refill product to displace the air.
- 8.2.3 The air shall be vented at downstream locations as required.
- 8.2.4 Venting shall be accomplished through temporary frac tanks or vacuum trucks.

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8.2.5 As approved by local management, venting may also be accomplished thru a two inch valve and gooseneck vent pipe into a grounded metal bucket, to accumulate possible residual product from the line.

8.2.6 Upon arrival of refill product and/or pig the vent may be closed down.

8.2.7 Open path shall initialized to the downstream location before vents are closed.

8.2.8 Every attempt shall be made to remove as much air as possible to limit damage to stations and processes downstream.

8.3 Flow Rates

8.3.1 Flow rates equivalent to 2.5 miles per hour are optimum during refill activities.

The slower rate allows for ease of tracking refill pig(s), allows for manageable air venting, and provides sufficient time to maintain open path and switch to delivery location to maximize air evacuation.

8.3.2 Refer to Table 2, Section 11 Appendix for optimum cleaning pig tool speeds.

9.0 Inline Inspection Pigging

9.1 Purpose

9.1.1 Intelligent inspection tools shall be run in all main line pipeline segments to define pipeline geometry and identify anomalous structural defects on the interior and exterior of the pipe.

9.1.2 Various tools shall be utilized and run to identify pipeline bends, deformations, mill defects, ovalities, wall thickness changes, appurtenance locations, seam and weld integrity.

9.1.3 Tool runs shall be conducted in accordance to Section 5.

9.1.4 Refer to the Sunoco Logistics IMP plan for specific tool selection and reporting requirements and procedures.

9.1.5 Cleaning runs shall be performed in the line segment prior to initiating in line inspection.

9.1.6 Cleanliness acceptance criteria shall conform to requirements of section 5.5.

9.2 Inspection Tool Types

9.2.1 Dummy Tool

1. A dummy geometry tool, dimensionally consistent to the size and buildup of the geometry tool, shall be run in the line prior to the actual geometry tool run.
2. The dummy tool shall confirm line geometry will allow the passage of the more restrictive geometry tool.

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0506 Rev. 1**9.2.2 Geometry Tool Run**

1. A geometry tool, vendor non-specific, shall be run prior to smart tool runs to confirm line condition will allow the passage of the more restrictive intelligent tool.
2. The geometry tool will be used to identify deformation structural anomalies in the line (dents), wall thickness changes, and bends.
3. The tool shall be designed to incorporate inertial guidance data, utilized in conjunction with GPS survey information, to assist in the mapping of the line segment.

9.2.3 Intelligent Tool Run

4. An intelligent tool, smart tool, vendor non-specific, shall be run to identify additional structural anomalies present in the line segment.
5. The intelligent tool shall conform to high-resolution data collection standards.
6. The smart tool will collect data on structural anomalies consistent with internal and external metal loss, mill defects, wall thickness changes, bends, dents, seam orientation and other anomalous pipe features.
7. Smart tool technology chosen is dependent upon specific information required.
 - A. Magnetic Flux Leakage, MFL, technology is the standard format.
 - B. This system utilizes the measurement of leakage from an induced magnetic field to determine the percentage of metal loss on the pipe.
 - C. Ultrasonic thickness tools, UT, utilize ultrasonic radio waves to determine the amount of metal loss present along the line.
UT tools provide the same information as an MFL tool and also provide greater detail of seam information.
 - D. Both tools shall be coupled with a deformation section to identify, confirm and correlate line geometry information.

9.3 ILI Tracking

- 9.3.1 In line inspection runs shall be tracked at pre-determined observation locations referred to as above ground marker (AGM's) locations.
- 9.3.2 Inspection tools shall be physically tracked to confirm tool progress during the run and monitor integrity of run.
- 9.3.3 Tracking crew shall utilize geo-phones, sub surface audible amplification devices to monitor tool progress.
- 9.3.4 Tool vendor specific marker boxes shall be utilized at AGM locations to demark and correlate the tool run with pipeline reference stationing.
- 9.3.5 Tool AGM passing times and marker box numbers shall be documented on the tool run AGM list, see Data Forms 11.3 for reference document.



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10.0 Appendix

10.1 Table 1 – Cleaning Tool Selection Table

Tool Type	Purpose							
	Construction	Lines with < 1.5 D Bends	Drying	Light Cleaning	Moderate Cleaning	Aggressive Cleaning	Nitrogen Displacement	Ferrous Material Removal
Foam Swab			X	X				
Foam Poly *		X	X	X			X	
Foam Disc *		X	X	X	X		X	
Unicast Cup				X				
Unicast Disc				X				
Single Body Cup *, **	X			X			X	
Single Body Disc *				X	X			
Multiple Section Cup *, **	X			X	X		X	
Multiple Section Disc *				X	X			
Multiple Section Disc and Cup *					X		X	
Brush and Cup *					X	X		
Knife and Cup						X		
Magnet and Cup (Bars or shaft)				X				X
Magnet, Brush and Cup (Bars or shaft)				X	X	X	X	X

*Most pigs can be available in dual -diameter arrangement, consult specific pig vendor

** New line construction geometry shall be verified by pig run with an appropriately sized gauging plate installed, refer to gauge plate diameter requirements in Ops Engrg program files. As an alternate a clock geometry tool may be run to document exact piping geometric information.

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10.2 Table 2 – Tool Speed Requirements

	Minimum Cleaning / ILI Tool Rate (BPH)	Target Nitrogen Displacement / ILI Tool Rate (BPH)	Maximum Nitrogen Displacement Tool Rate (BPH)	Maximum Cleaning / ILI Tool Rate (BPH)
Line Size	@ 1 MPH	@ 2.5 MPH	@ 4 MPH	@ 8 MPH
4"	82	205	328	656
6"	189	472	755	1510
8"	327	817	1307	2614
10"	515	1288	2060	4120
12"	739	1847	2954	5909
14"	932	2331	3729	7458
16"	1122	2805	4488	8976

11.0 Data Forms

11.1.1 Nitrogen Calculation Form – See Attachment

11.1.2 Nitrogen Tracking Form – See Attachment

11.1.3 AGM Tracking Form – See Attachment

12.0 Drawings

Refer to Sunoco Logistics Standard Trap drawing, for Launcher and Receiver traps.

End of Specification

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Sunoco Logistics

Sunoco Pipeline L.P. and Affiliates CONSTRUCTION STANDARDS

Subject:

Machinery, Commissioning, and Startup

Prepared By:
Lindy Barile [REI]

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Lindy Barile [REI]**Revision:**
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2 of 3**Code:****Number:**
0507**Approved:**
Lindy Barile**Date:**
10/1/13**Replaces:**
0507 Rev. 1**1.0 Introduction****1.1 Purpose**

This specification establishes a procedure for machinery commissioning and start-up for use at Sun Logistics, Pipe Line and F&D Terminal facilities.

1.2 Scope

- 1.2.1 This specification is used as a supplement to current Industry Standards for machinery, commissioning, and startup.
- 1.2.2 This Standard and referenced Recommended Practices are intended to provide guidelines for the design and installation practices that affect the commissioning of general purpose equipment, and to provide guidelines for equipment commissioning. Unless otherwise specified by the Owner, manufacturer instructions supplied by the machinery vendor should be included as part of the commissioning plan.

2.0 References

API RP – 686, PIP REIE 686, First Edition, April 1996 Recommended Practices for Machinery Installation and Installation Design, Chapter 9 – Commissioning.

API RP – 686, PIP REIE 686, First Edition, April 1996 Recommended Practices for Machinery Installation and Installation Design, Chapter 9 – Commissioning, Section 6 – Machinery Commissioning Checklist.

3.0 Procedure**3.1 Requirements**

API RP – 686, PIP REIE 686, First Edition, April 1996 Recommended Practices for Machinery Installation and Installation Design, Chapter 9 – Commissioning, should be followed to define the following.

- 1. Machinery Commissioning
- 2. Commissioning Design
- 3. Field Commissioning
- 4. Machinery Commissioning Checklists

3.2 Record Keeping

Construction Records and completed Checklists should be forwarded to the Project Manager for inclusion in the project file.

End of Specification



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Preparations for Final Tie into Existing Pipelines

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1.0 Introduction

1.1 Scope

- 1.1.1 The work required under this specification includes the furnishing of supervision, labor, equipment, materials, and services necessary for completion of the final tie-in of new pipeline or pipeline system to an existing pipeline or facility.
- 1.1.2 This specification also prescribes the division of responsibilities between the Owner and the Contractor in order to complete the final tie-in of pipe.

2.0 References

- PIP REIE 686, Recommended Practices for Machinery Installation and Installation Design, Chapter 6- Piping
- Sunoco Logistics Construction Spec 0501, Coating of Underground Steel Pipe
- Sunoco Logistics Construction Spec 0502, Underground Pipe Installation
- Sunoco Logistics Construction Spec 0503, Piping and Equipment Installation
- Sunoco Logistics Welding Manual

3.0 General Requirements

- 3.1 Due to operating procedures and the nature of pipeline shipments, the Owner reserves the right to delay the tie-in for a period not to exceed fourteen (14) calendar days after the completion of the hydrostatic test.
- 3.2 Should a delay of tie-in occur within the specified fourteen (14) day period, the Owner shall not be held liable for any adverse economic or business effects to the Contractor as a result of the tie-in not occurring immediately after the Contractor has made preparation for the tie-in.

4.0 Division of Responsibilities

- 4.1 After completion of the hydrostatic test of the pipeline, the Owner shall make ready the existing pipeline and complete the tie-in of the new section of pipeline to the existing pipeline or facility.
- 4.2 If the tie-in is to a live or in-service line, the Owner shall perform all welding on the existing pipeline that is required to attach fittings for the completion of hot tapping work.
- 4.3 The Owner shall cut and cap the existing pipeline after purging the line of all liquid.
- 4.4 The Contractor shall provide good operating equipment and reliable labor, on a stand-by basis, as necessary to assist the Owner's welders with completion of the tie-in work, and as directed by the Owner's Representative.
- 4.5 In the event that the Owner requests the assistance of the Contractor's welders in order to perform the tie-in work, the Contractor's time and material rates, as contained in the Contract, shall apply.

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- 4.6 The Owner will complete the final tie-in, including installation of the weld wraps and any associated work as the Owner's foreman deems necessary.
- 4.7 After completion of the tie-in, the Contractor shall backfill and clean up all areas involved in the project, in accordance with the Owner supplied construction specifications, and to the satisfaction of the Owner's Representative.

5.0 Lowering of Pipe into Trench

- 5.1 No pipe shall be lowered into the trench excavation until all rocks, clods, skids, cans, welding rods, or other debris have been removed, by the Contractor, from the trench.
- 5.2 The bottom of the trench shall be graded to give support to the line throughout its entire length.
- 5.3 In rock sections, the bottom of the trench shall be padded with loose, soft earth, sand or like materials, for a minimum depth of 6-inches before the pipe is lowered into the trench. All material used for backfilling shall be approved by the Owner's Representative prior to its use.
- 5.4 **No pipe shall be lowered into the trench, by the Contractor, until the Owner's Representative has been notified and approval has been granted by the Owner's Manual.**
- 5.5 Coated pipe shall be treated at all times with extreme care and precaution to avoid damage to the coating. Coated pipe shall be handled with wide fabric non-abrasive slings, having a minimum width equal to the diameter of the pipe. Slings shall be constructed so that they can be disengaged without allowing metal parts to come in contact with the coated pipe.
- 5.6 Where the coated pipe is placed on skids, it shall be holiday inspected by the Contractor and all skid blisters or other damages to the coating shall be repaired by the Contractor before the pipe is lowered into the trench.
- 5.7 The line shall be entirely lowered into the trench with the exception of slack loops in the amount and location as designed by the Owner's Representative.
- 5.8 When the line has been entirely lowered into the trench, all vertical and lateral bends of the lowered line shall fit the trench with proper lateral and vertical clearances. The Contractor shall, at his expense, do all the necessary handwork to insure that these proper clearances are met.
- 5.9 Slack loops shall be left on skids above the trench until the lowered pipe has been anchored by backfill. Slack loops shall then be forced into the trench and backfilled when the pipe temperature is the lowest, to the extent that when finally completed, the pipe in the trench will be under compression in the longitudinal direction.
- 5.10 Extreme care shall be used in removing the sling after the pipe is lowered into the trench to prevent damage to the protective coating. If the protective coating is damaged during the lowering-in process, the pipe shall be removed from the trench and the coating repaired to the satisfaction of the Owner's representative.
- 5.11 Where "push" or "pull" sections of pipeline are required to facilitate proper construction, they shall be done in such a manner as to achieve a finished pipeline that meets the requirements of these specifications and shall be approved by the Owner's Representative prior to completion.



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Subject:

WELDING OR HOT TAPPING ON EQUIPMENT IN SERVICE

Prepared By: D. B. Wagner (REI)	Revision: 2	Page: 1 of 17	Code:	Number: 0511
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1.0 OBJECTIVE

- 1.1 The objective of this specification is to outline procedural requirements for welding on piping, tanks, and vessels under pressure and / or in service, welding in preparation for hot tapping. A detailed written procedure for the hot tapping and welding involved must be prepared and reviewed for each job in addition to the completion of design drawings, checklists, and authorizations described in this procedure.
- 1.2 This specification supplements applicable codes, it does not supersede them.
- 1.3 Hot tapping and welding on piping or equipment in service are hazardous operations and should be avoided if possible. Options to isolate the equipment should be carefully reviewed before considering a hot tap.

2.0 POLICY

- 2.1 The instructions set forth in this specification are the Owner's approved standards and policies governing hot tap work.
- 2.2 It is Sunoco Logistics policy to provide sufficient guidance and information to ensure that designs, component selections, and welding processes will enable a hot tap to be made safely and in accordance with current industry practices and appropriate codes.

3.0 SCOPE OF SPECIFICATION

- 3.1 The scope of this procedure covers hot tapping on piping, tanks, and vessels at Sunoco Pipeline and Terminal facilities.
- 3.2 Hot tapping is the technique of attaching connections to any pressure containing equipment in service (not properly isolated, depressurized, or cleaned for welding) by welding the connection in place and then drilling or cutting through the pressure containing equipment. Hot tapping is usually performed when it is not feasible, or it is impractical, to take the piping or equipment out of service, or to purge or clean it by conventional methods. The differences between hot tapping on lines and on tanks or vessels are outlined in this specification. This hot tapping specification applies only to piping and equipment fabricated from ferritic and austenitic carbon steel. Consult Engineering if other materials are involved.
- 3.3 This specification also applies to any welding on piping or equipment in service, even if the equipment will not be drilled into, with a hot tap machine. Examples could include welding a repair sleeve to a line in service.

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4.0 REFERENCES

- 4.1 API Publication 2201 Procedure for Welding or Hot Tapping on Equipment Containing Flammables
- 4.2 API Publication 653 Tank Inspection, Repair, Alteration, and Reconstruction
- 4.3 ASME/ANSI B31.4 Pipeline Transportation Systems for Liquid Hydrocarbons and other Liquids
- 4.4 ASME Boiler and Pressure Vessel Code, Section VIII
- 4.5 API STD 1104 Welding of Pipelines and Related Facilities
- 4.6 Sunoco Logistics Company DOT Maintenance Manual
- 4.7 Sunoco Logistics Company Welding Manual

5.0 ENGINEERING AND DESIGN GUIDELINES

- 5.1 Initiation of Hot Tap Design and Approval Guidelines
 - A. Requests for hot taps can be made by Operations, Maintenance and, Engineering personnel.
 - B. The requester shall initiate the "Hot Tap Authorization" Attachment 3, including a simple 8-1/2" sketch or formal drawing showing the proposed location indicating the work to the Owners representative.
- 5.2 Restrictions for Hot Tapping
 - A. Hot Tapping shall not be done when conditions are present that prohibit such work.
 - B. Hot tapping shall not be performed on lines, tanks, or vessels if the equipment:
 - 1. Contains hydrogen and has operated above the Nelson Curve limits because of the possibility of hydrogen embrittlement of the metal.
 - 2. Contains flammable vapor / air (or oxygen) mixtures near the flammable or explosive range.
 - 3. Contains chemicals, such as acids and chlorides, which are likely to decompose and become hazardous due to heat of welding.
 - 4. Contains caustic or amine which could cause the weld to crack.
 - 5. Contains compressed air or oxygen which may contain residual oil or grease.

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6. Contains unsaturated hydrocarbons, unless evidence precludes the possibility of explosive decomposition of the liquid/material within the equipment at the location of the weld (e.g, ethane under specific temperature pressure, and oxygen mixture conditions).
7. Contains product operating under vacuum where the introduction of oxygen, should burn-through occur, brings the contents within the flammable or explosive range.
8. Has a base metal thickness of less than 0.20 in. where the welding will be done.
9. Must be stress-relieved.
10. Operates above the design limits of the hot tap equipment (including operating excursions).
11. Cannot operate at a reduced pressure during the hot tap work.
12. Is operating below 32 °F.

5.3 Design

- A. The sketch or formal drawing, along with the partially completed "Hot Tap and Welding Check Lists," shall be forwarded by the requester to the Owner's Maintenance Engineering department for thickness readings at the proposed location. Thickness readings shall be recorded on these forms, along with the Inspector's initials, and forwarded with the sketch or formal drawing to the Owner's Project Engineer for design of the hot tap connection.
- B. The Owner's Project Engineer, with assistance from Engineering and Design, will design the Hop Tap connection or welded attachment based on the thickness readings and routing requirements. Adequate support of the existing piping shall be considered in the design for the additional load of the connection as well as the "hot tapping" machine during installation. If necessary, the Project Engineer will revise the sketch or formal drawing to include the following:
 1. Location of the proposed connection in a manner that will prevent any error in positioning the connection.
 2. Service, design pressure and temperature, operating pressure and temperature, welding procedure and testing procedure, and shall indicate full-port opening (typically a WKM Ball Valve). The valve body, trim and packing specifications shall be indicated.
- C. If engineering drawings have been made which show the hot tap in question, the sketch will not be necessary.

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- D. The engineering drawing shall include all requirements of Item B above. The number of this drawing shall be entered on the Hot Tap and Welding Check Lists.
- E. The Engineer's initials, indicating approval by the Owner's Project Engineer must appear on either the 8-1/2" x 11' sketch, the engineering drawing, or a drawing prepared by a contracting firm if applicable. Formal drawings will be issued by normal distribution.
- F. Branch Design
 - 1. The design of the branch must conform to applicable industry codes that the connection is being made to, and the Owner's piping design practices. Consult the Owner's piping specifications for branch reinforcement to confirm fitting selection.
 - 2. Normally the branch size will be selected to be at least one full pipe size smaller than the main pipe size (i.e., 2" branch into 3" main, 10" branch into 12" main, etc.). Weldolets, sockolets, or threadolets should be used on 2" and smaller taps, and weldolets shall be used for taps exceeding 4".
 - 3. The Owner's Project Engineer may approve alternate suppliers or designs.
- G. Tank Nozzles and Connection Designs
 - 1. Tank nozzle and connection design shall be in accordance with API 653.
 - 2. Although it is not required by the code, it is common practice among operators of petroleum storage facilities to take advantage of the opportunity presented when the tank is later taken out of service for inspection or repairs, to go into the tank and backweld the hot tap connection.

5.4 Equipment

- A. Single-Cut Boring Machines, use of this type machine is **PROHIBITED**
 - 1. This machine, usually employed for installing 1/2-in. to 2-in. pipe branches, is frequently shop made and consists of an ordinary drill or diamond point bit attached to shaft run through a packing gland. While it is normally hand operated, power may be supplied by a electric air drills. Feed may be manual or automatic.
 - 2. A disadvantage of the boring machine is that cuttings fall into the line.
- B. Pilot Drill and Shell Cutter
 - 1. This type of machine is usually a manufactured item and may be manually or power operated. Suppliers include Mueller Co., T.D. Williamson, Inc., and A.P. Smith Mfg. Co.

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2. Operators must be trained and qualified in the use of the manufactures equipment.
3. The Mueller machine, handling taps from 2 in. through 12 in. in any size of pipe, is the one mostly commonly used. It has the advantage that a minimum of cuttings are left in the line because it permits removal of the coupon.

C. Types of Valves

1. The valves normally used shall be full port Ball valves.
2. **CAUTION**-Reduced port valves are what the Owner normally buys for smaller sizes, so care should be taken to obtain the full port style.

5.5 Welding

- A. Welding on DOT regulated pipelines and facilities shall be performed in accordance with an approved Sunoco Logistics welding procedure from the Welding Manual.
 1. Non DOT welding shall be IAW Construction Specification 0800.
 2. The appropriate welding procedure will be identified on the drawing and will be included in the work package for the hot tap job.
- B. Fluid temperature and velocity, will transfer heat away from the welding zone to the fluid. In high-strength steels, this might amount to quenching the heat-affected zone and creating undesirable metallurgical results (e.g., weld cracking).
- C. Preheating -- Studies have indicated that all steels should be preheated when the fluid or metal temperatures are under 50 °F. Preheat reduces the rate of heat transfer from the weld to the fluid. High carbon equivalency or high tensile strength steels, such as Grade C, X-42, X-46, X-52, and above should be preheated for all temperatures. Welding procedures will typically define the preheat requirements. Preheat temperature can be conveniently determined by "Tempilstik" on high strength materials.

5.6 Hot Taps by Contractor

- A. This procedure shall also apply to hot tapping/welding done by construction contractors.
- B. On capital projects, the Construction Manager or designated Inspector shall verify that the Contractor adheres to this procedure.
- C. On field run projects, the Maintenance Supervisor or Field Engineer shall verify that the contractor adheres to this procedure.

- 5.7 The Hot Tap Authorization and Check List, along with the approved sketch or formal drawing, shall be forwarded by Engineering to the appropriate Supervisor for completion of the form and execution of the hot tap.

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6.0 PLANNING PROCEDURES

6.1 Planning

- A. Hot tapping and welding on piping or equipment in service are hazardous operations and should be avoided if possible. Options to isolate the equipment should be carefully reviewed before considering a hot tap. If hot tapping is unavoidable, then a detailed work plan for the work, including a contingency plan should be developed and submitted to appropriate parties.
- B. A Hot Tap Planning Checklist (Attachment I) is attached to assist in preparing a plan for doing a hot tap, and requires completion as part of the Hot Tap work package.

6.2 Detailed Plan

A detailed plan (procedure) should be developed which outlines and clarifies all concerns applicable to the hot tap including:

- A. Adequate Site Preparation.
- B. Permit requirements.
- C. Flow / Level Verification Method.
- D. Comprehensive Contingency Plan.
- E. Detailed Work Plan

6.3 Contingency Plan

A contingency plan with an emergency notification system shall be developed which addresses potential problems that might occur including (where applicable):

- A. Burn through during welding and a possible fire resulting.
- B. Malfunction which does not allow the hot-tap or stopple machine to be removed.
- C. Failure to stop flow when stoppling a line.
- D. Loss of coupon.

6.4 Hot Tap Authorization and Checklist

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A. The Hot-Tap Authorization form and the Hot Tap Check List form, must be included within the Hot-Tap Plan and completed during the hot-tap operation.

B. Properly executed forms shall be attached to the Work Plan and circulated for approval.

6.5 Hot-Tap Work Plan

A work plan must be prepared for the hot tap that describes the work to be done, specifying the welding procedures to be used, tapping procedure (describe sequence for information of those unfamiliar with the process), and outline any safety issues and concerns.

6.6 Field Survey

A field survey of the approved Work Plan by the Lead Engineer, Operations, and Maintenance should be completed prior to the review meeting.

6.7 Approvals and Permits

A. All Work Plans for hot tapping must be approved by the Owner's Supervising Project Engineer and the Owner's Area Manager.

B. Any deviations from this instruction should be noted and approved by the above mentioned individuals.

C. The Operations Representative shall issue final permission to proceed at the time of hot tap.

D. A work permit, as issued by the Owner's Operations Representative or Maintenance Supervision, is required.

7.0 WELDING AND TAPPING PROCEDURES

7.1 Inspection of hot tap location

A. Determine by inspection and by use of ultrasonic thickness devices, radiography, or other approved thickness measuring devices that the equipment to be welded (for hot-tapping) is of sufficient wall thickness and strength. Data on corrosion rates will be helpful in making this determination.

B. Base metal thickness should not be less than 0.20 inches.

7.2 The following procedure is recommended:

A. UT pipe for general condition for hot tap.

B. File or use a sanding disc to clean rust and paint from the area to be welded. Verify UT readings on the area to be welded.

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- C. Position the fitting to be welded (i.e. Weldolet) on the pipe, tank or equipment and mark the periphery of the fitting to identify the location of the weld.
1. UT the pipe, tank shell or equipment where the weld bead will be deposited.
 2. Determine the material thickness at intervals no greater than 2" along the weld bead and obtain no less than 4 readings.
 3. The recommended area of UT is a 2-inch band around areas where the pipe attaches.
 4. This final inspection will be done just prior to welding and prior to final sign-off by inspection of the hot tap.
- D. Perform an X-ray if there is any indication of a problem.

7.3 Preparation for Welding and Tapping

- A. If the Hot Tap work will take place within a Pump Station or terminal, the Operations representative in charge of the equipment to be hot tapped, along with the Technical Supervisor and Maintenance Supervisor shall carefully inspect the site. Any special precautions, protective equipment, or other safety measures mutually agreed upon shall be provided. See the special considerations in section 8 to insure proper controls are in place for pipeline and tank work.
- B. Cover the sewers and drains in the affected area within a 50 ft. radius.
- C. Provide at the job site, a suitable fire extinguisher, preferably a dry chemical. If available provide a pressurized fire hose with a fog nozzle.
- D. The Operations, Maintenance or Construction Supervisor shall identify the line, tank, or equipment to be hot tapped and mark a visible "X" at the centerline of the spot where the hot tap is to be located.
- E. Maintenance Supervisor/Tech Supervisor shall obtain the hot work permit.

7.4 Hot Tap Welding

- A. Care should be exercised that the fitting is properly positioned to prevent misalignment of the tapping machine when the cut is made.
- B. Fluid velocity in the pipe will cool welded surfaces.
1. Heating elements (if required) should be sized for expected cooling load.
 2. Fluid velocities should be in a range of 1.0 -4.0 feet/second for liquids. Slower velocities will increase burn through potential. Faster velocities may rapidly cool the weld, potentially causing hard, brittle crack sensitive welds. There is also an increased chance of losing the coupon off the pilot.

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- C. If the fluid or metal temperature is less than 50 °F the area to be welded is to be preheated prior to welding.

7.5 Weld the fitting to the piping or equipment per the Owner's Welding Procedure.

7.6 Inspection and Testing of Hot Tap Welds

- A. Completed hot tap welds for all connections are to be liquid dye penetrant tested or wet mag particle tested as a minimum, prior to tapping.
- B. Detection of inadequate welds shall halt the process requiring resolution to be obtained by Engineering.

7.7 Tapping

Follow all Tapping Equipment manufactures recommended procedures and specifications related to the tapping process. The following is a list of key points to consider during the tapping procedure.

- A. Attach a full port ball valve to the branch.
- B. The tapping machine shall be carefully inspected to assure that it is in satisfactory condition. Packing shall be suitable for the service to the tapped. The machine shall be installed and operated in accordance with the manufacturer's instructions.
- C. Install the cutting machine on the valve in the closed position to assure that adequate clearance exists.
- D. For connections greater than 2" pipe size, the connection, including the valve through which the tap will be made, shall be integrity tested as noted on the drawing, prior to tapping. Integrity testing shall be performed per engineering instructions, which shall specify the conditions, including the pressure and the test medium.

7.8 Attach a tapping machine onto the valve.

- A. Align so the cutter clears inside of valve.
- B. Securely attached the Tapping Machine to the valve and support as necessary.
- C. Mark the stem with the drill backed off and the valve closed.

7.9 Run pilot and cutter through open valve to contact the pipe, mark stem and make sure enough stem remains to make tap. The small vent connection on the machine should be closed.

7.10 Cut an opening through the pipe wall with a shell cutter or drill.

- A. When the pilot drills through, soap the weld and inspect for leaks.

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B. When cut-through is completed, run cutter on through the opening an inch or so to clean off burrs. However, observe the drill travel to prevent drilling into the opposite side of the pipe.

7.11 Back the cutter (or drill) out of the valve, close the valve, release pressure from the tapping machine at the bleeder and remove the machine. Check for cutout coupon to make sure that it is removed from the line (if not drilled).

7.12 After tapping has been completed and the machine removed, the open end or the valve (or line) shall be properly capped with a plug, blind flange, or pipe cap if other piping is not connected immediately.

8.0 SPECIAL CONSIDERATIONS

8.1 Pipelines

- A. When performing hot-work below grade level (See HES Standard for confined space requirements if excavation is defined as a confined space), excavations, pits or boxes shall permit quick access/egress. If necessary to remove fumes or flammable vapors, an air siphon or some other positive means of ventilation should be provided. If the job is above ground in a congested area, necessary precautions should be taken to prevent the trapping of personnel.
- B. Flow in the line should be maintained, at least until after welding operations have been completed. If the line is long and heat can be dissipated without flow, the flow may be disconnected.

8.2 Tanks

- A. All Tanks: Never pump in or out of tanks, or mix the contents of tanks while hot work is in progress. The mixer switches should be de-energized, locked and tagged "OPEN". Close and tag all valves on product lines at the tanks. Avoid any procedure associated with operation of gas-blanketing valves or heater coil valves which would cause venting to occur. Assure that all hatches and roof drains are closed. Secure heating coils before beginning any hot tap.
- B. Cone Roof Tanks: Maintain at least three (3) feet of liquid head above the hot-work areas when welding or similar hot-work is being done. A tape gauge of the tank contents should be made.
- C. Floating Roof Tanks: Maintain at least three (3) feet of liquid above the hot work area as in "B" above. Never perform welding or similar hot-work on the roof, on the sleeves of the roof legs, or on pontoon hatches.

9.0 CHECKLISTS



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9.1 Check lists under the following Attachments 1 through 4, shall be completed for each Hot Tap.

Hot Taps performed by Contractors, are required to be signed by both the Contractor Supervisor and the Owner's Representative.

10.0 ATTACHMENTS

- A. Attachment 1, Hot Tap Planning Checklist (General Plan)
- B. Attachment 2, Hot Tap Planning Checklist (Contingency Plan)
- C. Attachment 3, Hot Tap Authorization
- D. Attachment 1, Hot Tap Checklist (execution)



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ATTACHMENT 1

HOT-TAP PLANNING CHECKLIST

General Plan

1. *Scope of work defined?* _____
2. *Detailed plan prepared?* _____
3. *Adequate lighting present?* _____
4. *Continuous flow level verification method established?* _____
5. *Applicable permits obtained?* _____
6. *Appropriate organizations (Control Center, HES, etc.)* _____
7. *Adequate first-aid facilities available?* _____
8. *Required fire-fighting equipment determined* _____
9. *Impact of metal particles from cutting the coupon in the
System reviewed?* _____
10. *Work area protected from adverse weather conditions?* _____
11. *Escape routes determined?* _____
12. *Steady state operation maintained?* _____
13. *Adequate clearance at the jobsite to do the work?* _____
14. *Hot-Tap work meets all requirements of Hot Tap Procedure?* _____
15. *Nonessential personnel evacuated?* _____
16. *Adequate supervision available?* _____
17. *Protective clothing specified?* _____
18. *Unnecessary staging removed?* _____
19. *Are all individuals involved properly trained?* _____

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ATTACHMENT 2
HOT-TAP PLANNING CHECKLIST
Contingency Plan

1. *Emergency procedures established in case of burn-through* _____
2. *Emergency procedures established in case of fire?* _____
3. *Area evacuation plan been set?* _____
4. *Plan for malfunction preventing Hot-Tap machine removal discussed?* _____
5. *Plan for a malfunction preventing stopple machine removal?* _____
6. *Plan discussed in case stopple does not stop flow?* _____
7. *Communication network established in case of emergency?* _____
8. *Plan established for spill contaminant and clean-up?* _____
9. *Procedure set in case the coupon is not recovered?* _____



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ATTACHMENT 3 **HOT TAP AUTHORIZATION**

REGION: _____

STATION/TERMINAL: _____
OR LINE SEGMENT

HEADER:	Line No.	_____	BRANCH:	Size	_____
	Line Size	_____		Flange Rating	_____
	Pipe Class	_____		Reinforcement	_____
	Flange Rating	_____		Required?	_____
	Material	_____			

OPERATING DATA: **Product** _____ **Temp** _____ **Press** _____

INSPECTION DATA:

Minimum UT Reading _____

MAXIMUM ALLOWABLE LINE PRESSURE DURING WELDING: _____

MAXIMUM ALLOWABLE BRANCH HYDROTEST PRESSURE: _____

APPROVALS:

Engineer _____

Resp. Shift Supervisor (Ops) _____

Tech Supervisor _____

Maintenance Supervisor _____

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ATTACHMENT 4

HOT TAP CHECK LIST

<u>CHECK LIST</u>	<u>INITIALS</u>	
1. Full joint review	(O) _____	(M) _____
2. Mark exact spot for hot tap	(O) _____	(M) _____
3. Line Suitable for Welding. UT Measured minimum thickness _____ "		(M) _____
4. Obtain work permit and approvals		(M) _____
5. Check stub materials against work order		(M) _____
6. Welder aware that line is under pressure and thickness		(M) _____
7. Flow and pressure in line	(O) _____	(M) _____
8. Fire hose or extinguisher ready	(O) _____	(M) _____
9. Standing by during welding	(O) _____	(M) _____
10. Hydrotest stub as specified		(M) _____
11. Hot tap machinist is properly trained		(M) _____
12. Hot tap machine is suited for temp and press		(M) _____
13. Hot tap machine in good order, including cutter and packing and proper cutter size		(M) _____
14. Valve inspected. Seat lugs and burrs removed if needed		(M) _____
15. Valve tested for tight shut off		(M) _____
16. Pressure test machine and connection in	(O) _____	(M) _____
17. Check that valve will close with cutter withdrawn		(M) _____
18. Set "stop" and mark travel indicator to avoid drilling into far side		(M) _____
19. Mark and deliver coupon to operating rep.	(O) _____	(M) _____
20. Verify line stock and release for connection	(O) _____	(M) _____
21. If below grade or inside a vessel, obtain confined space permit.		

COMMENTS:



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1	11/15/2006			D. Wagner	NA	
2	09/20/2013	Lindy Barile	REI		NA	General review and update.



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Subject:

Installation of Insulating Joints

Prepared By:
J. Field [REI]

Revision:
2

Page:
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1.0 Introduction

1.1 Purpose

- 1.1.1 This specification prescribes the procedure for installation of insulating components within bolted pipe flanges, coating and testing of the assembled flanges to effect electrical isolation of the flanges.
- 1.1.2 Reference *Sunoco Logistics, Bolted Flange Assembly Procedure, PR-11-0038* for additional information related to installation of Insulated Flange Assemblies.

2.0 Flange Preparation

- 2.1 Flange pairs should be mated, if possible. As a minimum, the flanges shall be compared to assure bolt hole alignment will allow insertion of the insulating sleeves without distortion. Reaming of the bolt holes may be required if the bolt holes do not line up sufficiently for insertion of the insulating sleeves without distortion.
- 2.2 Remove all mill coating and lubricants from the flange surfaces, including within the flange bolt holes. The flange surfaces shall be clean and dry prior to assembly.
- 2.3 Remove all lubricants from the flange studs and nuts. Care must be taken to remove lubricants from the threads, including within the nut bore. The flange studs and nuts shall be clean and dry prior to assembly.
- 2.4 Solvents used to clean the flanges, studs and nuts must not leave a conductive residue and shall displace surface moisture. Acetone or equivalent solvents are acceptable for this use.

3.0 Flange Assembly

- 3.1 The work site should be clean and dry, preferably indoors. Insulating flanges shall not be assembled outdoors during inclement weather, such as rain or snow. If outdoor assembly is necessary during inclement weather, the work site shall be enclosed to maintain dry working conditions. The decision to proceed with the insulating joint assembly during inclement weather is at the discretion of the owner's project inspector.
- 3.2 Flange faces shall be aligned so they are parallel and concentric with each other within 0.010 inch, without external loading or springing. Bolt holes can be lined up by driving a minimum of two tapered drift pins, in opposite directions to each other, into diametrically opposite bolt holes.
- 3.3 Two insulating bolt sleeves shall be temporarily installed within the lower fourth portion of the flange pair. The center gasket shall be installed and positioned by contact with the two sleeves. Following installation of the center gasket, two additional bolt sleeves shall be installed in the upper fourth portion of the flange pair, followed by installation of the studs (with insulating washers and backup steel washers). These studs shall be tightened to secure the flange alignment. The drift pins may be removed and the remaining studs (with all insulating components) installed at this time.
- 3.4 The stud insulation consists of one insulating sleeve with insulating washers at each end. Steel backup washers followed by the stud nuts, complete the installation. Care must be exercised during handling of the insulating components so as not to introduce moisture, dirt or conductive lubricants on to these

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components. These contaminants may provide electrical paths across the insulating joint and may cause the insulating joint to fail the acceptance testing.

- 3.5 The insulating sleeve shall be centered on the two flanges and must extend through the insulating washers on both flange faces. The insulating sleeve may extend into the steel backup washer during tightening of the studs. The steel backup washers must remain centered on the insulating washer during the stud tightening to prevent binding the insulating sleeve which may cause the sleeve to crack.
- 3.6 The studs shall be tightened, using a star pattern, in three steps, using increasing torque settings of approximately 33% of the final stud torque as recommended by the insulating kit's manufacturer. Care shall be exercised to prevent the stud from turning during the tightening sequence, as stud turning may cut the sleeve material.

4.0 Inspection and Testing

- 4.1 The insulating flange effectiveness and acceptance shall be evaluated through flange-to-flange resistance measurements for installations where at least one flange and any connecting piping is suspended without contact to earth or other structures. Minimum flange-to-flange resistance is one (1) meg-ohm measured using a suitable low voltage ohmmeter. Resistance readings less than one (1) meg-ohm require disassembling the flange pair, cleaning and/or replacement components. As an alternate to disassembling the complete insulating flange, additional testing may be conducted to identify, clean and/or replace defective individual insulating components until the acceptance criteria is achieved. The decision to permit identifying, cleaning and/or replacement of defective individual insulating components shall be at the discretion of the Owners Project Inspector.
- 4.2 For insulating flange installations where connecting piping on both sides of the insulating flange is below grade or grounded, the effectiveness and acceptance of the insulating joint shall be based on a minimum flange-to-stud resistance of one (1) meg-ohm measured using a suitable low voltage ohmmeter and evaluation of flange-to-flange resistance using specialized tests conducted by the owner's representative.
- 4.3 The owner's representative shall witness assembly of the insulating joint. All acceptance testing shall be conducted by the Owner's Representative or an Owner Approved Testing Agent. Acceptance of resistance values less than those specified shall be at the discretion of the owner's project inspector. Two (2) working days' notice shall be provided to allow the owner to schedule personnel to witness and test the insulating joint assembly.

5.0 Insulating Joint Coating

- 5.1 Exterior Coating
 - 5.1.1 The flange pair center gap (raised face flanges only) shall be filled using a non-conductive hot filler wax applied as per the manufacturers specified procedures.
 - 5.1.2 The specified exterior coating shall be applied immediately after acceptance of the assembly by the owner's project inspector. The specified exterior coating shall be applied in strict accordance with the manufacturer's specifications and as specified on the project drawings. Particular care shall be taken to meet the surface preparation and application temperature requirements. Preliminary flange surface preparation, as a minimum, for exterior coating shall be considered

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prior to assembling the insulating joint as the surface preparations procedures for certain coatings may damage the insulating components if these actions are completed after the insulating joint has been assembled.

5.1.3 The coating shall be visually inspected and tested with appropriate test equipment, i.e. high voltage spark or low voltage wet sponge holiday detectors, as specified by the coating manufacturer. All coating faults shall be repaired following manufacturer procedures.

5.1.4 The coating shall be allowed to fully cure or dry prior to exposing the insulating flange to weather or backfilling.

5.2 Interior Coating

5.2.1 The specified interior coating shall be applied in strict accordance with the manufacturer's specifications and as specified on the project drawings. Particular care shall be taken to meet the surface preparation and application temperature requirements. Preliminary surface preparation, as a minimum, for interior coating shall be considered prior to assembling the insulating joint as the surface preparations procedures for certain coatings may damage the insulating components if these actions are completed after the insulating joint has been assembled.

5.2.2 The coating shall be applied after the insulating flange has been assembled and approved by the owner's project inspector. The coating shall extend continuously across the insulating gasket for the specified distance.

5.2.3 The coating shall be visually inspected and tested with appropriate test equipment, i.e. high voltage spark or low voltage wet sponge holiday detectors, as specified by the coating manufacturer. All coating faults shall be repaired following manufacturer procedures.

5.2.4 The coating shall be allowed to fully cure or dry prior to placing the insulating flange in service.

6.0 General Requirements

6.1 During welding on the assembled insulating flange and connected piping, the welding negative or ground shall be attached to the piping on the same side of the insulating joint on which the weld is being made. Attachment of the negative cable or ground to the opposite flange piping may result in damaging the insulating flange.

6.2 During welding, the assembled insulating joint flanges and connected piping shall not be allowed to reach temperatures which may damage either the insulating components or coating (interior and/or exterior). As a general rule, the welding operation should be suspended and the piping/flange allowed to cool, if the flange in the area of the insulating components or piping in the area of the area of interior or exterior coating becomes uncomfortable to touch (approximately 150° F).

6.3 Care must be exercised when installing and/or working in the area of the assembled insulating joint to avoid damaging the applied coating systems.

6.4 When using a high voltage coating fault detector, a ground connection shall be attached to the piping which is being tested. Without the ground, the output of the coating fault detector may be applied across



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the insulating joint, which may result in erroneous detection of coating faults and/or damage to the insulating joint.

End of Specification

7.0 Revision Log

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**Subject:****CP Test Stations**

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CP Test Stations

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1.0 Introduction

1.1 Purpose

- 1.1.1 CP Test Stations are required to monitor the effectiveness of cathodic protection along the length of a pipeline. They may serve other important purposes as well, such as: providing a connection point to the pipeline for line locators, marking the location of the pipeline and identifying the owner and contact information of the pipeline. This specification prescribes the requirements for installing new CP test stations on the pipeline.
- 1.1.2 Any deviation from this specification must be authorized, in writing, by representatives of Sunoco Logistics, LP.

2.0 References

2.1 Sunoco Logistics Drawing Standards

- S_STDS_C210000 Type I, Two Wire Test Station Cathodic Protection
- S_STDS_C210001 Type I, Flush Installed Two Wire Test Station Cathodic Protection
- S_STDS_C210002 Type II, 4 Wire Current Drop Test Station Cathodic Protection
- S_STDS_C210003 Type II, Flush Installed 4 Wire Current Drop Test Station Cathodic Protection
- S_STDS_C210004 Casing Test Station Type III
- S_STDS_C210005 Foreign Pipeline Crossing Type IV
- SE_STDS_C210006 Cathodic Protection Station Type II/III
-

2.2 Sunoco Logistics Specification 1002 – Conductor Attachment to Pipe

3.0 General Requirements

3.1 There are four main types of test stations (Types I, II, III and IV).

- 3.1.1 Type I – Two Wire Test Station
- 3.1.2 Type II – Four Wire Current Drop Test Station
- 3.1.3 Type III – Casing Test Station
- 3.1.4 Type IV – Foreign Pipeline Crossing Test Station

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CP Test Stations

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- 3.2 Each Test Station (TS) type may have one or more subcategories, variations and/or combinations. They include:
 - 3.2.1 Flush-to-grade mounted enclosures, instead of standard above grade enclosures.
 - 3.2.2 Magnesium anode installation(s) in conjunction with the test wires.
 - 3.2.3 Steel coupon installation in conjunction with the test wires.
 - 3.2.4 ER Probe installation in conjunction with the test wires.
 - 3.2.5 Combination of Type II and Type III test stations.
 - 3.2.6 Combination of Type II and Type IV test stations.
- 3.3 All test wires shall be stranded copper with THW or MTW insulation.
- 3.4 Test wires shall be of the gauge and color indicated on the applicable standard drawings (listed in references).
- 3.5 Test wires are to be connected to the pipe and casing (if applicable) as described in Specification 1002 - "Conductor Attachment to Pipe".
- 3.6 Install the test wires within the pipe trench at the five and/or seven o'clock position of the pipe. The wires shall not be in immediate contact with the pipe. The length of the wires should extend approximately three (3) feet above the test box to prevent the wires from being unduly stressed or broken during backfilling or future excavations.
- 3.7 Back-fill around the wires must be free of sharp materials, stones larger than ¼ inch and other foreign material that could damage the test wire insulation.
- 3.8 Test wires shall come above grade and terminate inside a COTT Big Fink – yellow or Flush Fink type test station. If there are more than 5 wires terminating in the test station, a COTT Fat Fink or a larger flush-to-grade enclosure, available from Bingham and Taylor, may be substituted.
9. Test each wire for electrical continuity after backfilling.

4.0 Test Station Types

- 4.1 Type I – Two Wire Test Station
 - 4.1.1 This is the most common type of test station to be installed.
 - 4.1.2 Refer to Sunoco Logistics Dwg Nos. S_STDS_C210000 and S_STDS_C210001.
 - 4.1.3 The two test wires, one 10 gauge and one 12 gauge, both shall have black insulation.
 - 4.1.4 The wires shall be connected to the pipe two feet apart from each other.

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4.1.5 The No. 10 wire shall be attached to the pipeline at the lower station number ("upstream" side) in comparison to the No. 12 wire.

4.2 Type II – 4 Wire Current Drop Test Station

4.2.1 This test station allows the measurement of current flow along the pipeline via the calibrated resistance of the pipe between the black and red No.12 wires.

4.2.2 Refer to Sunoco Logistics Dwg Nos. S_STDS_C210002 and S_STDS_C210003.

4.2.3 The two test wires with black insulation, one 10 gauge and one 12 gauge, shall be attached to the pipeline location with the lower station number ("upstream" side of the pipe), two feet apart from each other.

4.2.4 The two test wires with red insulation, one 10 gauge and one 12 gauge, shall be attached to the pipeline location with the higher station number ("downstream" side of the pipe).

4.2.5 The distance between the black No. 12 wire and the red No. 12 wire shall be 100 feet for 16" or smaller diameter pipelines. For pipe larger than 16", the distance shall be 150 feet.

4.2.6 The two No. 10 wires should be attached on the pipe outside of the two number 12 wires.

4.3 Type III – Casing Test Station

4.3.1 This test station provides a way to test for electrical isolation between the pipeline and casing.

4.3.2 Refer to Sunoco Logistics Dwg Nos. S_STDS_C210004 and S_STDS_C210006.

4.3.3 The No. 10 gauge test wire with black insulation shall be attached to the pipe one foot from the edge of the casing. If an existing casing end seal or boot prevents the wire from being attached a foot away from the casing end, attach the wire as close to one foot away as possible. The No. 12 gauge test wire with black insulation shall be attached to the pipe two feet from the black No. 10 wire.

4.3.4 The No. 10 gauge test wire with white insulation shall be attached to the casing one foot from the edge of the casing. If an existing casing end seal or boot prevents the wire from being attached a foot away from the casing end, attach the wire as close to one foot away as possible. The No. 12 gauge test wire with white insulation shall be attached to the casing two feet from the white No. 10 wire.

4.4 Type IV – Foreign Pipeline Crossing Test Station

4.4.1 This test station provides a way to test the effect a foreign pipeline's CP system has on Sunoco Logistics' pipeline at the point where the two lines cross. In some cases it provides a location to "drain back" interfering CP current from one pipeline to the other.

4.4.2 Refer to Sunoco Logistics Dwg Nos. S_STDS_C210005.



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- 4.4.3 The two test wires on the Sunoco Logistics pipeline, one 10 gauge and one 12 gauge, both shall have black insulation.
- 4.4.4 The two test wires on the foreign pipeline shall be of the color and size designated by the foreign pipeline company. These wires shall be clearly marked and identified inside the test station.
- 4.4.5 The Sunoco Logistics (black) No. 10 wire shall be attached to the pipeline at the lower station number ("upstream" side) in comparison to the No. 12 wire. These wires shall be attached to the pipe two feet apart and should straddle the location where the foreign line crosses under or over.
- 4.4.6 Foreign pipeline test wire shall be installed only if the foreign pipeline owner approves the installation. The wires should be installed by the foreign pipeline's representative.
- 4.4.7 Under no circumstances should anyone other than a Sunoco Logistics representative repair or attach a wire to a Sunoco Logistics pipeline or facility.

4.5 Coupon Test Station

- 4.5.1 This test station provides a way to temporarily simulate removing all current effects on an area of the pipeline. It is beneficial in areas where DC transit systems are close by, or where a large number of foreign CP systems exist. A coupon and coupon tube can be installed on any type of test station (I thru IV).
- 4.5.2 Steel coupon shall be manufactured and supplied by MC Miller, part # COU170. Each coupon shall include a coupon holder, also manufactured and supplied by MC Miller, part # COU175.
- 4.5.3 The flat exposed steel coupon surface shall be placed six inches from the side of the pipe (3 or 9 o'clock position) and face away from the pipe surface.
- 4.5.4 The area around the CP coupon shall be backfilled with the same material as the pipeline. Tamp as necessary to remove all voids and air pockets.
- 4.5.5 2" electrical (gray) PVC pipe shall be used for the coupon tube. The PVC tube should come above grade inside the test station and terminate 8" below the test station head.
- 4.5.6 The 2" PVC pipe shall be filled with the same backfill material as the pipeline. Screen the backfill material to remove all stones and clumps larger than ¼". Tamp at 1" lifts to remove all voids and air pockets.
- 4.5.7 Follow specification(s) above for wire installation according to test station type.

End of Specification

5.0 Revision Log



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1	02/12/2007	Lindy Barile		J. Field	NA	
2	09/05/2013	Lindy Barile	REI		NA	General updates
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9/25/13**Replaces:**
1100 Rev. 3**1.0 Introduction****1.1 Scope**

- 1.1.1 Unless stated otherwise on the construction drawings or in the project scope of work description, this specification covers the requirements for field painting exterior surfaces of aboveground tanks, piping, equipment and structural steel. Structural steel includes exposed steel framing inside buildings, cranes, crane runways, fixed ladders, safety railings, steel stairways and platforms, pipe supports, pipe racks, cable tray supports, the base frames of equipment skids and similar items.
- 1.1.2 This specification includes both new construction and recoating requirements. The painting of buildings (interior and exterior) is not covered in this specification.
- 1.1.3 Tank internal linings are not covered in this Specification.

2.0 General Requirements

- 2.1 The Contractor shall provide all necessary labor, material and equipment, as required to complete all work as specified.
- 2.2 The manufacturer's product data sheets for specified paint materials are incorporated as requirements by reference and by Owner approval of proposed coating systems submitted for approval by Contractor. The Contractor shall perform all work in strict compliance with manufacturer's data sheets. Contractor shall arrange for a pre-job meeting with the selected coatings manufacturers' area representatives prior to job start up to review project scope of work, and coatings manufacturers' application requirements.
- 2.3 The Contractor shall complete a copy of the attached Sunoco Logistics Coating Inspection Report each day. The Contractor shall retain one copy of this sheet, and one copy shall be submitted to the Owner's Representative, on a daily basis.
- 2.4 The following materials and surfaces are not to be coated unless specified otherwise on the construction drawings or in the scope of work description:
 - 2.4.1 Equipment name plates, tags, labels, or other identification.
 - 2.4.2 Concrete, glass, fiberglass, brick or glazed tile.
 - 2.4.3 Stainless steel, brass, bronze, copper or other non-ferrous surfaces.
 - 2.4.4 Insulation jacketing.
 - 2.4.5 Plastic pipe or plastic (PVC) electrical conduit.
 - 2.4.6 Galvanized surfaces.
 - 2.4.7 Interior surfaces of equipment, valve stems or moving parts.
 - 2.4.8 Electrical devices, instruments or similar equipment.



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3.0 Products

- 3.1 All paint materials shall be manufactured by The Sherwin-Williams Company (SW), International Paint LLC/Akzo Nobel (IP), or Carboline (C), or Owner-approved equal.
- 3.2 The following charts summarize several surface preparation and coating systems that are to be used, depending on field conditions.

CHART 1: New Steel (Shop Applied Primer and Intermediate Coats; Field Applied Finish Coat)

SURFACE PREPARATION: All surfaces to be coated shall be free from grease and oil; solvent cleaning as per SSPC-SP1 may be required. All surfaces to be coated shall be abrasive blasted to SSPC-SP10 Near-White Blast Standard with a minimum sharp angular profile of 2.0-3.0 mils. All mill scale must be completely removed. Prepared surfaces must be primed within eight hours of blasting or before flash rusting occurs. All published environmental conditions and recoat windows must be followed.

Coat	Product Name	Volume Solids	Recommended Min	DFT Range Max	Coverage (sq.ft./gal) Theoretical No Loss
1st	(Shop Applied Primer) (SW) Macropoxy 646 Fast Cure Epoxy	72%	4.0	6.0	192-288
	(C) Carboguard 60 Epoxy	72%	4.0	6.0	192 – 288
	(IP) Intergard 345 Epoxy	70%	4.0	6.0	187-280
2nd	(Shop Applied Intermediate Coat) (SW) Recoatable Epoxy Primer	65%	4.0	6.0	176-260
	(C) Carboguard 60 Epoxy	72%	4.0	6.0	192 – 288
	(IP) Intergard 345 Epoxy	70%	4.0	6.0	187-280
3rd	(Field Applied Finish Coat) (SW) Epolon 7 HS Porcelain White	63%	2.0	4.0	265-400
	(C) Carboguard 893SG Tank White	63%	2.0	4.0	265 – 400
	(IP) Intergard 1033 Tank White Epoxy (See notes below)	62%	2.0	4.0	249-498

Chart 1 Notes:

- 3.2.1 All plate ends and areas where welding is to be done shall be blasted as specified above but receive a 2" stand-back during the shop applied coating application only.



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- 3.2.2 Once erected in the field, all weld seams, plate edges, stand-backs and areas subject to mechanical damage shall be prepared in accordance with either SSPC-SP2, SSPC-SP3, SSPC-SP10 or SSPC-SP11. The appropriate surface preparation shall be decided by the Owner's Representative.
- 3.2.3 Prepared areas will require a firm featheredge at coating transitions.
- 3.2.4 All pre-primed steel must be clean and free from contaminants before coating.
- 3.2.5 The applicator shall apply two spot prime coats of Macropoxy 646, Intergard 345 Epoxy or Carboguard 60 at 4.0-6.0 mils dry film thickness per coat to the prepared areas.
- 3.2.6 Safety cages, ladders, top handrails of stairways and platforms, bumper posts, curbs and fencing around transformers shall receive a finish coat of Acrolon 218 ANSI Safety Yellow or Interthane 990HS ANSI Safety Yellow or Carbothane 134HG Safety Yellow in place of the finish coat.
- 3.2.7 Fire hydrants and monitors, hose racks, foam lines, foam generating equipment and foam storage tanks shall receive a finish coat of Acrolon 218 ANSI Safety Red or Interthane 990HS ANSI Safety Red or Carbothane 134 HG Safety Red in place of the finish coat.
- 3.2.8 Stencils/Labels shall be Acrolon 218 Black or Interthane 990HS Black or Carbothane 134HG Black.
- 3.2.9 Ethanol Tanks should use a Mildewcide, such as, Carboline M-1 Advanced Additive (or SW or IP equivalent) in the topcoat layer to deter staining.

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CHART 2: New or Existing Steel (Field Applied Primer, Intermediate and Finish Coats)

SURFACE PREPARATION: All surfaces to be coated shall be free from grease and oil; solvent cleaning as per SSPC-SP1 may be required. All new steel shall be abrasive blasted to SSPC-SP10 Near-White Blast Standard with a minimum sharp angular profile of 2.0-3.0 mils. All mill scale must be completely removed. All surfaces that have been previously coated shall be abrasive blasted to SSPC SP6 Commercial Blast Standard with a minimum sharp angular profile of 2.0 mils. Prepared surfaces must be primed within eight hours of blasting or before flash rusting occurs. All published environmental conditions and recoat windows must be followed.

Coat	Product Name	Volume Solids	Recommended Min	DFT Range Max	Coverage (sq.ft./gal) Theoretical No Loss
1st	(Primer) (SW) Macropoxy 646 Fast Cure Epoxy	72%	4.0	6.0	192-288
	(C) Carboguard 60 Epoxy	72%	4.0	6.0	192 – 288
	(IP) Interseal 670 HS Epoxy	82%	4.0	4.0	219-328
2nd	(Intermediate Coat) (SW) Macropoxy 646 Fast Cure Epoxy	72%	4.0	6.0	192-288
	(C) Carboguard 60 Epoxy	72%	4.0	6.0	192 – 288
	(IP) Interseal 670 HS Epoxy	82%	4.0	4.0	219-328
3rd	(Field Applied Finish Coat) (SW) Epolon 7 HS Porcelain White	63%	2.0	4.0	265-400
	(C) Carboguard 893SG Tank White	63%	2.0	4.0	265 – 400
	(IP) Intergard 1033 Tank White Epoxy (See notes below)	62%	2.0	4.0	249-498

Chart 2 Notes:

- 3.2.10 Safety cages, ladders, top handrails of stairways and platforms, bumper posts, curbs and fencing around transformers shall receive a finish coat of Acrolon 218 ANSI Safety Yellow or Interthane 990 HS ANSI Safety Yellow or Carbothane 134HG ANSI Safety Yellow in place of Epoxy finish coat.
- 3.2.11 Fire hydrants and monitors, hose racks, foam lines, foam generating equipment and foam storage tanks shall receive a finish coat of Acrolon 218 ANSI Safety Red or Interthane 990 HS ANSI Safety Red or Carbothane 134HG ANSI Safety Red in place of the finish coat.



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3.2.12 Stencils/Labels shall be Acrolon 218 Black or Interthane 990 HS Black or Carbothane 134HG Black.

3.2.13 Ethanol Tanks should use a Mildewcide, such as, Carboline M-1 Advanced Additive (or SW or IP equivalent) in the topcoat.

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CHART 3: Existing Steel (High Pressure Water Wash Surface Preparation)

SURFACE PREPARATION: Note: this section only applies to recoating surfaces that have been previously blasted and painted. All surfaces to be coated shall be free from grease and oil; solvent cleaning as per SSPC-SP1 may be required. All surfaces to be coated shall be high pressure water washed at 3,000-5,000 PSI with a rotating tip to remove all loose or peeling coating, debris, dirt and contamination. Failed and delaminating existing coatings or corroded shall be prepared in accordance with SSPC-SP2/SP3 Hand Tool/Power Tool Cleaning. Glossy areas may require abrasion to promote coating adhesion. All coating termination will require a firm featheredge in accordance with SSPC-SP/SP3 Hand Tool / Power Tool Cleaning Standards. All published environmental conditions and recoat windows shall be followed.

Coat	Product Name	Volume Solids	Recommended Min	DFT Range Max	Coverage (sq.ft./gal) Theoretical No Loss
1st	(Primer) (SW) Macropoxy 920 Rust Penetrating Epoxy Pre-Primer	100%	1.5	2.0	800-1,050
	(C) Rustbond Penetrating Sealer	99%	1.0	2.0	786 – 1572
	(IP) Interbond 600 Epoxy Sealer	85%	1.5	2.0	682-909
2nd	(Intermediate Coat) (SW) Macropoxy 646 Fast Cure Epoxy	72%	4.0	6.0	192-288
	(C) Carboguard 60 Epoxy	72%	4.0	6.0	192 – 288
	(IP) Interseal 670 HS Epoxy	82%	4.0	6.0	219-328
3rd	(Field Applied Finish Coat) Epolon 7 HS Porcelain White	63%	2.0	4.0	265-400
	Carboguard 893SG Tank White	63%	2.0	4.0	265 – 400
	(IP) Intergard 1033 Tank White Epoxy	62%	2.0	4.0	249-498
	(See notes below)				

Chart 3 Notes

- 3.2.14 Safety cages, ladders, top handrails of stairways and platforms, bumper posts, curbs and fencing around transformers shall receive a finish coat of Acrolon 218 ANSI Safety Yellow or Interthane 990 HS ANSI Safety Yellow or Carbothane 134HG Safety Yellow in place of the finish coat.

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- 3.2.15 Fire hydrants and monitors, hose racks, foam lines, foam generating equipment and foam storage tanks shall receive a finish coat of Acrolon 218 ANSI Safety Red or Interthane 990 HS ANSI Safety Red Carbothane 134HG Safety Red in place of the finish coat.
- 3.2.16 Stencils/Labels shall be Acrolon 218 Black or Interthane 990 HS Black or Carbothane 134HG Black.
- 3.2.17 Pre-finished new or relocated equipment such as pumps, motors, valves, actuators, etc. are also covered under this specification but do not require the power washing procedure.
- 3.2.18 Valve stems, relief valves, lightning arrestors, instrumentation, mechanical moving parts, etc. shall be properly masked and protected before sandblasting and painting adjacent surfaces.
- 3.2.19 Ethanol Tanks should use a Mildewcide, such as, Carboline M-1 Advanced Additive (or SW or IP equivalent) in the topcoat.


4.0 Inspection

- 4.1 Coating work shall be inspected by the Owner's Representative. Owner reserves the right to engage third-party agencies to perform these inspections and supplementary testing as deemed to be in the Owner's interests. In general, the inspection shall include, but not limited to the following aspects of the Contractor's work. Contractor shall provide reasonable access for inspections during the course of the work.
 - 4.1.1 Protection of equipment and areas not to be coated
 - 4.1.2 Surface preparation and cleanliness
 - 4.1.3 Surfaces checked for chemical contamination
 - 4.1.4 Determine and document daily ambient conditions
 - 4.1.5 Compliance with material mixing and/or thinning requirements
 - 4.1.6 Coating application and compliance with coating thickness requirements
 - 4.1.7 Coating repair and clean-up
 - 4.1.8 Documentation and coating inspection reports
- 4.2 Coating defects, including improper surface preparation, incorrect dry film thickness, discontinuities, overspray, runs, sags, entrapped foreign matter, and other coating defects shall be repaired by the Contractor at no additional cost to the Owner.

5.0 Labeling, Decals, and Stencils

The Owner may include as part of the project scope to require the Contractor to install tank labeling. The listed items are for general information only. If labeling is required by the Owner, additional scope and requirements will be provided

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- 5.1 Storage tank identification numbers shall be twelve-inch (12") high numerals, either decals or stencils, with the top of the numeral located up one-third of the shell height, and oriented toward the primary access/egress point to the tank area. Smaller tanks may need to be evaluated for labeling line of sight.
- 5.2 All other labels, if required and unless specified otherwise, shall be two-inch (2") high decals or stencils.
- 5.3 Some local jurisdictions may also require the installation of the NFPA 704 Hazard Rating System "fire diamond" symbol  which is used by emergency personnel to identify risks associated with the contents of the tank.

6.0 Surface Preparation Standards

The basic standards for preparing metal substrates are a joint effort between the Society for Protective Coatings (SSPC) and the National Association of Corrosion Engineers International (NACE).

- 6.1 **SSPC-SP1 Solvent Cleaning**
Removal of all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants from steel surfaces with solvent, vapor, cleaning compound, alkali, emulsifying agent, or steam.
- 6.2 **SSPC-SP2 Hand Tool Cleaning**
Removes all loose mill scale, loose rust, loose paint, and other loose detrimental foreign matter by hand chipping, scraping, sanding, and wire brushing.
- 6.3 **SSPC-SP3 Power Tool Cleaning**
Removes all loose mill scale, loose rust, loose paint, and other loose detrimental foreign matter by power wire brushing, power sanding, power grinding, power tool chipping, and power tool descaling.
- 6.4 **SSPC-SP5 / NACE 1 White Metal Blast Cleaning**
When viewed without magnification, the surface shall be free of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products and other foreign matter.
- 6.5 **SSPC-SP6 / NACE 3 Commercial Blast Cleaning**
When viewed without magnification, the surface shall be free of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products and other foreign matter of at least 66-2/3% of unit area, which shall be a square 3 in. x 3 in. (9 sq. in.). Light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coating in less than 33-1/3% of the unit area is acceptable.
- 6.6 **SSPC-SP7 / NACE 4 Brush-Off Blast Cleaning**
When viewed without magnification, the surface shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose coating. Tightly adherent mill scale, rust, and coating may remain on the surface. Mill scale, rust, and coating are considered tightly adherent if they cannot be removed by lifting with a dull putty knife.

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6.7 SSPC-SP10 / NACE 2 Near-White Blast Cleaning

When viewed without magnification shall be free of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products and other foreign matter of at least 95% of each unit area. Staining shall be limited to no more than 5 percent of each unit area, and may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coatings. Unit area shall be approximately 3 in. x 3 in. (9 sq. in.).

6.8 SSPC-SP11 Power Tool Cleaning to Bare Metal

When viewed without magnification, the surface shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter. Slight residues of rust and paint may be left in the lower portion of pits if the original surface is pitted. The surface profile shall not be less than 1 mil (25 microns).

6.9 SSPC-SP12 / NACE 5 Surface Preparation and Cleaning of Steel and Other Hard Materials by High- and Ultra High- Pressure Water Jetting Prior to Recoating

This standard requires water jetting at high- or ultra high-pressure to prepare a surface for recoating using pressure above 10,000 psi. Water jetting will not produce a profile; rather, it exposes the original abrasive-blasted surface profile. Water jetting shall be performed to meet four conditions: WJ-1, WJ-2, WJ-3, and WJ-4. The minimum acceptable surface shall have all loose rust, loose mill scale, and loose coatings removed.

6.10 SSPC-SP13 / NACE 6 Surface Preparation of Concrete

Provides requirements for surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems

6.11 SSPC-SP14 / NACE 8 Industrial Blast Cleaning

Removal of all visible oil, grease, dust and dirt, when viewed without magnification. Traces of tightly adherent mill scale, rust, and coating residues are permitted to remain on 10% of each unit area of the surface if they are evenly distributed. Shadows, streaks, and discoloration caused by stains of rust, stains of mill scale, and stains of previously applied coating may be present on the remainder of the surface.

6.12 SSPC-SP12 / NACE 5 - Surface Preparation and Cleaning of Steel and Other Hard Materials by High- and Ultra High- Pressure Water Jetting Prior to Recoating

This standard requires water jetting at high- or ultra high-pressure to prepare a surface for recoating using pressure above 10,000 psi. Water jetting will not produce a profile; rather, it exposes the original abrasive-blasted surface profile.

The Contractor shall use one of the visual surface preparation definitions (WJ-1 to WJ-4) and one of the non-visual surface preparation definitions (SC-1 to SC-3) to achieve the degree of visible and non-visible surface matter removed to produce a surface in compliance with the coating manufacturer's requirements for the various coating(s) to be applied.

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CHART 4: Pressure Categorization

PRESSURE CATEGORIZATION	
Low-Pressure Water Cleaning (LP WC) Cleaning performed at pressures less than 34 MPa (5,000 psi)	High-Pressure Water Cleaning (HP WC) Cleaning performed at pressures from 34 to 70 MPa (5,000 to 10,000 psi)
High-Pressure Water Jetting (HP WJ) Cleaning performed at pressures from 70 to 170 MPa (10,000 to 25,000 psi)	Ultrahigh-Pressure Water Jetting (UHP WJ) Cleaning performed at pressures above 170 MPa (25,000 psi)

CHART 5: Visual Conditions of Surface Cleanliness

VISUAL CONDITIONS OF SURFACE CLEANLINESS	
WJ-1 Surface shall be free of all previously existing visible rust, coatings, mill scale, and foreign matter and have a matte metal finish	WJ-2 Surface shall be cleaned to a matte finish with at least 95% of the surface area free of all previously existing visible residues and the remaining 5% containing only randomly dispersed stains of rust, coatings, and foreign matter
WJ-3 Surface shall be cleaned to a matte finish with at least two-thirds of the surface area free of all previously existing visible residues (except mill scale), and the remaining one-third containing only randomly dispersed stains of previously existing rust, coatings, and foreign matter	WJ-4 Surface shall have all loose rust, loose mill scale, and loose coatings uniformly removed

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CHART 6: Non-Visual Conditions Of Surface Cleanliness**NON-VISUAL CONDITIONS OF SURFACE CLEANLINESS****SC-1**

Surface shall be free of all detectable levels of contaminants as determined using available field test equipment with sensitivity approximating laboratory test equipment. For purposes of this standard, contaminants are water-soluble chlorides, iron-soluble salts, and sulfates.

SC-2

Surface shall have less than 7 $\mu\text{g}/\text{cm}^2$ chloride contaminants, less than 10 $\mu\text{g}/\text{cm}^2$ of soluble ferrous ion levels, and less than 17 $\mu\text{g}/\text{cm}^2$ of sulfate contaminants as verified by field or laboratory analysis using reliable, reproducible test equipment.

SC-3

Surface shall have less than 50 $\mu\text{g}/\text{cm}^2$ chloride and sulfate contaminants as verified by field or laboratory analysis using reliable, reproducible test equipment

**Subject:****Painting of Tanks, Pipes, Equipment, and Steel Structures****Prepared By:**

Kyle Donnelly[REI]

Revision:

4

Page:

13 of 14

Code:**Number:**

1100

Approved:

Lindy Barile

Date:

9/25/13

Replaces:

1100 Rev. 3

7.0 Coating Inspection Report

Project Location/Description: _____

Report Prepared By: _____ Work Date _____

Contractor: _____ Foreman: _____

Structure Identification: _____

Ambient Temp. Start, °F: _____ ; % Relative Humidity Start: _____

Ambient Temp. Finish, °F: _____ ; % Relative Humidity Finish: _____

Dew Point _____ Surface Temp., °F: _____ Surface Preparation, SSPC-SP: _____

Surface Preparation: Start _____ A.M./P.M. ; Finish _____ A.M./P.M.

Acceptance of Surface Preparation By: _____

Coating Used: _____ ; Thinner Used: _____

Coating Batch Numbers: _____

Existing Surface Description (Pitted, Prime Coat, etc.): _____

Method of Application (Spray, etc.): _____

Prime Coat : Start _____ A.M./P.M. ; Finish _____ A.M./P.M.

Intermediate Coat : Start _____ A.M./P.M. ; Finish _____ A.M./P.M.

Top Coat : Start _____ A.M./P.M. ; Finish _____ A.M./P.M.

Prime: Wet Film Mils: Minimum _____ ; Maximum _____ ; Average _____

Prime: Dry Film Mils: Minimum _____ ; Maximum _____ ; Average _____

Intermediate: Wet Film Mils: Minimum _____ ; Maximum _____ ; Average _____

Intermediate: Dry Film Mils: Minimum _____ ; Maximum _____ ; Average _____

Top: Wet Film Mils: Minimum _____ ; Maximum _____ ; Average _____

Top: Dry Film Mils: Minimum _____ ; Maximum _____ ; Average _____

Visual Appearance: _____



Sunoco Pipeline L.P. and Affiliates CONSTRUCTION STANDARDS

Subject:

Painting of Tanks, Pipes, Equipment, and Steel Structures

Prepared By:

Kyle Donnelly[REI]

Revision:

4

Page:

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8.0 Revision Log

Revision No.	Revision Date	Document Authorizer	Document Reviewer	Document Author	Document Administrator	Revision Details
2	3/26/2012	Lindy Barile	John Pachuta	Kyle Donnelly		Updated standard to include Carboline and International Paint options
3	01/22/2013	Lindy Barile	Justin Sauers			Updated to include Coating Inspection Report left out of rev 1 and 2
4	09/25/2013	Lindy Barile	REI			General updates



Sunoco Logistics



PRESSURE TESTING OF USDOT PART 195 REGULATED PIPELINES

PR-11-0004

Rev.8,Aug-13

Issuing Dept	Engineering
Authorizer	Lindy Barile
Reviewer	Standard Committee
Author	Katelyn Smith
Next Rev. date	03/15/2016

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1 GENERAL

The following procedure is a company approved procedure. These are considered the minimum requirements. Specific cases may be handled under other methods and procedures. Deviations to this procedure should be handled through the deviation process defined in ENGR-PR-0002 *Engineering Standards, Procedures, & Guidelines*. Approval must be obtained from the Manager of Operations Engineering or Manager of Asset Integrity prior to performing test.

It is the policy of the Company to pressure test its pipelines and pipeline facilities that operate under pressure to a predetermined test pressure and to maintain a record of such tests for the life of the pipeline or pipeline system tested. Certain facilities may be exempt from pressure testing under the CFR 49.195 or may be inspected in conjunction with the Sunoco Logistics L.P. Integrity Management Plan (IMP).

1.1 Purpose

This Procedure is designed to ensure that the tested pipe and components meet the requirements of DOT "Transportation of Hazardous Liquids by Pipeline", 49CFR.195, Subpart E and "Transportation of Natural or Other Gas by Pipeline" 49CFR Part 192 Subpart J(Refer to Appendix A of this Standard).

1.2 Objective

- To establish a standard procedure for the pressure testing of DOT regulated pipelines
- To establish guidelines in the preparation of a permanent record certifying that the pipeline has been tested to withstand a predetermined pressure limit.

1.3 References

- US Department of Transportation 49 CFR 195
- API RP 1110, *Pressure Testing of Liquid Petroleum Pipelines*
- API Manual of Petroleum Measurement Standards, Chapter 11, *Physical Properties Data*
- PR-11-0037, *Activating and Deactivating Pipelines*



- PR-11-0010 - *Determination of the Maximum Operating Pressure (MOP), Maximum Allowable Operating Pressure (MAOP), or Current Operating Limit (COL) for a Pipeline System*
- ASME B31.4 or ASME B.31.8
- PR-11-0004, Appendix A – Pressure Testing of DOT 192 Pipelines
- PR-11-0004, Appendix B – Hydrotest Pressure Calculation Program
- PR-11-0004, Appendix C – Pressure Test Validation Program, Water
- PR-11-0004, Appendix D – Pressure Test Validation Program, Anti-Freeze
- PR-11-0004, Appendix E – Pressure Test Validation Program, Product
- PR-11-0004, Appendix F – Pressure Test Certification (formally Sun 48080)
- PR-11-0004, Appendix G – Pressure Test Recorder Calibration Log (formally Sun 48081)
- PR-11-0004, Appendix H – Pressure Test Corrosion Checklist
- PR-11-0004, Appendix I – Hydrostatic Test Failure Report

1.4 Equipment and Tools Required

- Certified Meter for measuring line fill or comparable means for measuring line fill volume.
- Portable Centrifugal Pump may be used to fill the section of line that is to be tested.
- Portable Positive Displacement Pump with known volume per stroke and stroke counter, or PD meter if required, is to be used when applying the test pressure to the section of line that is being tested. Consider using a pressure relief valve on equipment to ensure pipeline is not overpressured during the filling process.
- Calibrated, certified 24-hour Pressure Recorder.
- Calibrated Pressure Gauges as needed.
- 24-hour Temperature Recorder with remote sensing bulb properly calibrated with accuracy of 1 °F and sensitivity of 0.1 °F.
- Certified Dead Weight Tester / Recorder capable of measuring in increments less than or equal to 1 psi: for the pressure test and for calibrating the test instruments. The certification of accuracy shall be current within the last 12 months of the test date.
- Electronic pressure / temperature monitoring and recording devices may be used if the level of accuracy and sensitivity matches the standard equipment stated above. In addition the devices must have calibration certification or be capable of being field calibrated according to standard equipment.



- Consideration should be given for the need of a pressure-relief valve to be installed within the test loop. If determined required set pressure should be at test pressure plus 50 psi, or test pressure plus 10% of test pressure, whichever is lower.

1.5 Definitions

The following definitions shall apply to this procedure and shall be used to resolve conflict that may arise out of improper context.

- **Approver:** The engineer or individual who is trained and knowledgeable in the requirements of this procedure and can sign off a test as “passed”. This can be an engineer from Operations Engineering, Asset Integrity, Capital Projects, or the District/Regional Engineer.
- **Area:** Sunoco Logistics, L.P. Eastern Area Operations or Sunoco Logistics, L.P. Western Area Operations.
- **Centrifugal Pump:** An assembly that draws liquid into its body from the centerline flow and delivers the resultant liquid volume from the center to the radial edge of the body.
- **Company:** Sunoco Logistics, L.P.
- **Component:** Any part of a pipeline that may become subjected to pump pressure including, but not limited to, pipe, valves, elbows, tees, flanges, closures, and fabricated assemblies.
- **Conducted by:** The person (mechanic, technician, contractor, etc.) physically conducting the pressure test in the field.
- **Dead Weight Tester:** An instrument consisting of a hydraulic cylinder and weights of various sizes, used to accurately measure the gauge pressure inside a pressurized system.
- **Factory:** The place or location where the system component was built and manufactured.



- **Leak Test:** Test designed to determine the presence or absence of leaks in a pipeline system.
- **Manager of Asset Integrity:** An individual managing integrity for Sunoco Logistics
- **Maximum Operating Pressure (MOP):** The maximum pressure that an operator may operate a pipeline segment established in accordance with DOT Part 195.406.
- **Mill Test Report (MTR):** Includes pipe mill test reports, component certification, etc. that indicate the ratings/design of the material from the manufacturer.
- **Out-of-service:** Refers to any pipeline or pipeline system that has been removed from transportation service of gas or hazardous liquid subject to the pipeline safety laws. These pipelines do not contain gas or hazardous liquid and are safely disconnected from an operating pipeline system (i.e. air-gapped, blinded, or isolated with a skillet). These pipelines will be maintained to a less than full DOT 191, 192 or 195 requirements. The relevant maintenance activities for each out-of-service pipeline are to be documented in a Pipeline Service Change Record (Ref PR-11-0037).
- **Part 195 or DOT:** Refers to the Code of Federal Regulations Title 49 - Transportation, Part 195 - Transportation of Hazardous Liquids by Pipeline.
- **PD Meter:** A measuring device that operates on the principal of positive displacement of any liquid or vapor.
- **Pipe or Line Pipe:** Steel tube, usually cylindrical, through which a petroleum product flows from one point to another. In some instances this may also refer to steel tubes with non-steel liners or tubes of polyethylene pipe. In this procedure all pipelines are considered DOT 195 regulated. (NOTE: Currently some petroleum movements, leading away from production facilities through lines \leq 8 inches in rural areas which do not impact Unusually Sensitive environmental Areas (USA's), are exempt from compliance to this requirement in DOT 195).



- **Pipeline Pig:** An independent, self-contained utility device, which is propelled through the interior of the pipeline for the purpose of cleaning, inspecting, or purging the pipeline.
- **Pipeline or Pipeline System:** all parts of a pipeline facility through which a hazardous liquid moves in transportation, including, but not limited to, line pipe, valves and other appurtenances connected to line pipe, pumping units, fabricated assemblies associated with pumping units, metering and delivery stations and fabricated assemblies therein, and breakout tanks.
- **Responsible Person:** Project Manager, Engineer, or other person who is gathering the paperwork and is responsible for the overall test and/or project.
- **Spike Test:** A pressure test of short duration (typically less than one hour) and high amplitude (test pressure ratio typically greater than 1.25).
- **Strength Test:** Test with water used to establish the maximum operating limit of a pipeline segment. The test pressure ratio is a minimum of 1.25 times the pressure required to establish the pipe MOP and is held for minimum duration of 4 hours or longer. Strength tests are determined acceptable if no ruptures or leaks occur.
- **Witnessed by:** SXL representative in the field who saw the test being performed and can vouch that it took place. This may be the SXL Mechanic or Technician who performed the test, or SXL third party inspector for the job, etc.

2 CONDITIONS REQUIRING PRESSURE TESTING

Tests are to be made under the following conditions:

- Prior to placing in service a newly constructed pipeline or pipeline facility.
- Prior to operating an existing pipeline segment which has been relocated, replaced, or otherwise changed.



- Prior to raising the maximum operating pressure on an existing pipeline.
- Prior to converting an existing pipeline to a DOT Part 195 regulated service when the existing test does not meet the Part 195 requirements for the new type of service.
- Prior to installing pipe into an existing pipeline.
- Out-of-service pipelines shall go through the Conversion to Service Process to determine if a Pressure Test is necessary prior to returning the line to active service. Refer to PR-11-0037, *Activating and Deactivating Pipelines*.
- Those portions of previously untested older pipelines that have not been exempted from hydrotesting under DOT Part 195.302(b) prior to December 7, 2003.
- As required by the Sunoco Logistics, L.P. Integrity Management Plan (IMP).

3 TEST MEDIUM

- The pressure test should be conducted with water. In geographic areas that are typically subjected to freezing temperatures during the winter months, when hydrotesting an existing facility, or new facility piping in-place, anti-freeze treated water or distillate should be considered as the test medium regardless of the season the test occurs.
- Geographic areas that are subject to freezing during winter months, and where the risk of a major product release is minimal due to the limited volume of product involved in a test of an isolated facility, consult engineering to determine the feasibility for using anti-freeze treated water, distillate, or crude oil as the pressure test medium.



3.1 Water

- 1) **Untreated Water:** Special care should be taken to ensure the complete removal of all residual hydrotest water from the pipeline and pipeline components upon the conclusion of the hydrotest. Refer to 4.2.6 for additional dewatering information.
- 2) **Anti-Freeze Treated Water:** Anti-freeze treated water may be used as a hydrotest medium. Contact the Area HES coordinator regarding specific handling requirements and the potential need for a spill trailer on-site during testing.
- 3) **Use of Corrosion Inhibitors:** The use of corrosion inhibitors in the water can be used with the approval of the Corrosion Field Services Manager. Regulatory Agencies may require pre-and post-testing of water to be used in pressure testing. Contact the Area HES coordinator for specific handling requirements.
- 4) **Dye Treated Water:** EPA approved fluorescent tracer dyes may be added to hydrostatic testing water to assist in locating pipeline leaks on mainline piping. The proportion of dye to test water is provided by the dye manufacturer. Regulatory Agencies may require pre and post testing of dye treated water to be used in pressure testing. Contact the Area HES coordinator for specific requirements.

3.2 Distillates and Crude Oil:

- 1) Where the risk of a major product release is minimal due to the limited volume of product involved in a test of an isolated facility, “diesel-like distillates” (preferred) or crude oil (that does not vaporize readily) may be used as a pressure test medium in accordance with DOT Part 195.306. The approvals of the Manager of Operations Engineering, Manager of Asset Integrity, and the District/Regional/Operations Manager (or his/her designee) will be required.

In order to meet Part 195.306 requirements, the test segment is required to be located outside of cities and populated areas, buildings within 300 feet of the test piping must be unoccupied when the pipeline is tested above 50% SMYS, the piping must be kept



under surveillance by patrol during the pressure test, and continuous communication must be maintained along the test section.



4 PRESSURE TESTING GUIDELINES

4.1. Test Pressures

The methods of determining a test pressure described below is consistent with the recommendations of API RP 1110, *Pressure Testing of Liquid Petroleum Pipelines*, for Strength Pressure Tests and 49CFR Part 195, Subpart E. Other test methods may be considered based on threats being evaluated.

4.2. Minimum Test Pressure

- The basic test pressure shall not be less than the minimum test pressure required by 49CFR Part 195, Subpart E, paragraph 195.304.
- The test pressure for each pressure test must be maintained throughout the part of the system being tested for at least 4 continuous hours (for a pipe section that can be fully visually inspected) at a pressure equal to 125 percent, or more, of the maximum operating pressure as determined through system analysis in water and proposed product.
- In the case of a pipeline that is not visually inspected for leakage during the test, pressure must be maintained and monitored for at least an additional 4 continuous hours at a pressure equal to 110 percent, or more, of the maximum operating pressure.
- An Operations Engineer, Asset Integrity, Capital Projects, or the District/Regional Engineer shall determine the minimum test pressure when testing existing pipeline facilities.
 - Test Pressure determination should include the following:
 - Pipeline Operating Conditions,
 - Impact of Pipeline Elevation/Profile (high and low points for entire segment)
 - Adjustment for Specific Gravity of product (ex., ethane or crude)
 - Maximum Test Pressure,



- Historical Operation, Integrity, Corrosion and Engineering Data,
 - Pipeline Characteristics, and Design Pressure,
 - Design rating of components (ANSI...) compared to test pressure, including low point elevations.
- The Pressure Calculation Program (Appendix B) shall be utilized. (This calculation program is a basic guide for pipe without elevation or product compensation. Be sure calculations compensate for product type and elevation profile of the pipeline.)
 - Pipeline segments included in the Integrity Management Plan (IMP) to be Pressure Tested for a Baseline Assessment or Re-Assessment must be reviewed for the effectiveness of the Corrosion Control Program on the line segment prior to hydrotesting. Refer to Specification PR-11-0032, *Pipeline Assessment Method Selection* Procedure for additional information.

4.3 New Pipe

If the new pipe to be tested is intended as Stock, it should be tested at the highest possible pressure to allow the most flexibility for installation in a maximum number of pipeline pressure applications. Engineering should be consulted to conduct test calculations to ensure pressures will not yield the pipe. If the new pipe is not tested to maximum pressure, then it shall be clearly marked with the Hydro-test #, MOP and test pressure it was tested to before going back into Stock.

Proper pressure test documentation and MTR's must be maintained for the pipe.

- The basic minimum test pressure to which the pipe segment is tested shall be 90% SMYS, and due to potential variations in elevation, the maximum test pressure at any point shall not exceed 95% of SMYS without prior approval from the Manager of Operations Engineering, Manager of Asset Integrity, and the District/Regional/Operations Manager. Where multiple diameters, grades, and/or wall thickness are tested simultaneously, the entire section shall be tested to the lowest calculated SMYS as previously stated.



Exceptions to the 90% SMYS minimum test pressure are permissible as follows:



These instances are not incorporated into the Pressure Determination Program

- When 90% SMYS is above 2220 psig on pipe to operate at 1480 psig maximum operating pressure, the test pressure may be limited to 2220 psig.
- When 90% SMYS is above 2775 psig on systems to operate at 2220 psig maximum operating pressure, the test pressure may be limited to 2775 psig.

4.4. Components

- A single component (the only item being replaced or added) such as a valve or a tee, does not need to be pressure tested if the component was pressure tested at the factory or was manufactured under a documented quality control system that ensures each component is at least equal in strength to a prototype that was tested at the factory. Components should not be subjected to normal operating pressure in excess of their design pressure.
- The minimum test pressure for components included in a pressure test is 125 percent of the component design pressure.
- The maximum test pressure for ANSI Rated Components (flanges, flanged fittings, flanged valves, fabricated assemblies ...) shall not exceed 135 percent of the component design pressure without approval from the Manager of Operations Engineering, Manager of Asset Integrity, and the District/Regional/Operations Manager. Pressures required over 135% of ANSI Rating will require an engineering evaluation to be performed with the considerations given to Section 4.2, Minimum Test Pressure defined in this procedure. Evaluation may suggest using higher rated components to meet MOP requirements.

If the minimum test pressure is based on SMYS or Limiting Components, the program sheet named "Limiting Component, SMYS" on the Hydrotest Pressure Calculation Program shall be used. (Be sure calculations compensate for product type and elevation profile of the pipeline.)



4.5. New MOP

- Piping may be tested to an MOP that is less than its limiting components and its SMYS. In this case, the minimum test pressure must be 125% of the MOP being established. The maximum test pressure shall not exceed 135% of the MOP being established.



It is always best to pressure test lines to their maximum potential in case the MOP is to be raised in the future.

If the minimum test pressure is based off new MOP only, the sheet named “MOP” on the Hydrotest Pressure Calculation Program shall be used. (Be sure calculations compensate for product type and elevation profile of the pipeline.)

5 PRESSURE TESTING PROCEDURE

5.1. Preparation of Pipeline for Pressure Test

- 1) A site Test Plan should be developed detailing the specifics related to the pipeline system being tested. The plan should include items such as product displacement, cleaning and pigging, line isolation, pressure and temperature monitoring locations, test pressures, safety and environmental or permit requirements, as well as other requirements.
 - In addition, it is required to begin the Hydro Test documentation process during the initiation phase of the Test Plan.
 - Prior to performing a pressure test, a unique pressure test tracking number shall be obtained by an SXL employee (Responsible Person) from Asset Integrity by sending a completed [Hydro Request Form](#) (located on the Sunoco Logistics' Asset Integrity homepage) to hydrorequest@sunocologistics.com.
- 2) The pipeline to be tested is to be filled with the testing medium (volume based on Test Plan) to ensure that no air remains in the pipe. It is preferable that the pipeline to be tested be filled from the lower end of the segment that is being tested and that a pig or sphere be run ahead of the liquid column. Use caution when filling with a pig. An initial pig speed of 2-3 mph is recommended to prevent air or nitrogen to mix with the



test medium. When the option of running a pig through the line is not possible, all air should be removed prior to starting the test. The use of a Pressure-Volume plot is recommended to determine residual air or monitor pipe elastic limit effects.

- 3) The Test Plan should determine the pipe pressurization rate; typically, rates of 10 psig/minute or lower are used. After the pipeline has been filled, the pressure shall be raised to 20% of the prescribed test pressure or to 100 psig calculated at the highest point. Water shall stand for a period of time, preferably overnight, to allow the temperature of the water stabilize with the ground and pipe temperature. Should the pipeline be 100% exposed, this step can be omitted.

5.2. Conducting Pipeline Pressure Tests

- 1) After the segment of pipe that is to be tested has been filled with the testing medium, a reciprocating or PD Pump is to be used to supply the test pressure on the pipe. The pump is to be of a known cylinder volume and efficiency. A stroke counter or a PD Meter is required to measure the volume added to pressurize the system during any phase of the test.
 - The calculated volume of test medium required to pressurize the system from 0 psi to the target test pressure is provided in the applicable Pressure Test Validation Program (use Appendix C and Appendix E depending on test medium). This value may be used to determine the amount of entrained air in the test segment relative to the actual measured volume required to pressurize the system. Any change in temperature during a pressure test will affect the volume of entrained air as well as the test medium and will need to be accounted for.
- 2) To minimize the effects of entrained air during 8 hour pressure tests, the segment should be brought up to the designated test pressure and held for 15 minutes. The pressure is then to be lowered to 25% of the test pressure and held for another 15 minute period. Finally, the pressure is then raised in the pipe segment to targeted test pressure to mark the start of the pressure test. The pressure - volume plot can be helpful in determining the amount of entrained air in the system.



- The pressure on the segment of pipe being tested is to be controlled, raised to the test pressure, and maintained for the duration of the test. Once the pressure reading is 100 psi below the targeted test pressure steps should be taken to control the pressure rise to 10 – 20 psi per minute to the point that the targeted pressure is obtained.
- 3) If the line pressure varies slowly during the test, calculations are to be made to verify the variation is due to temperature changes by using the Pressure Test Validation Program (Appendix C and Appendix E depending on test medium).
- Provisions are to be made during the test period to withdraw fluid to prevent over pressure and to inject fluid to maintain pressure. Each withdrawal or injection shall be measured, documented, and accounted for in the calculations (Pressure Test Validation Program) to verify no leaks are present in the test segment. Accurate determination of fluid volumes removed or injected should be measured using the most precise graduations available.
 - When testing pipe or a piping system where the entire facility tested can be visually inspected, it will not be necessary to perform calculations using the Pressure Test Validation Program. Periodic visual inspections of the facility and test pressure shall be performed during the test to verify no leaks or deformation of the pipe. The verification of these inspections shall be noted in the test report. Consideration should be given to the pressure-volume plot to account for entrained air.
- 4) The test pressure is to be maintained on the segment of line under test for a minimum of 8 continuous hours. Pipelines that can be 100% visually inspected during test will only require a 4-hour test period.



- 5) Pressure recorders are to be calibrated and their accuracy certified before and after the test.
- 6) The Test Plan should identify the location and installation of instrumentation to be used for the test

- 24-Hour Pressure Recorder

At least one 24-hour Pressure Recorder is to be used on each pressure test. The location of the pressure recorder may be identified in the Test Plan or determined in the field. Adjusting the basic test pressure in accordance with the difference in pipeline elevation from the planned installation location will be required. The recorder is to be connected to the segment of pipe under test with a manifold of pipe work that has connections for the recorder, indicating gauge and dead weight tester. The manifold must be capable of isolating all of the instruments from the segment of pipe being tested.

- 24-Hour Temperature Recorder

Volume changes in the test section are sensitive to the effects of temperature. At least one 24-hour temperature recorder is to be used on each pressure test. The temperature bulb is to be located in the test segment thermowell. Exposed pipe in the test section shall be covered with sufficient thermal insulation so that the recorded temperature will not be affected by the ambient conditions. Alternatively, the temperature bulb can be strapped next to the pipe, wrapped with insulation, and back-filled. It is recommended that the temperature bulb be placed at least 100 feet from water injection point to avoid recorded temperature fluctuations.

- 7) Buried pipeline tests require that all significant exposed pipe segments shall be covered with sufficient thermal insulation so that the recorded temperature will not be affected by the ambient conditions. Insulation shall be protected from any moisture contact, i.e. snow or rain.



- 8) Only qualified personnel as determined by the project responsible person are to be used for conducting the pressure tests. Qualifications will be based on certification, training and experience.
- 9) The pressure test shall be conducted by (see definition) an OQ qualified (Task 411) person; contractor or SXL employee.
- 10) Pressure sensing equipment and personnel conducting the test should be maintained at a safe distance from the pipeline being tested. Safe distance will be contingent upon the pressure of the pipeline being tested.
- 11) Dead weight tester readings shall be recorded every half-hour.

6 DEWATERING UPON HYDROTEST COMPLETION

Once testing has been completed, depressurization and draining of the test medium from the pipeline should follow a predetermined control plan that identifies pressure bleed locations and medium disposal requirements.

The testing of piping and components can result in the potential for residual test water to remain trapped in low points and minor piping upon the conclusion of the hydrotest. Even months after a hydrotest has been completed, water trapped in remote tubing, instrumentation, valves, dead legs, and fittings is susceptible to freezing during cold weather. This could potentially cause instrumentation to not function properly or rupture a component causing a product release. It is necessary to completely purge all system points of residual water. Dewatering may require the removal of individual components or sections of manifold piping in order to remove the remaining water.

Prior to commencing the hydrotest, the requirements for permitting responsibility (contractor/owner) and the disposal of the hydrotest water should be determined. Contact the Area HES coordinator to determine if any special permit, testing and disposal requirements exist.



6.1.1. Purging Untreated Water

a) Tested In-Place Components

If untreated water is used for an in-place hydrotest, the hydrotest crew must be certain to thoroughly flush all water from the system including, but not limited to major piping, small diameter piping, valves, valve bodies, instruments, instrument tubing, and drain lines. Since water is heavier than the products currently shipped, special care should be given to ensure low spots and fixtures attached to the bottom of the pipeline that can potentially retain water are fully purged. All temporary drain valves shall be removed and plugged unless opened to a gravity sump line. This draining should be done at least twice at pipeline facilities, once upon the conclusion of the hydrotest, and once after the facility has been in service for several days or weeks to flush any residual water may have migrated to the low spots or dead end sections of a component.

b) Prefabbed Piping Sections

When testing prefabbed sections of piping, it will be necessary to completely drain and/or swab all piping, components, and valve bodies of potential residual water prior to installation into the pipeline system.

1) Purging Anti-Freeze Treated Water

Contact the Area HES coordinator regarding specific collection and disposal requirements of anti-freeze treated hydrotest water. The same considerations for draining of components should be followed as described above for water medium.

6.1.2. Purging of Water Treated with Corrosion Inhibitors

Water treated with corrosion inhibitors shall be purged with the same care as taken for untreated water. Contact the Area HES coordinator regarding specific collection and disposal requirements of anti-freeze treated hydrotest water. The same considerations for draining of components should be followed as described above for water medium.



7 DOCUMENTING PRESSURE TEST FAILURES

The Test Plan should include provisions for the documentation and handling of failed piping or components. Test failures of new or existing pipe must be documented in accordance with DOT Part 195.310. All failures must be evaluated for root cause as described below.

In the event a pipeline fails under test pressure, the cause of the failure is to be evaluated and documented using Appendix I, Hydrostatic Test Failure Report. Metallurgical evaluations of test failures may be required to assure a full understanding of the test failure. If the root cause of the failure was caused by a mechanism that may be present in other sections of the line (i.e. Selective seam corrosion, internal corrosion, hook cracks, etc.), additional inspection methods using either ILI tools or direct assessment options, may need to be utilized to verify the line for adequacy prior to re-testing. Where appropriate, the results of the failure analyses are to be taken into account during the development of risk factors in the Risk Model of the Company's IMP.

8 TEST VERIFICATION CALCULATIONS

The calculations used to verify the pressure test may include:

- Effect of liquid temperature change on test pressure
- Effect of thermal expansion of pipe
- Compressibility of liquid and its effect on test pressure
- Elasticity of pipe
- **Consideration for the effects of pipeline elevations and product type should be made

These factors are accounted for in the Pressure Test Validation Program used to validate the Pressure Test. The allowable difference between calculated and measured volumes shall be +/- 0.02%. A written justification must be provided by the Approver certifying the pressure test for variances outside of the allowable range. Justification must be attached to the Pressure Test Certification form, Appendix F.

Test verification calculations are required for all eight-hour pressure tests (Pressure Test Validation Program (Appendix C through E).

Calculations using the Validation Program are not required for 4-hour visually inspected tests.



9 CERTIFICATION

All pressure tests conducted internally within the Company must be certified by the Approver (see definition) responsible for reviewing the Entrained Air (if applicable) and Pressure Test Validation Program calculations used to justify the pressure test. The Approver must sign the Certification statement on the front page of the test form (Certification of Pressure Test, Appendix F). The approver may or may not be a visual witness to the test.

During a four hour test, the Approver may be the SXL Engineer, Mechanic or Trained Employee that can verify the test has passed a visual examination. The eight hour test will require the Approver to be the Engineer running the calculations or reviewing the calculations performed by a 3rd party, and making the decision of the test to pass/fail. (The engineer may be from Operations Engineering, Asset Integrity, Capital Projects, or the District/Regional Engineer). Electronic approval (email) is acceptable if the Engineer is in a different location and a signature is too difficult to obtain.

Pressure Tests performed with a third party contractor as the Approver, must have the results certified by a Registered Professional Engineer (PE) in the state where the test was performed. The Certification form shall be certified and stamped by the PE. This would include a DOT 195, Subpart E pressure test being performed for relocations >1 mile and for the purposes of validating overall pipeline integrity in support of an IMP Baseline assessment or reassessment.

Four-hour tests shall be certified by the designated Approver. This person shall make the proper notation regarding observed leaks on the front page of the test form, and shall sign the form.

The Certification of the Pressure Test form requires the following four signatures: Conducted by, Witnessed by, Approver, & Responsible Person (see definitions). It is possible that some roles may overlap by a particular person; that person will need to sign the form for each role they are filling.



Test charts shall be signed by the person conducting the test and the person witnessing the test.

10 RECORD KEEPING

10.1 Data Collection

All test data for each test completed is assembled into a package as described below for easy reference and analysis. Pressure tests are tracked through the Splint database using a unique number identifier. The original Hydrostatic Pressure Test records for all pipeline tests (including pre-tested pipe for stock) are to be maintained, for the life of the facility, in the Asset Integrity/Engineering Files. Copies only of test records are to be maintained in the Regional/District Office DOT files. If subsequent pressure tests are made on the same pipe section, only the most current record is required to be retained as long as the pipeline section is in service.

Prior to performing a pressure test, a unique pressure test tracking number shall be obtained by an SXL employee (Responsible Person) from the Asset Integrity designee by sending a completed [Hydro Request Form](#) (located on the Sunoco Logistics' Asset Integrity homepage) to hydrorequest@sunocologistics.com. In extenuating circumstances and with notification and approval from the Integrity Manager or designee, a pressure test tracking number may be obtained after test completion. The Asset Integrity designee will assign the tracking number which will be utilized in recording test information in the SPLINT database. The Asset Integrity designee will return the Hydro Request Form to the requestor. The hydro request form should be completed in its entirety, and returned with the documentation package submitted to Asset Integrity designee in the time frame noted below.

Within thirty (30) days of test completion, all test documentation should be sent to the Asset Integrity office for completion of test documentation in the SPLINT database and permanent filing of original records. The Responsible Person shall ensure copies are distributed to the appropriate field office.



Asset Integrity will document the test in the SPLINT database, based upon the information provided on the hydro request form and documentation package that is submitted by the responsible person. The Responsible Person shall collect, organize and submit all required documents, data and supporting calculations for the pressure test.

Each report should contain adequate information and supporting data to prove that the segment of pipe was tested to a predetermined pressure and time period, and that the minimum requirements of the applicable code and/or government regulation has been met under the test. Submitted documentation shall satisfy the following Sunoco Logistics and U.S. Department of Transportation requirements as defined in the chart below:



Table of Sunoco Logistics and U.S. Department of Transportation hydrotest documentation requirements.

NOTE: Records and Charts must include Hydro-test #, date, and name of the individual performing the hydro-test.

Requirements for Test Records (New Pipeline Installations)	DOT	SXL
1. SXL Hydro Request Form & checklist fully populated		x
2. Pipe Mill Test Records (MTR), or lab results confirming material composition		x
3. Pipe & Fitting Purchase Orders		x
4. Temperature Charts		x
5. Dead Weight Tester Certificate		x
6. Sketch or Drawing w/Location and Stationing		x
7. If applicable, Corrosion Checklist (Applies to full line test used as IMP inspection) (Appendix H)		x
8. Pressure Test Calculations_8hr ONLY – (Appendix C-E depending on test medium)		x
9. Pressure Test Certification (Appendix F) & Recorder Calibration (Appendix G)	x	x
10. Name of the Operator, the name of the person responsible for making the test, and the name of the testing company used if any	x	
11. Date and time of the test	x	
12. Test Instrument Calibration Certificate/Data	x	
13. Pressure Recording Charts	x	
14. Minimum test pressure	x	
15. Test Medium	x	
16. Description of facility tested and test apparatus	x	
17. Where elevation differences exceed 100 ft, provide profile showing elevation & test sites of entire test section.	x	
18. If applicable attach, explanations of test anomalies, pressure discontinuities, and test failures that appear on the pressure recording charts (Consult Engineering for guidance)	x	



If the pipe being tested is **not installed**, the Responsible Person in charge of the test should notify the Asset Integrity designee during the time when the required paperwork is submitted to document the pressure test. A notation should be made in the comments field on the hydro request form stating that the pipe was tested, but not installed, and the pipe should be entered in as “Pretested, Stock Pipe” when Asset Integrity designee documents the test in the SPLINT database. When the pipe is installed in the field, the Responsible Person over the project should notify the Asset Integrity office representative that the pipe is being used so the SPLINT records can be updated.

10.2 Hydrotest Record Review and Auditing Process

The Asset Integrity group is responsible for the record keeping of Hydrostatic Pressure Test records. A periodic review of the SPLINT database may be performed to identify the outstanding hydrotest records. Management will be notified if records have not been submitted within initial 30-days on the hydrotest (unless advance notice for the exception has been provided to the Asset Integrity designee).

The record review and notification process should follow the guidelines as listed below. Notification will be made by the Integrity Department on a monthly basis.

Delinquent	Notify	Quarterly Report Schedule
30 Days	Asset Integrity Mgr	Jan - March
90 Days	Immediate Mgr	April - June
180+ Days	VP of Operations	July - Sept



11 SAFETY

- All pressure tests shall be conducted with due regard for the safety of life and property. Precautions should be taken to see that all persons not directly engaged in the testing operations remain out of the test area, insofar as practical, during the test period.
- Fill and discharge pressure hoses should be secured and avoided as much as practical during the fill and dewatering process to avoid possible injury in case of unforeseen failure of the component.
- Company Representatives and Contractor working directly with the pressure test equipment should locate the Pressure Recorder, Calibration Gauge, and Plotting Table behind a solid barrier (i.e., dirt pile, tractor, backhoe, etc.) and should try to avoid being near or crossing the segment, while subjected to the test pressure, as much as feasible.
- When the testing manifold contains a seam, the test equipment should be located on the side opposite the seam.
- High Pressure Pipe and fittings are required for connection of the High Pressure Pump and Manifolds. While hydrostatic testing cross-country pipelines, a means of rapid surveillance of the area in case of failure shall be used. Communication by two-way radio, or other method, is recommended between surveillance vehicles, as well as foot patrols, to expedite repairs.
- In the event of a release, avoid skin contact with the escaping test medium. High-pressure skin injections can occur at pressures as low as 35 psig and are a serious medical emergency that must be treated appropriately.
- Never attempt to tighten a fitting or flange while it is under high pressure, due to the possibility of failure and personal injury.

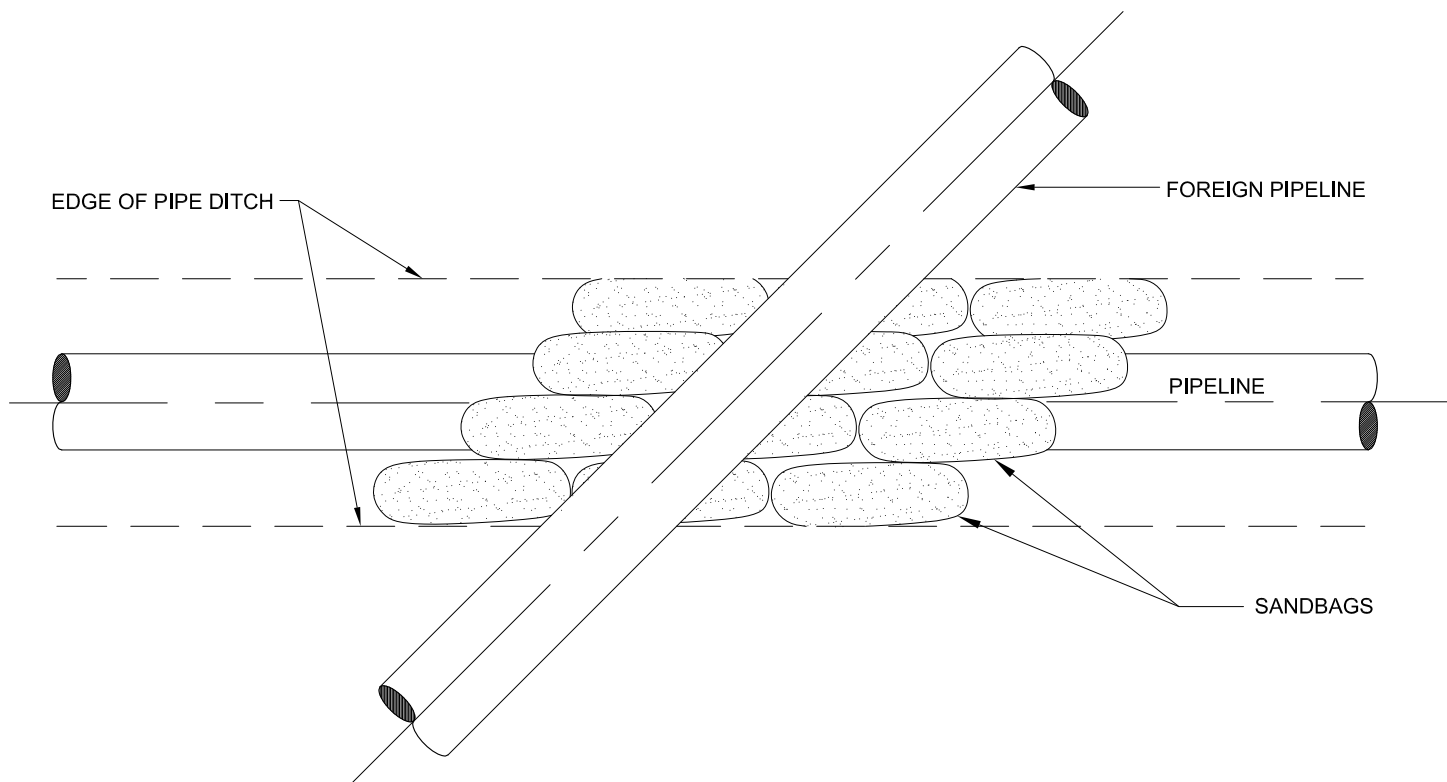


12 REVISION LOG

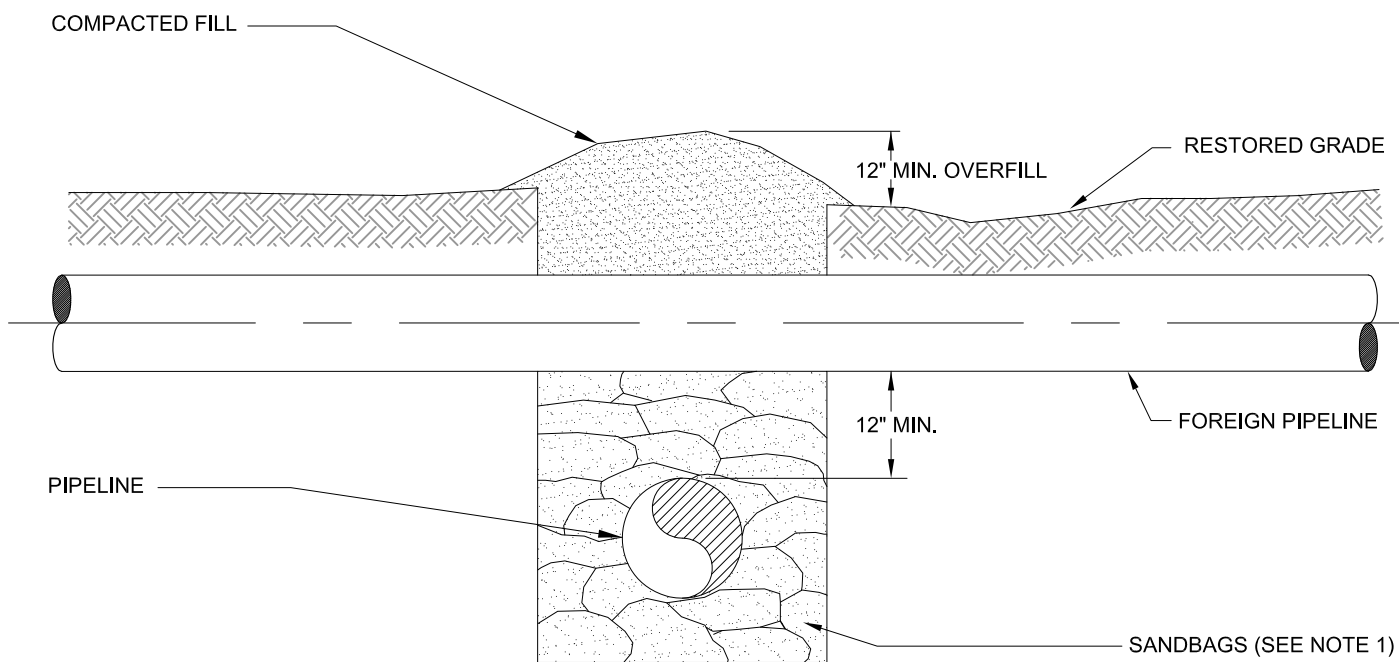
Revision No.	Revision Date	Document Authorizer	Document Reviewer	Document Author	Document Administrator	Revision Details
8	03/15/2013	Lindy Barile	Committee	Katelyn Smith	na	General updates, revisions, and expanded details related to testing and documentation process. (MOC 5951)

Exhibit SPLP MG-5

SPLP
MG-5



PLAN




ELEVATION

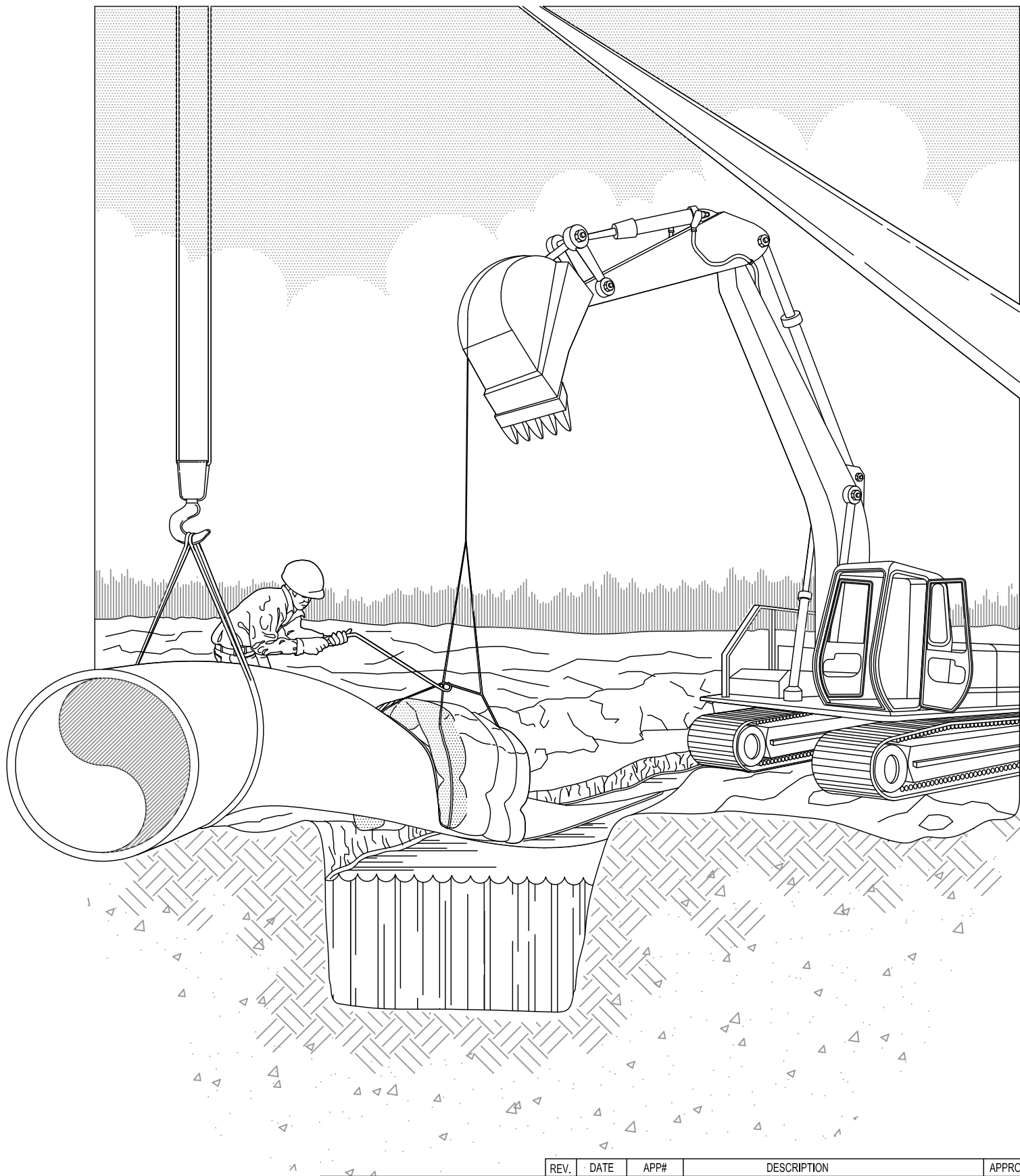
NOTES:

- 1) SANDBAGS OR FOAM SUPPORTS SHALL BE INSTALLED AS INDICATED IN ALL AREAS WHERE SUPPLY BACKFILL IS NOT USED.

ENGINEERING RECORD	
DRAWN BY	W. RYAN
CHECKED BY	D. MOLINSKY
APPROVED BY	Q. BAILEY
DATE	06/07/13
SCALE	NO SCALE

OLD DRAWING NO.

REV.	DATE	APP#	DESCRIPTION	APPROVAL
<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;">  <p>Sunoco Logistics Partners L.P.</p> </div> <div> <p>TYPICAL CONSTRUCTION DETAIL</p> <p>FOREIGN LINE PIPELINE CROSSING</p> </div> </div>				
DWG. NO.			REV. NO.	
S-2896-STDS-C008			A	



ENGINEERING RECORD	
DRAWN BY	C.HAAS
CHECKED BY	D.MOLINSKY
APPROVED BY	Q.BAILEY
DATE	06/07/13
SCALE	NO SCALE

REV.	DATE	APP#	DESCRIPTION	APPROVAL
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**Sunoco Logistics
Partners L.P.**

TYPICAL CONSTRUCTION DETAIL

**BUOYANCY CONTROL
INSTALLATION DETAIL**

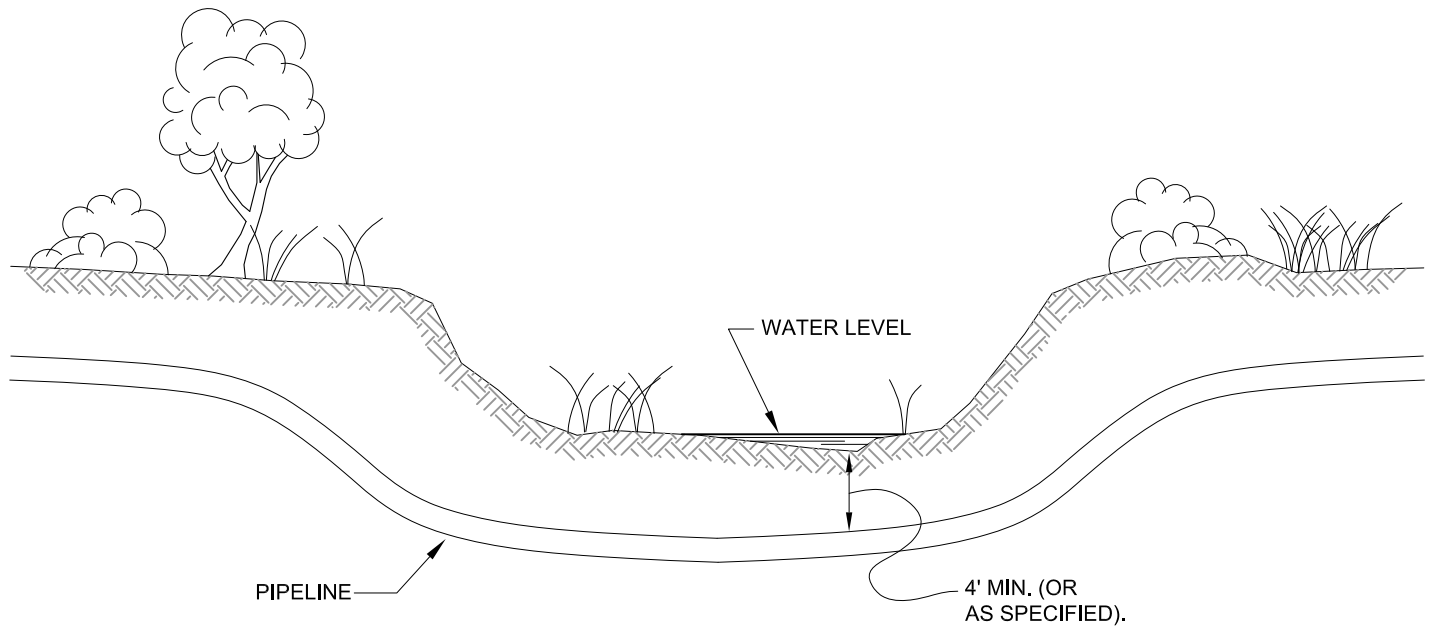
OLD DRAWING NO.

DWG. NO.

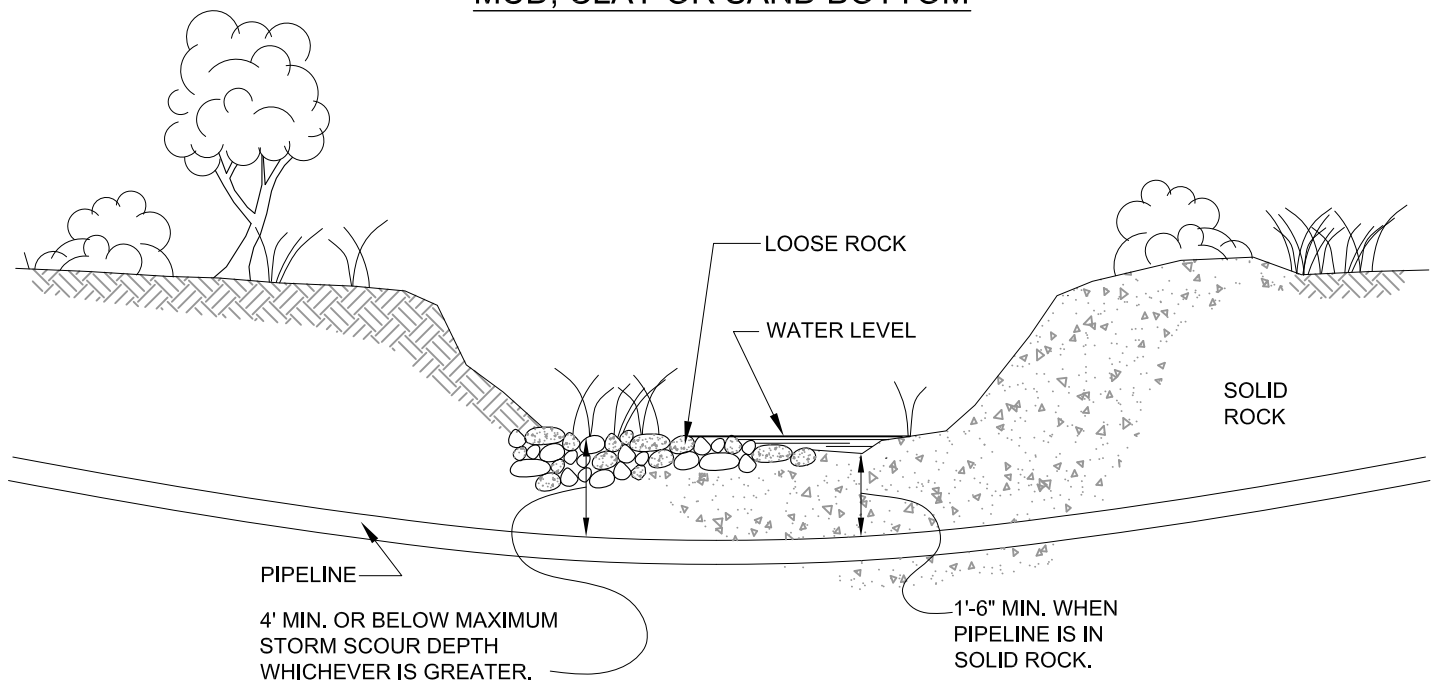
S-2896-STDS-C014

REV. NO.

A




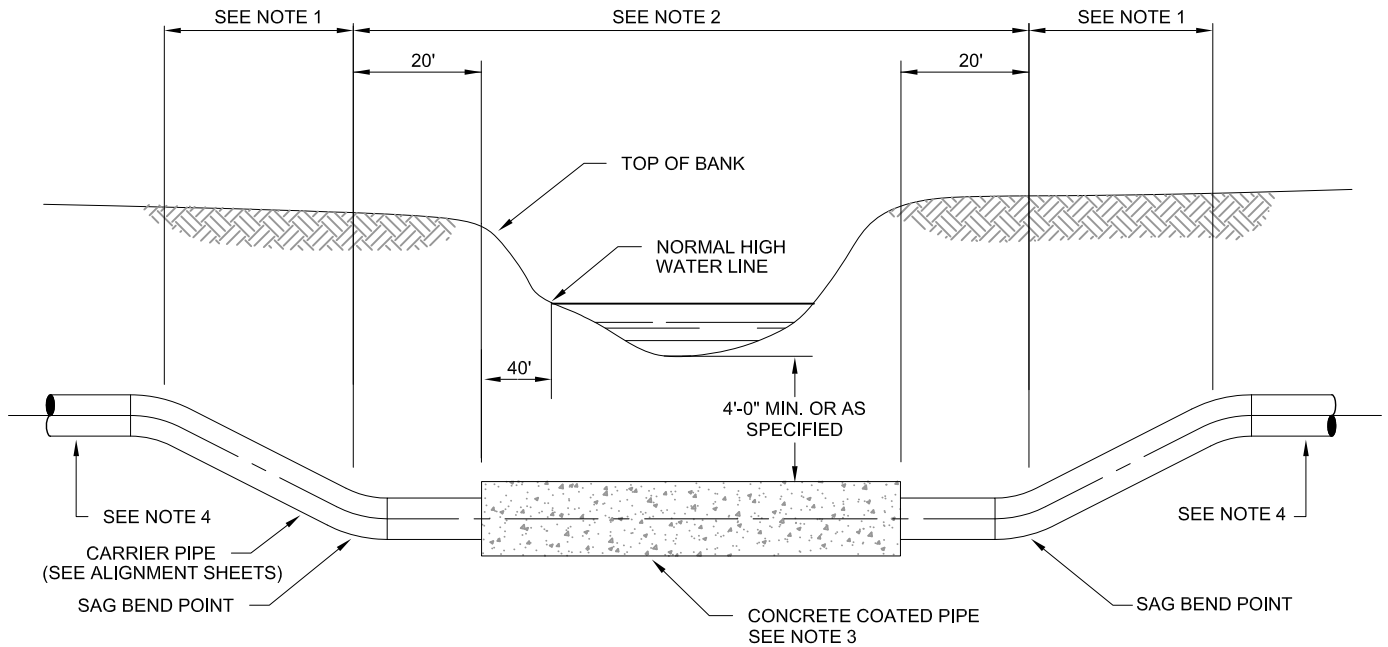
MUD, CLAY OR SAND BOTTOM



ROCKY BOTTOM

ENGINEERING RECORD	
DRAWN BY	W. RYAN
CHECKED BY	D. MOLINSKY
APPROVED BY	Q. BAILEY
DATE	06/07/13
SCALE	NO SCALE


REV.	DATE	APP#	DESCRIPTION	APPROVAL
<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;">  <p>Sunoco Logistics Partners L.P.</p> </div> <div> <p>TYPICAL CONSTRUCTION DETAIL</p> <p>PIPELINE SPECIFICATION</p> <p>TYPICAL MINOR WATER CROSSING</p> </div> </div>				
OLD DRAWING NO.			DWG. NO. S-2896-STDS-C018	REV. NO. A

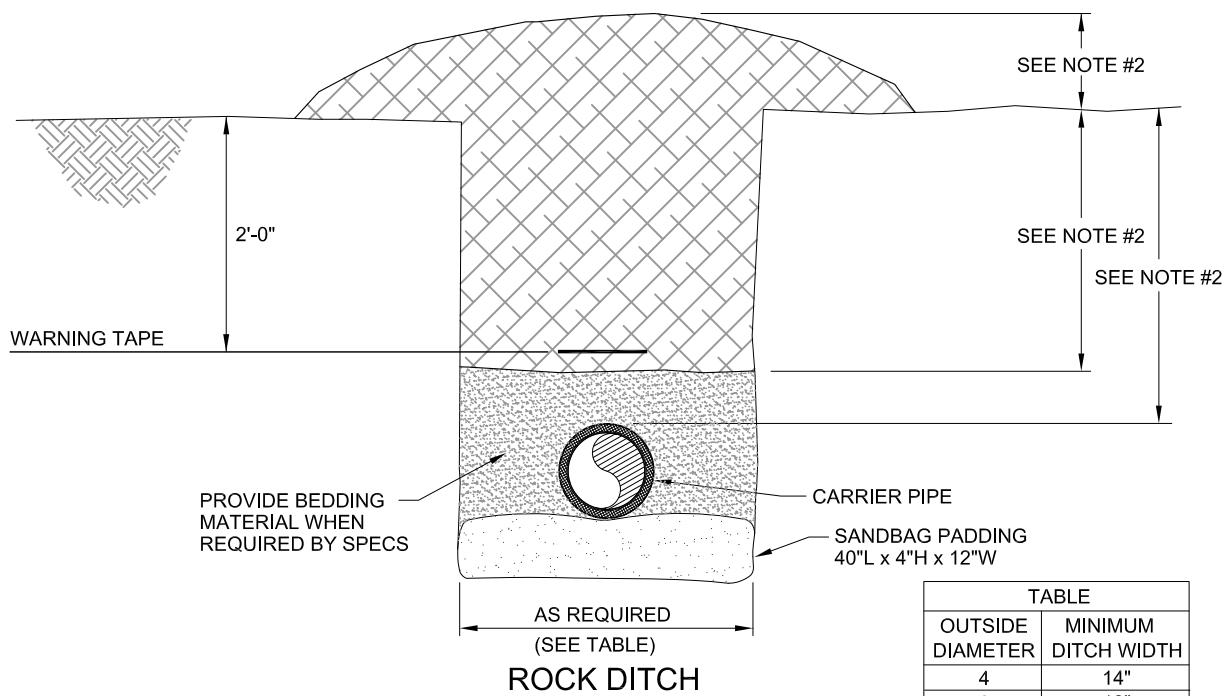
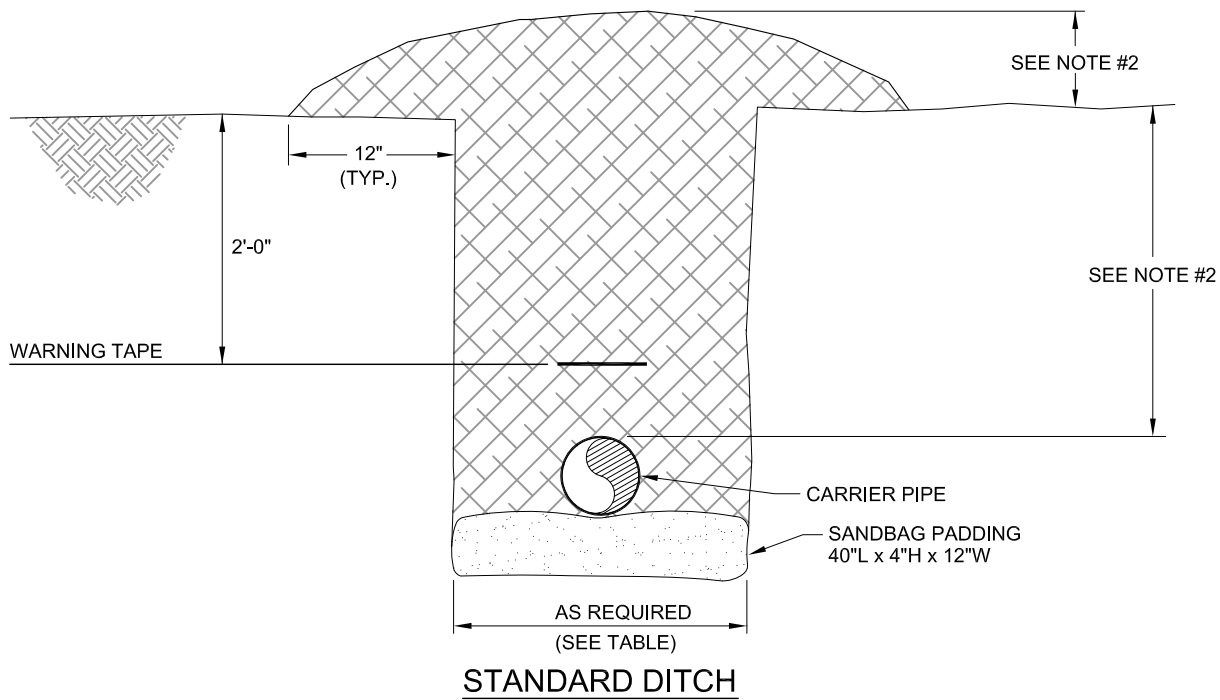


NOTES:

1. PIPE SHALL BE GRADUALLY LOWERED TO PREVENT EXCESSIVE BENDING.
2. PIPE SHALL BE LEVEL UNDER STREAM CHANNEL TO THE DEPTH SHOWN OR AS SPECIFIED.
3. CONTRACTOR SHALL INSTALL CONCRETE COATED PIPE AS SPECIFIED.
4. PIPE ENDS AT TANGENTS SHALL BE PREPARED AS NOTED IN ACCORDANCE WITH DOT & ANSI REGULATIONS.
5. CONTRACTOR SHALL WRAP AND CONCRETE COAT WELD JOINTS.

ENGINEERING RECORD	
DRAWN BY	W. RYAN
CHECKED BY	D. MOLINSKY
APPROVED BY	Q. BAILEY
DATE	06/07/13
SCALE	NO SCALE

REV.	DATE	APP#	DESCRIPTION	APPROVAL
<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;">  <p>Sunoco Logistics Partners L.P.</p> </div> <div> <p>TYPICAL CONSTRUCTION DETAIL</p> <p>CONCRETE COATED CANAL STREAM OR RIVER CROSSING</p> </div> </div>				
OLD DRAWING NO.			DWG. NO. S-2896-STDS-C019	REV. NO. A



NOTES:

1. SEE CONSTRUCTION DOCUMENTS FOR PADDING REQUIREMENTS UNDER PIPE.
2. SEE CONSTRUCTION DOCUMENTS AND DRAWINGS FOR ALL BACKFILL DIMENSIONS.
3. BERMS SHALL NOT BE INSTALLED IN THE RAILROAD R/W.

TABLE	
OUTSIDE DIAMETER	MINIMUM DITCH WIDTH
4	14"
6	18"
8	20"
10	24"
12	24"
20	36"
22	36"
24	42"

ENGINEERING RECORD	
DRAWN BY	W. RYAN
CHECKED BY	D. MOLINSKY
APPROVED BY	Q. BAILEY
DATE	06/07/13
SCALE	NO SCALE

REV.	DATE	APP#	DESCRIPTION	APPROVAL
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**TYPICAL CONSTRUCTION DETAIL
CROSS-COUNTRY AND R.R. R-O-W
CONSTRUCTION STANDARD SINGLE
DITCH DIMENSION FOR CARRIER PIPE**

OLD DRAWING NO.

DWG. NO.
S-2896-STDS-D001

REV. NO.
A

DITCH SPECIFICATION

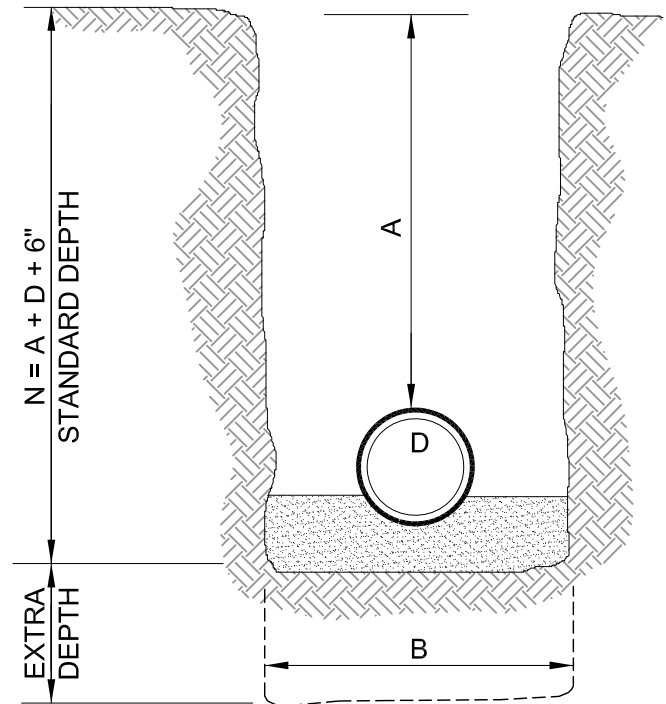
DITCH DIMENSIONS

THE MINIMUM DIMENSIONS OF THE FINISHED DITCH SHALL CONFORM TO THE TABLE SHOWN. THE DEPTH OF THE DITCH SHALL BE MEASURED FROM THE LEVEL OF THE GRADED GROUND ON EACH SIDE OF THE DITCH.

WHEN PIPELINE IS WITHIN 50 FEET OF ANY PRIVATE DWELLING OR BUILDING WHERE PERSONS WORK OR CONGREGATE, AN ADDITIONAL 12 INCHES OF SHALL BE PROVIDED.


NORMAL EXCAVATION

SIZE OF LINE	COVER A	MINIMUM WIDTH B	STANDARD N
3	36"	12"	46"
4	36"	14"	47"
6	36"	18"	49"
8	36"	20"	51"
10	36"	24"	53"
12	36"	24"	55"
14	36"	36"	56"
16	36"	36"	58"
18	36"	36"	60"
20	36"	36"	62"
22	36"	36"	64"
24	36"	42"	66"
26	36"	42"	68"
28	36"	42"	70"
30	36"	46"	72"
32	36"	46"	74"
34	36"	48"	76"
36	36"	48"	78"



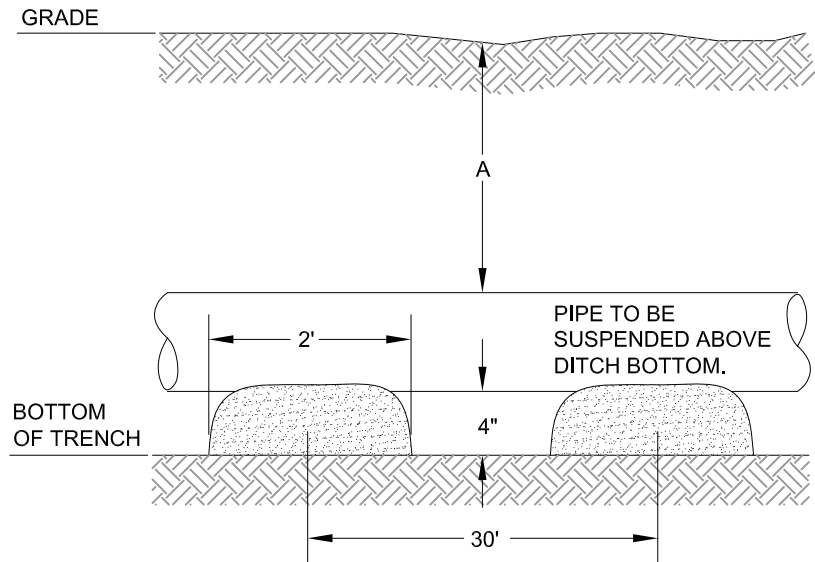
NOTE:

SIX (6) INCH PADS OF LOOSE SOFT EARTH, TAMPED DOWN, OR BAGS OF SAND ARE TO BE PLACED IN DITCH TO SUSPEND PIPE A MINIMUM OF FOUR (4) INCHES ABOVE DITCH BOTTOM IN AREAS WHERE ROCK OR CLODS COULD DAMAGE COATING.

ENGINEERING RECORD		REV.	DATE	APP#	DESCRIPTION	APPROVAL
DRAWN BY	W. RYAN	 Sunoco Logistics Partners L.P. TYPICAL CONSTRUCTION DETAIL DITCH SPECIFICATION				
CHECKED BY	D. MOLINSKY					
APPROVED BY	Q. BAILEY					
DATE	06/07/13					
SCALE	NO SCALE					
OLD DRAWING NO.		DWG. NO. S-2896-STDS-D006				REV. NO. A


ROCK EXCAVATION

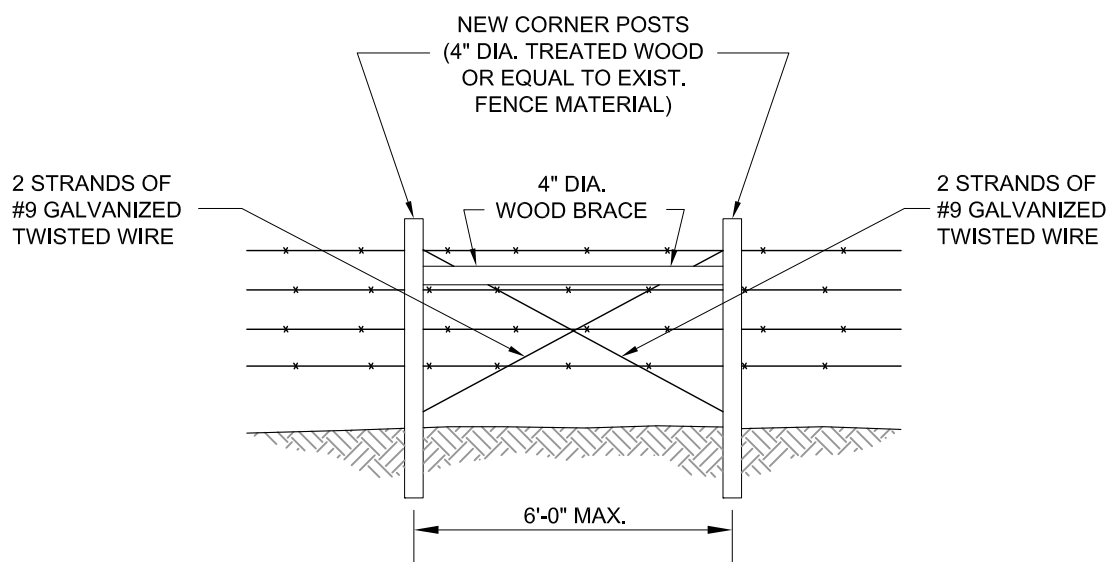
SIZE OF LINE	COVER* "A"	DITCH WIDTH
3	18"	16"
4	18"	18"
6	18"	22"
8	18"	24"
10	18"	28"
12	18"	32"
14	18"	34"
16	18"	36"
18	18"	40"
20	18"	44"
22	18"	48"
24	18"	52"
26	18"	52"
28	18"	52"
30	18"	58"
32	18"	58"
34	18"	60"
36	18"	60"



NOTE: SIX (6) INCH PADS OF LOOSE, SOFT EARTH, TAMPED DOWN, OR BAGS OF SAND ARE TO BE PLACED IN DITCH TO SUSPEND PIPE A MINIMUM OF FOUR (4) INCHES ABOVE DITCH BOTTOM IN AREAS WHERE ROCK OR CLODS COULD DAMAGE THE COATING.


* COVER TO BE A MINIMUM OF 30" IN INDUSTRIAL, COMMERCIAL AND RESIDENTIAL AREAS AND 36" IN DRAINAGE DITCHES AT PUBLIC ROADS AND RAILROADS.

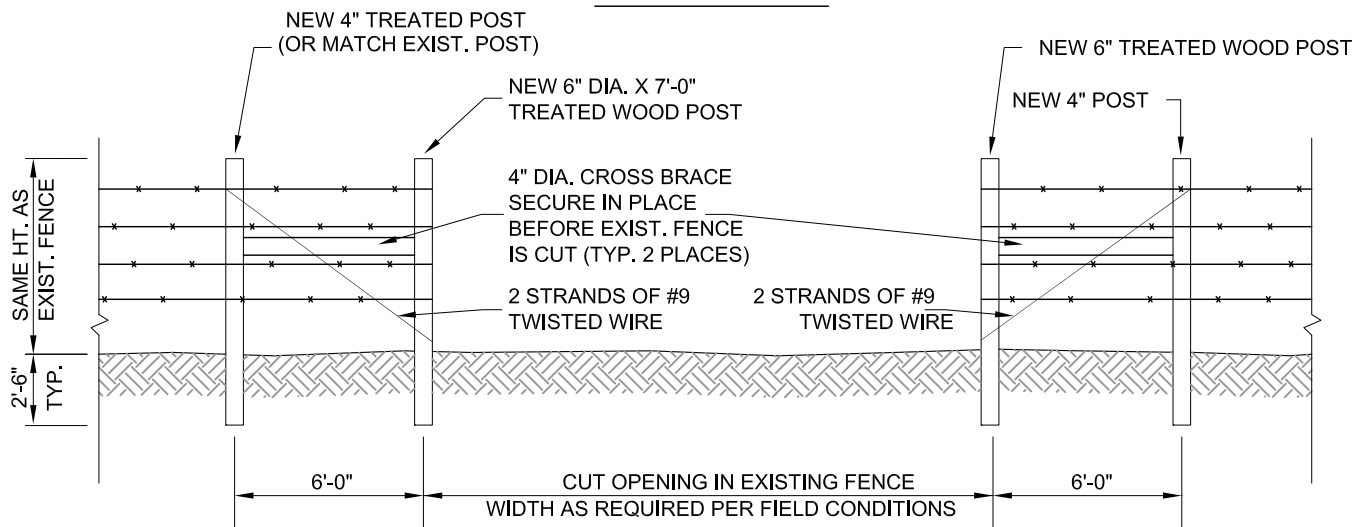
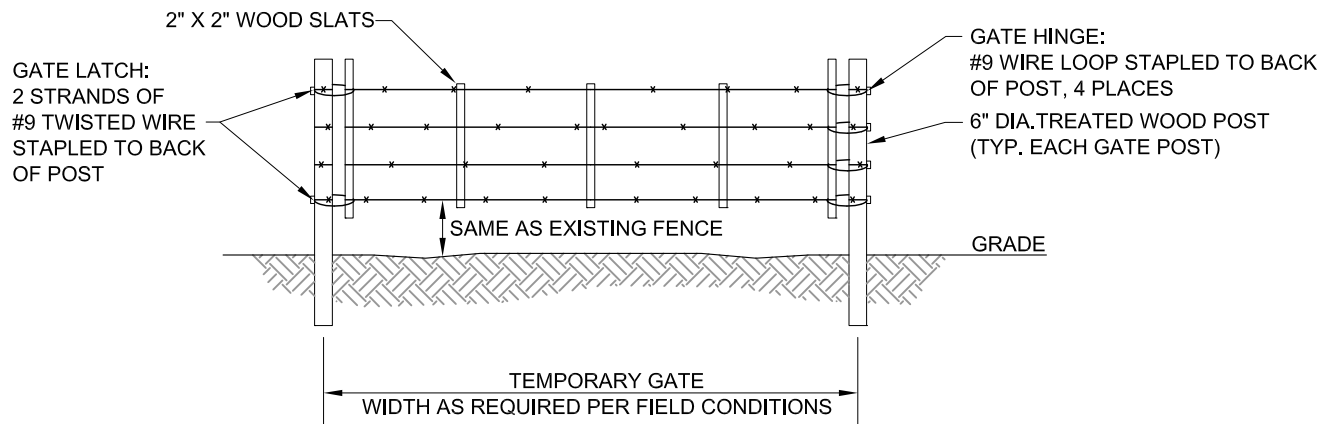
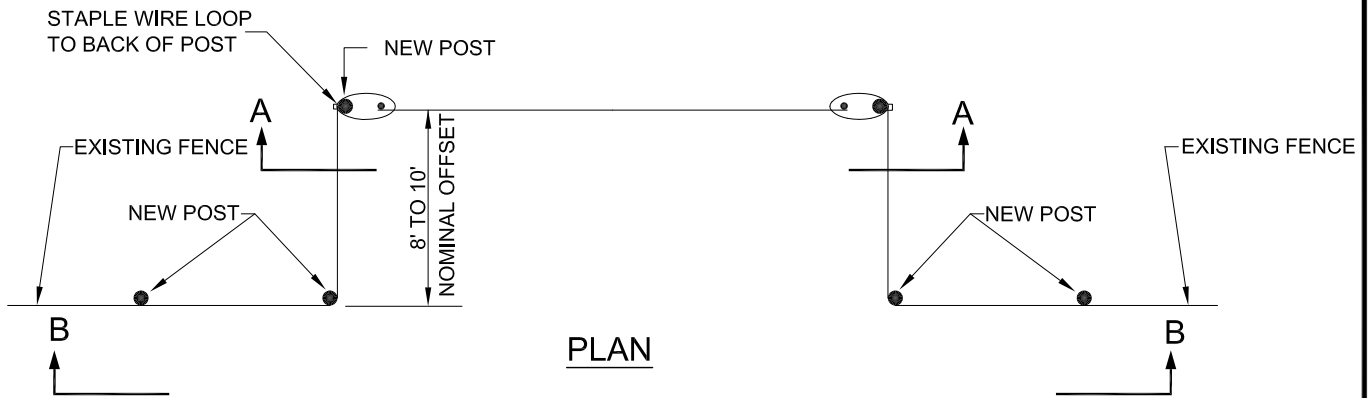
REV.	DATE	APP#	DESCRIPTION	APPROVAL																
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ENGINEERING RECORD																				
DRAWN BY	W. RYAN																			
CHECKED BY	D. MOLINSKY																			
APPROVED BY	Q. BAILEY																			
DATE	06/07/13																			
SCALE	NO SCALE																			
 <p>Sunoco Logistics Partners L.P.</p>		<p>TYPICAL CONSTRUCTION DETAIL</p> <p>ROCK EXCAVATION</p>																		
OLD DRAWING NO.			DWG. NO. S-2896-STDS-D007	REV. NO. A																



SEE NOTE 2

1. POSTS, WIRE AND OTHER MATERIAL SHALL BE OF EQUAL OR NEW MATERIAL TO MATCH EXISTING FENCE.
2. BRACE SPAN SHALL BE CONSTRUCTED ON EACH SIDE OF PIPELINE CROSSING PRIOR TO INITIAL DISMANTLING OF FENCE.
3. MARKERS SHALL BE INSTALLED AT PROPERTY LINE FENCES ONLY.

ENGINEERING RECORD		REV.	DATE	APP#	DESCRIPTION	APPROVAL
DRAWN BY	W. RYAN	 <p>Sunoco Logistics Partners L.P.</p> <p>TYPICAL CONSTRUCTION DETAIL</p> <p>FENCE CUT AND RESTORATION</p>				
CHECKED BY	D. MOLINSKY					
APPROVED BY	Q. BAILEY					
DATE	06/07/13					
SCALE	NO SCALE					
OLD DRAWING NO.		DWG. NO. S-2896-STDS-F010				REV. NO. A




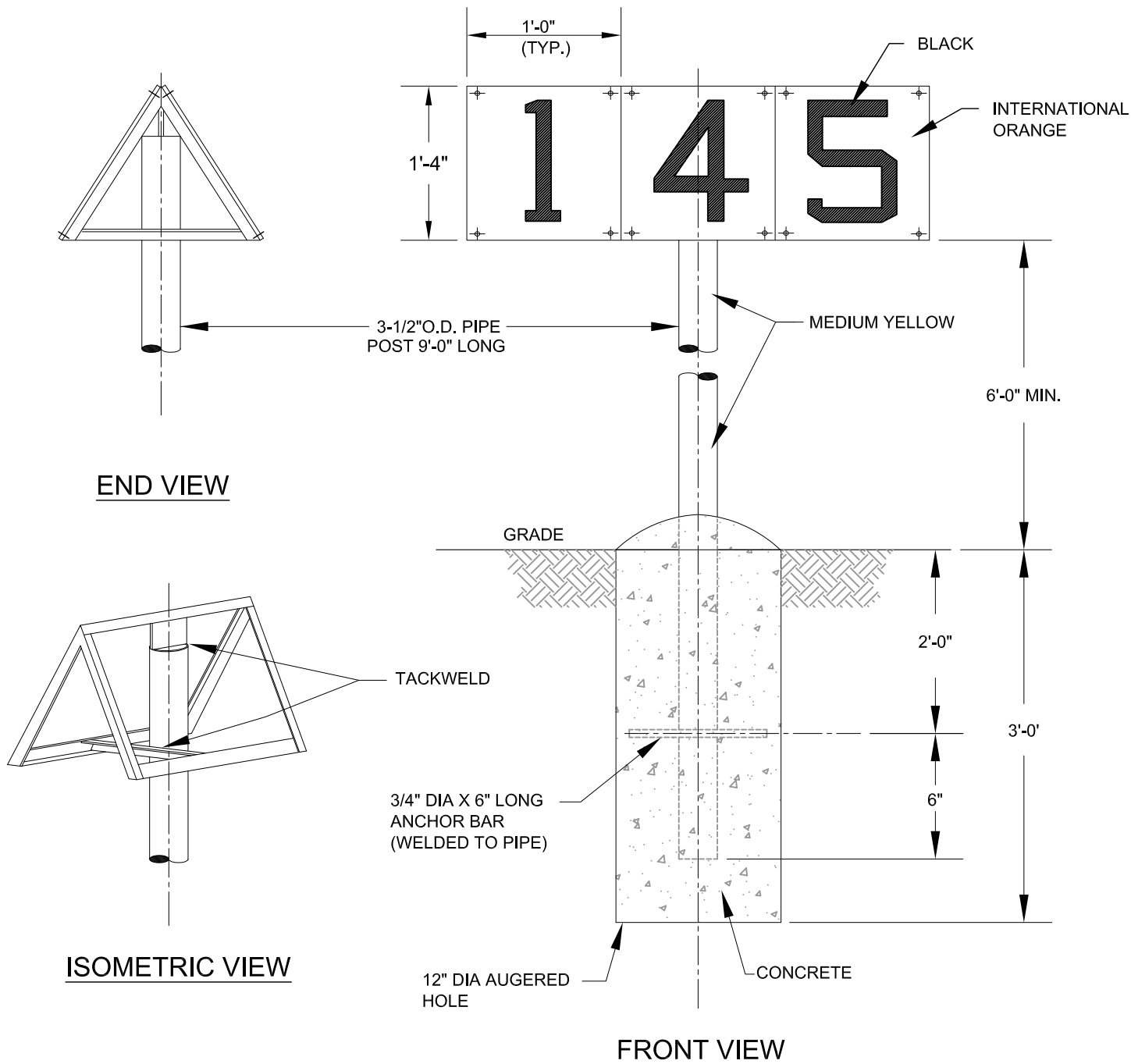
NOTES:

1. CONTRACTOR SHALL INSTALL AT ALL LOCATIONS DESIGNATED BY COMPANY.
2. OFFSET MAY BE INCREASED TO ALLOW ROAD CLEARANCE FOR LARGER VEHICLES WHILE OPENING OR CLOSING GATES.

ENGINEERING RECORD	
DRAWN BY	W. RYAN
CHECKED BY	D. MOLINSKY
APPROVED BY	Q. BAILEY
DATE	06/07/13
SCALE	NO SCALE

OLD DRAWING NO.

REV.	DATE	APP#	DESCRIPTION	APPROVAL
<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;">  <p>Sunoco Logistics Partners L.P.</p> </div> <div style="text-align: center;"> <p>TYPICAL CONSTRUCTION DETAIL</p> <p>TEMPORARY FENCE GATES</p> </div> </div>				
<p>DWG. NO.</p> <p>S-2896-STDS-F011</p>				<p>REV. NO.</p> <p>A</p>



NOTES:

1. INSTALL 3-1/2" O.D. STD. WT. PIPE POST 10 FEET LONG OR AS REQUIRED BY LOCATION.
2. CONTRACTOR TO ASSEMBLE SIGN AND MOUNT ON POST.
3. SIGNAGE AND INTEGRAL FRAME FURNISHED BY COMPANY, PIPE, FASTENERS, ETC. FURNISHED BY CONTRACTOR.
4. CONCRETE TO BE POURED TO GRADE AND ROUNDED ON TOP.

REV.	DATE	APP#	DESCRIPTION	APPROVAL
ENGINEERING RECORD				
DRAWN BY	W. RYAN			
CHECKED BY	D. MOLINSKY			
APPROVED BY	Q. BAILEY			
DATE	06/07/13			
SCALE	NO SCALE			
OLD DRAWING NO.			DWG. NO.	
			S-2896-STDS-G001	
			REV. NO.	
			A	

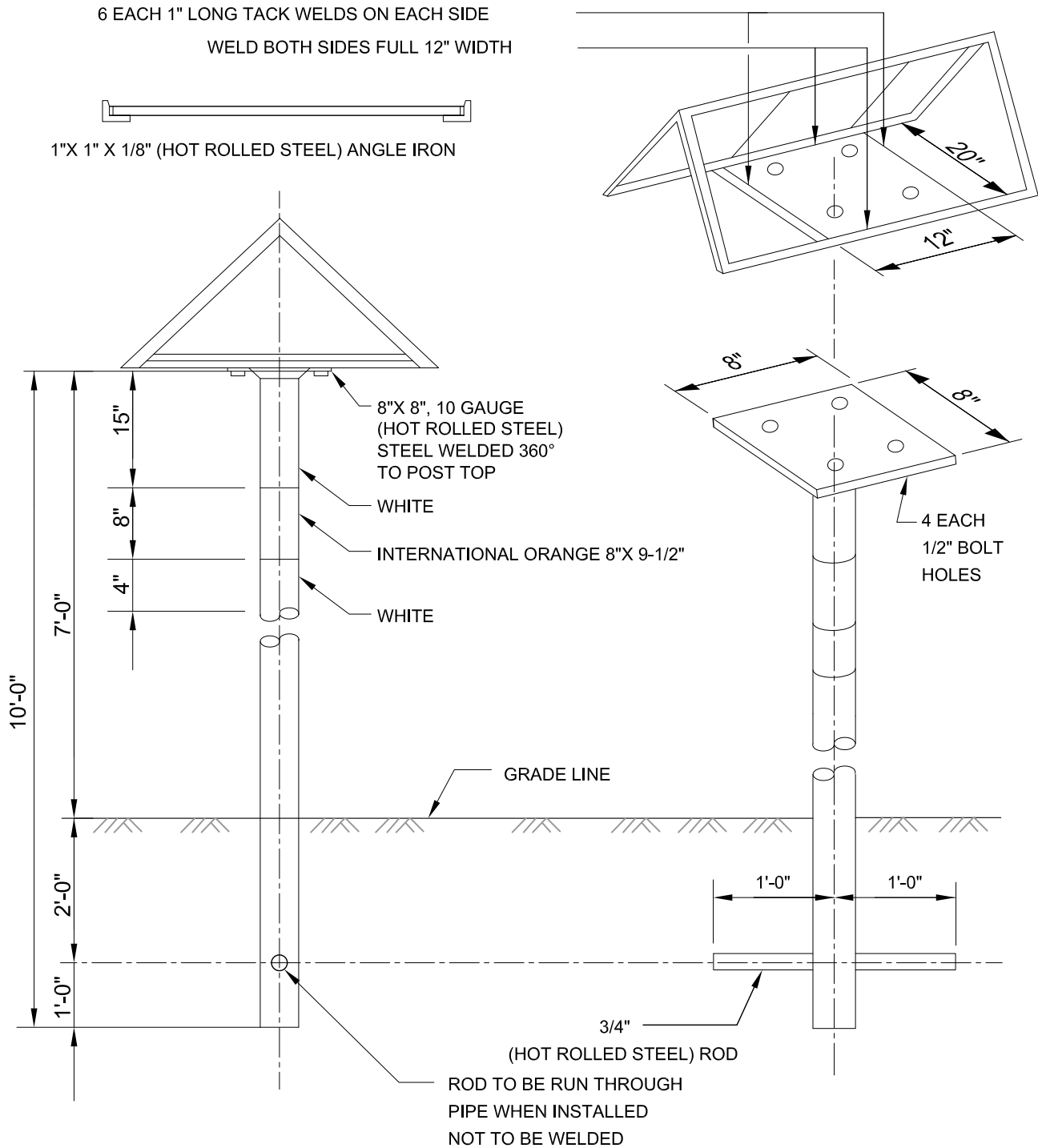


**Sunoco Logistics
Partners L.P.**

TYPICAL CONSTRUCTION DETAIL

**PIPELINE
AERIAL MARKER**

AERIAL MARKER



* NOMINAL O.D. STRUCTURAL PIPE 10'-0" LONG


COLORS:


WHITE - BRACKET 8"X 8", 10 GAUGE (HOT ROLLED STEEL) AND PIPE POST.

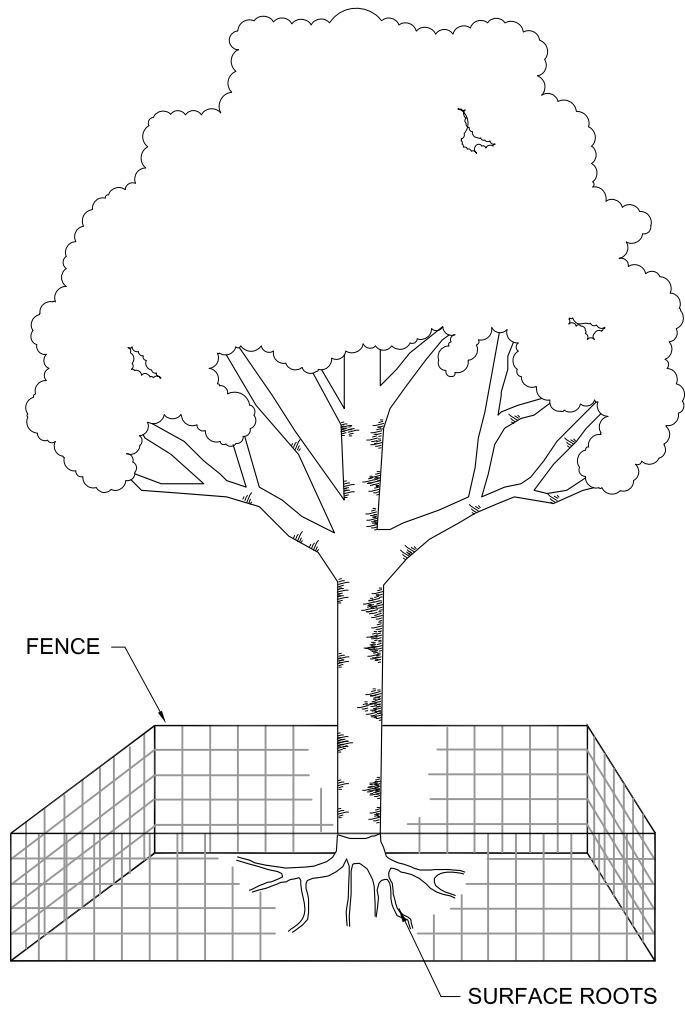
INTERNATIONAL GAUGE - 8"X 9-1/2"

ENGINEERING RECORD	
DRAWN BY	W. RYAN
CHECKED BY	D. MOLINSKY
APPROVED BY	Q. BAILEY
DATE	06/07/13
SCALE	NO SCALE

OLD DRAWING NO.

REV.	DATE	APP#	DESCRIPTION	APPROVAL
<div>  <p>Sunoco Logistics Partners L.P.</p> </div> <div> <p>TYPICAL CONSTRUCTION DETAIL</p> <p>AERIAL MARKER</p> </div>				
DWG. NO.			REV. NO.	
S-2896-STDS-G002			A	

ENGINEERING RECORD		REV.	DATE	APP#	DESCRIPTION	APPROVAL
DRAWN BY	W. RYAN	 <p>Sunoco Logistics Partners L.P.</p> <p>TYPICAL CONSTRUCTION DETAIL</p> <p>PIPELINE WARNING MARKER</p>				
CHECKED BY	D. MOLINSKY					
APPROVED BY	Q. BAILEY					
DATE	06/07/13					
SCALE	NO SCALE					
OLD DRAWING NO.		DWG. NO. S-2896-STDS-G003				REV. NO. A



TYPICAL TREE PROTECTION

ENGINEERING RECORD	
DRAWN BY	W. RYAN
CHECKED BY	D. MOLINSKY
APPROVED BY	Q. BAILEY
DATE	06/07/13
SCALE	NO SCALE

OLD DRAWING NO.

REV.	DATE	APP#	DESCRIPTION	APPROVAL
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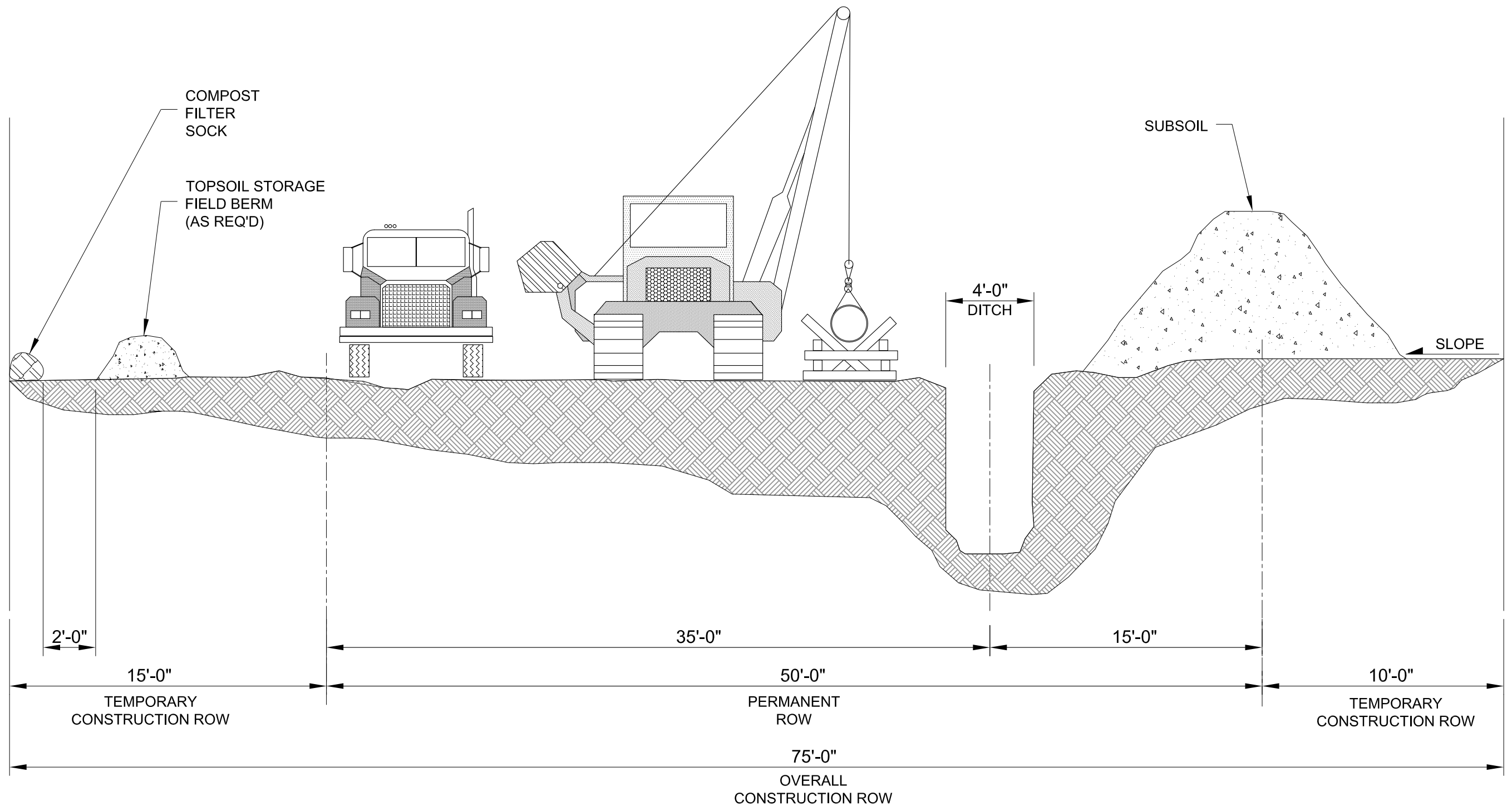
**Sunoco Logistics
Partners L.P.**

TYPICAL CONSTRUCTION DETAIL

TYPICAL TREE PROTECTION
DURING CONSTRUCTION

DWG. NO.
S-2896-STD SG005

REV. NO.
A



B	08/09/13	-	ISSUED FOR REVIEW	WR	BLT	QLE
A	06/07/13	-	ISSUED FOR REVIEW	WR	BLT	QLE
REV.	DATE	APP#	DESCRIPTION	APPROVAL		

ENGINEERING RECORD	
DRAWN BY	B. PHILLIPS
CHECKED BY	BLT
APPROVED BY	QLE
DATE	06/05/13
SCALE	NONE



TYPICAL CONSTRUCTION DETAIL
PIPELINE CONSTRUCTION DETAIL
TYPICAL 75' CONSTRUCTION
RIGHT-OF-WAY

LAST EDIT: 6/19/13



Rooney Engineering, Inc.
12201 E. Arapahoe Rd. C10
Centennial, CO 80112
(303) 792-5911

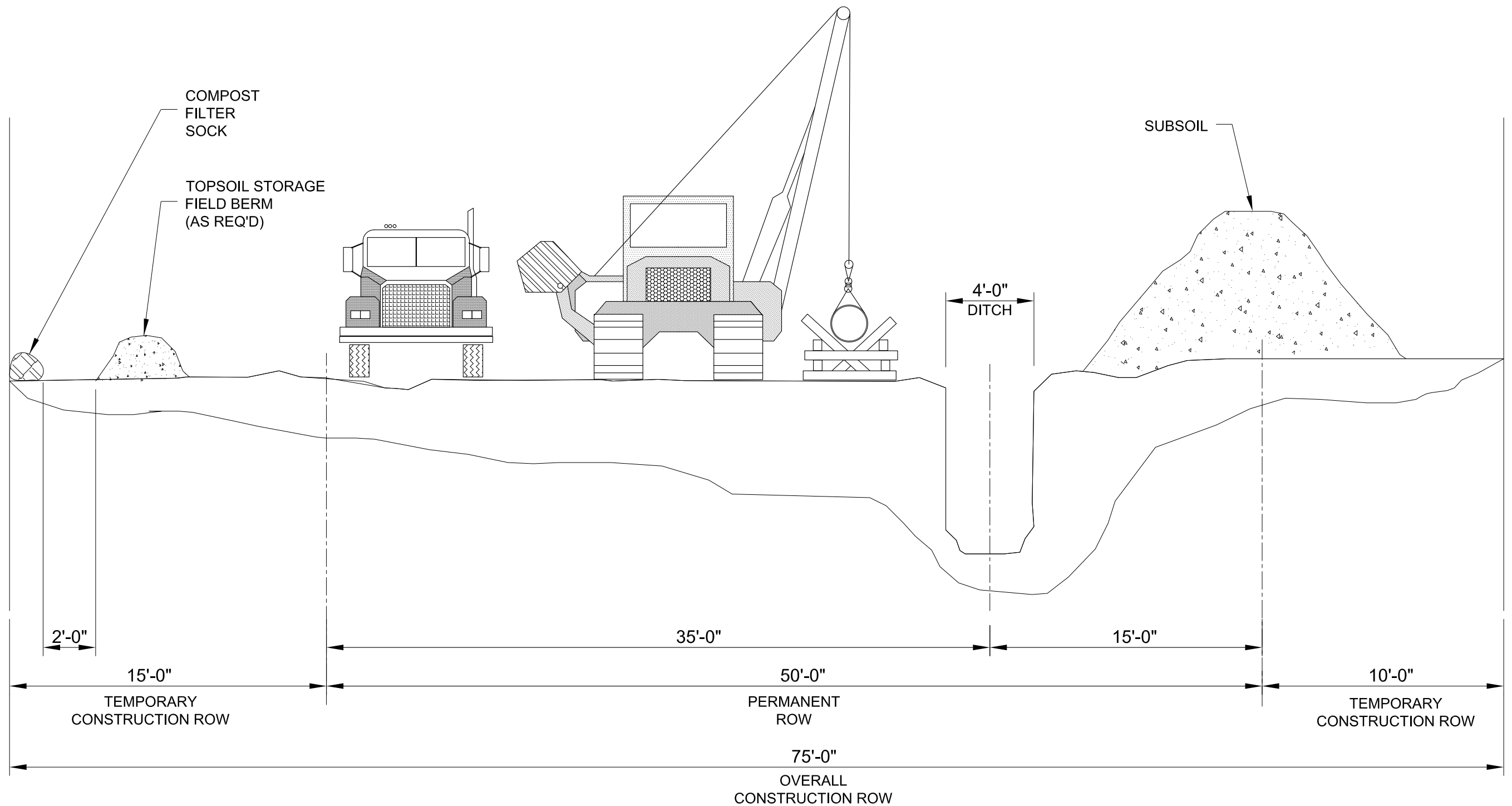
OLD DRAWING NO.

DWG. NO.

S-2896-STDS-G006

REV. NO.

B



B	08/09/13	-	ISSUED FOR REVIEW	WR	BLT	QLE
A	06/07/13	-	ISSUED FOR REVIEW	WR	BLT	QLE
REV.	DATE	APP#	DESCRIPTION	APPROVAL		

ENGINEERING RECORD	
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APPROVED BY	QLB
DATE	06/05/13
SCALE	NONE



TYPICAL CONSTRUCTION DETAIL
PIPELINE CONSTRUCTION DETAIL
TYPICAL 75' CONSTRUCTION
RIGHT-OF-WAY

LAST EDIT: 6/19/13



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Centennial, CO 80112
(303) 792-5911

OLD DRAWING NO.

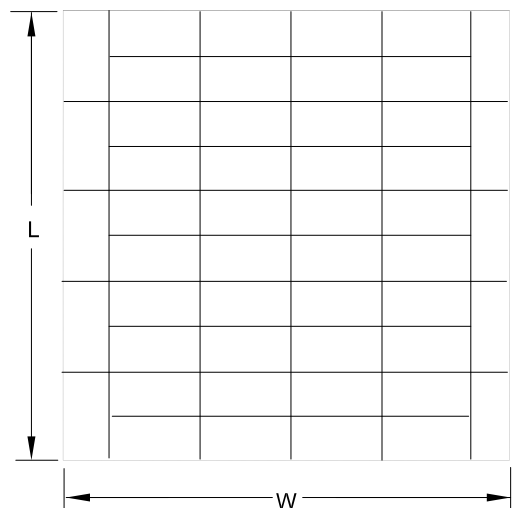
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S-2896-STDS-G006

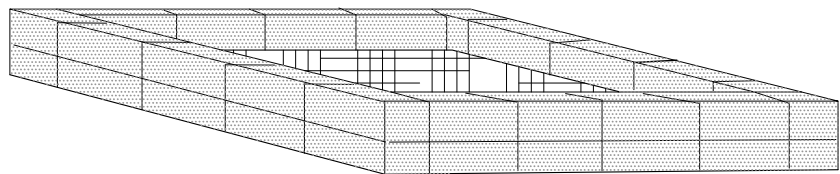
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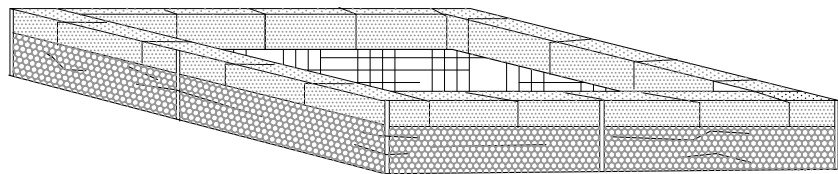
TYPICAL DEWATERING STRUCTURE



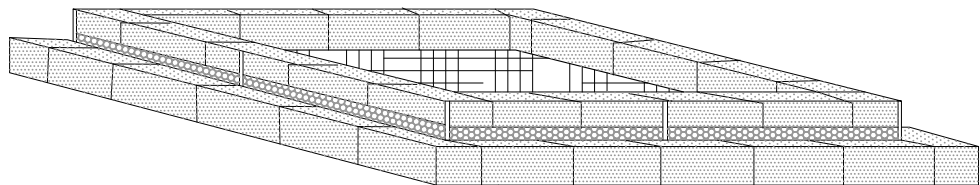
STEP 1: ARRANGE STRAW BALES ON LEVEL GROUND TIGHTLY PACKED AS SHOWN.



STEP 2: INSTALL ANOTHER LAYER OF STRAW BALES ON THE OUTER EDGE AS SHOWN.




STEP 3: INSTALL SILT FENCE AROUND HAY BALES AS SHOWN.

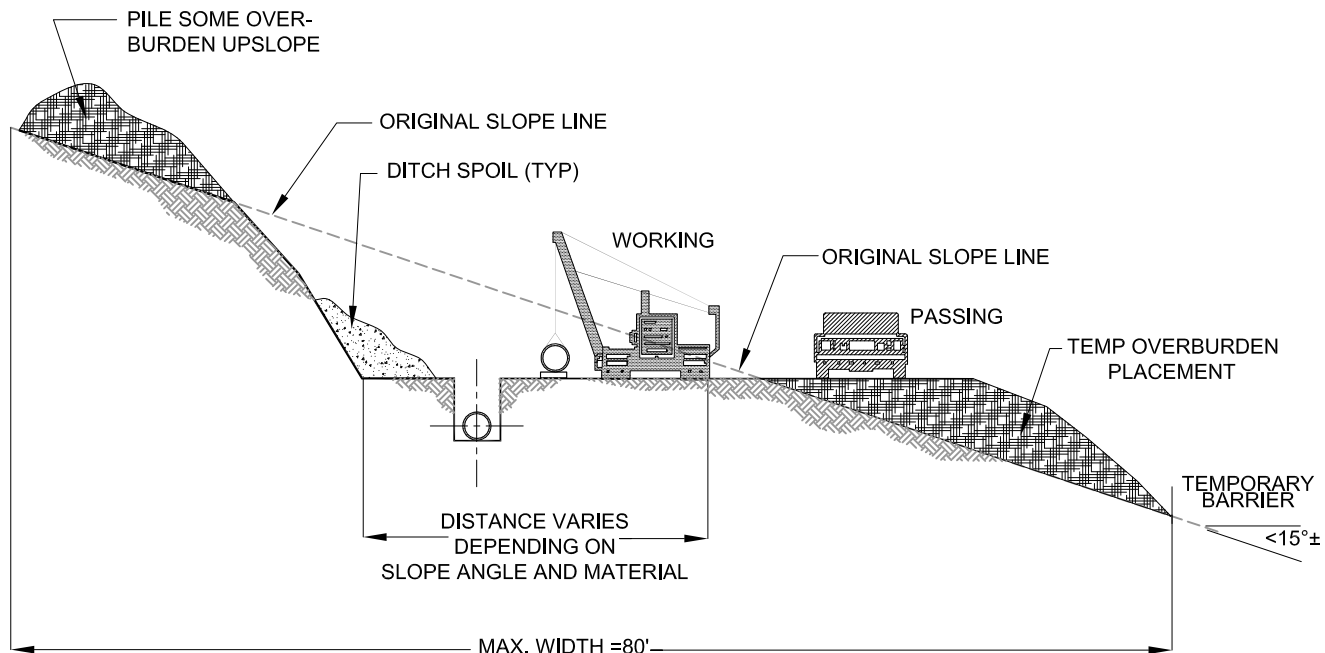


STEP 4: INSTALL ANOTHER LAYER OF STRAW BALES
ON THE OUTSIDE OF SILT FENCE
AND SECURE BY DRIVING STAKES
THROUGH EACH OF THE OUTER BALES.

ENGINEERING RECORD	
DRAWN BY	W. RYAN
CHECKED BY	D. MOLINSKY
APPROVED BY	Q. BAILEY
DATE	06/07/13
SCALE	NO SCALE

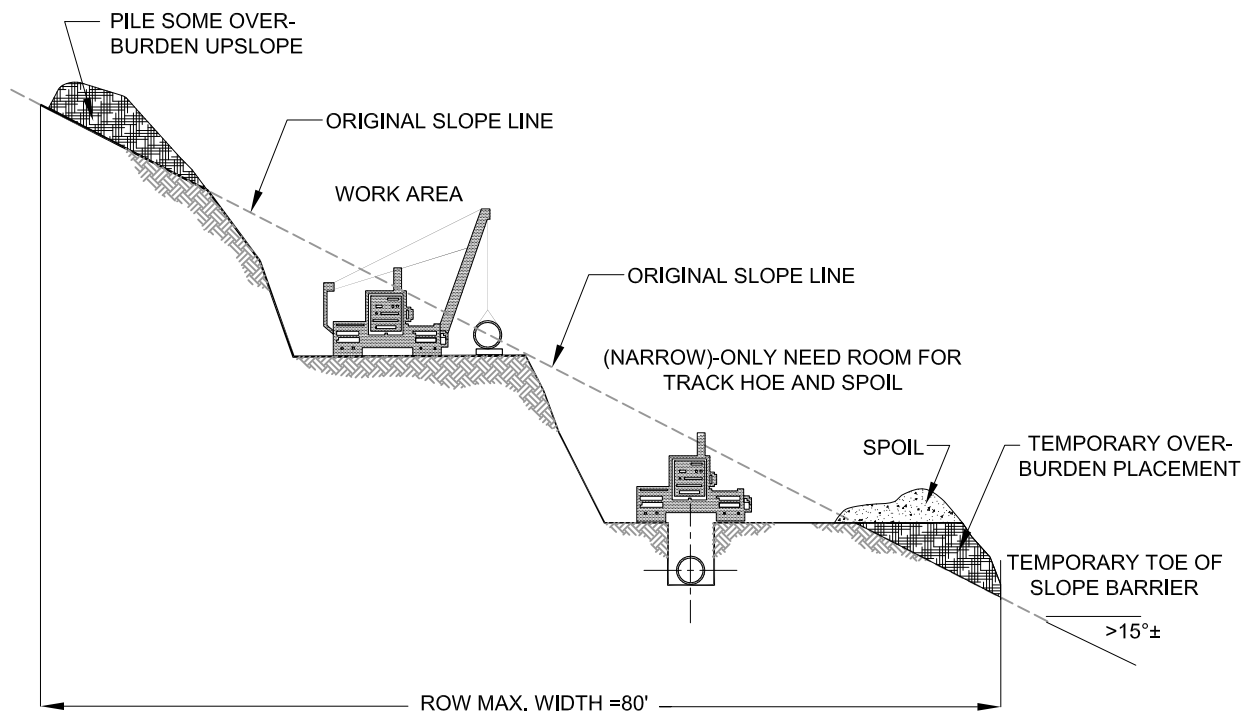
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REV.	DATE	APP#	DESCRIPTION	APPROVAL
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DWG. NO. S-2896-STDS-G013				REV. NO. A




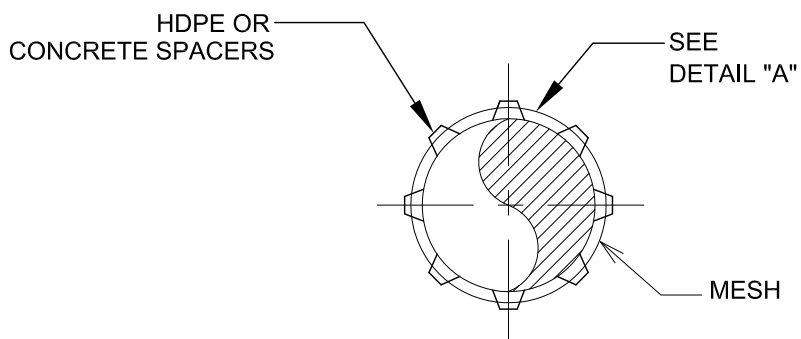
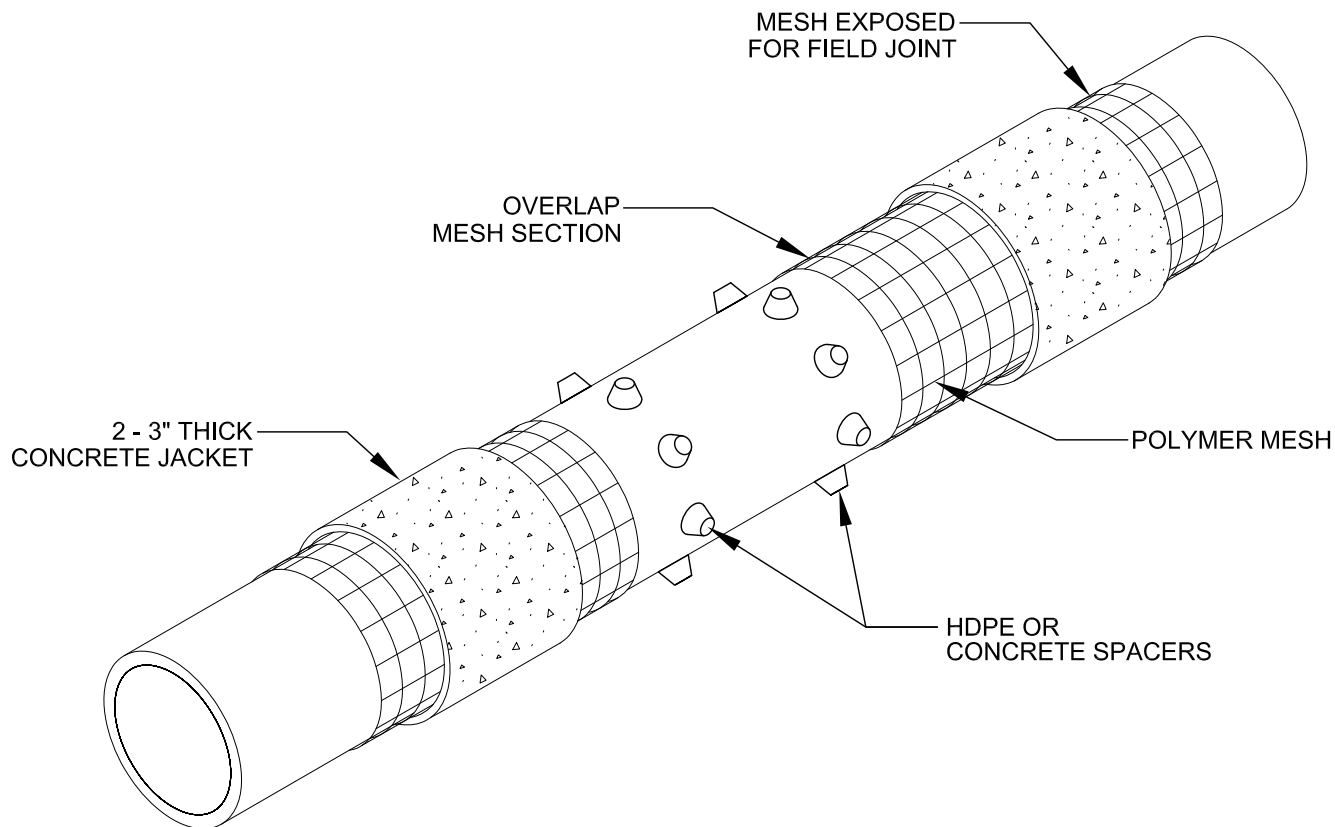
SIDE SLOPES UP TO 15° NOMINAL

OVERBURDEN IS SAVED AND USED TO RETURN SLOPE TO NEAR ORIGINAL CONTOUR

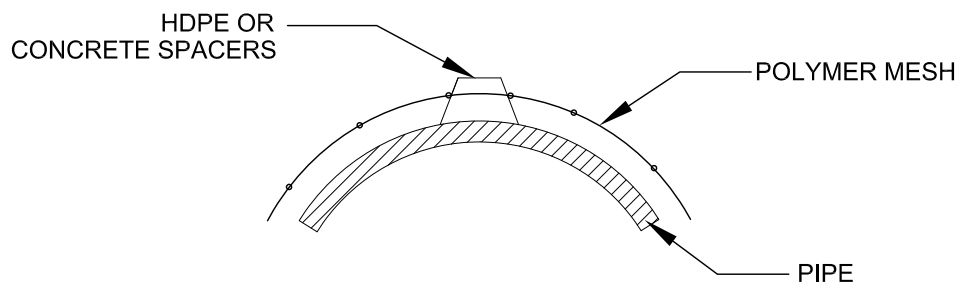


SIDE SLOPES EXCEEDING 15° NOMINAL

ENGINEERING RECORD		REV.	DATE	APP#	DESCRIPTION	APPROVAL
DRAWN BY	W. RYAN	 <p>Sunoco Logistics Partners L.P.</p> <p>TYPICAL CONSTRUCTION DETAIL</p> <p>TYPICAL SIDEHILL CONSTRUCTION TECHNIQUE</p>				
CHECKED BY	D. MOLINSKY					
APPROVED BY	Q. BAILEY					
DATE	06/07/13					
SCALE	NO SCALE					
OLD DRAWING NO.		DWG. NO. S-2896-STDS-G014				REV. NO. A



END VIEW



ENGINEERING RECORD	
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APPROVED BY	Q. BAILEY
DATE	06/07/13
SCALE	NO SCALE

REV.	DATE	APP#	DESCRIPTION	APPROVAL

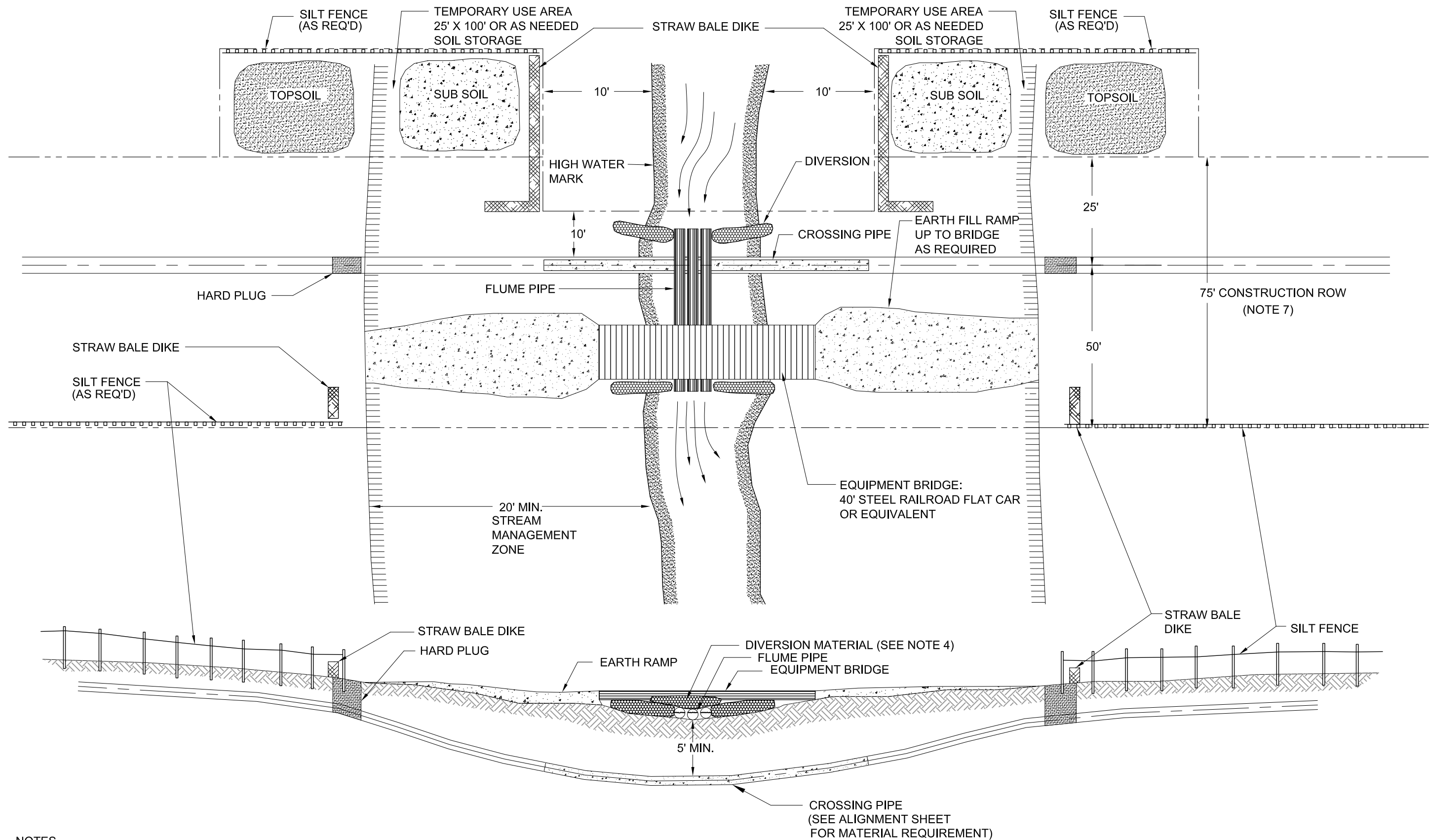


TYPICAL CONSTRUCTION DETAIL
PIPELINE SPECIFICATION
CONSTRUCTION DETAIL
TYPICAL CONCRETE COATING

OLD DRAWING NO.

DWG. NO.
S-2896-STDS-P005

REV. NO.
A



- NOTES**
1. DEPTH OF COVER IS MEASURED FROM BOTTOM OF FLUME PIPE TO TOP OF CARRIER PIPE.
 2. FLUME PIPE SHALL BE STRONG ENOUGH TO SUPPORT WEIGHT OF WATER, AND SPAN DITCH EXCAVATION IN ONE SEGMENT.
 3. NUMBER OF FLUME PIPES AS REQUIRED TO CARRY FLOW.
 4. DIVERSION SHALL BE EARTH OR ROCK-FILLED BAGS OR ROCK COVERED WITH A PLASTIC COVERING DRAPED SO AS TO PREVENT STREAM FLOW INTO DITCH EXCAVATION
 5. TOPSOIL AND SUB SOIL TO BE STORED SEPERATELY TO PREVENT CONTAMINATION OF TOPSOIL.
 6. STREAM MANAGEMENT ZONE SHALL EXTEND 20' MIN. BEYOND HIGH WATER MARK OR 20' BEYOND ADJACENT, MARKED WETLAND LIMIT.
 7. FOOTAGES ARE BASED ON 75' ROW. ADJUSTMENT WILL BE MADE FOR DIFFERING ROW WIDTH.

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DATE	06/05/13		
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OLD DRAWING NO.

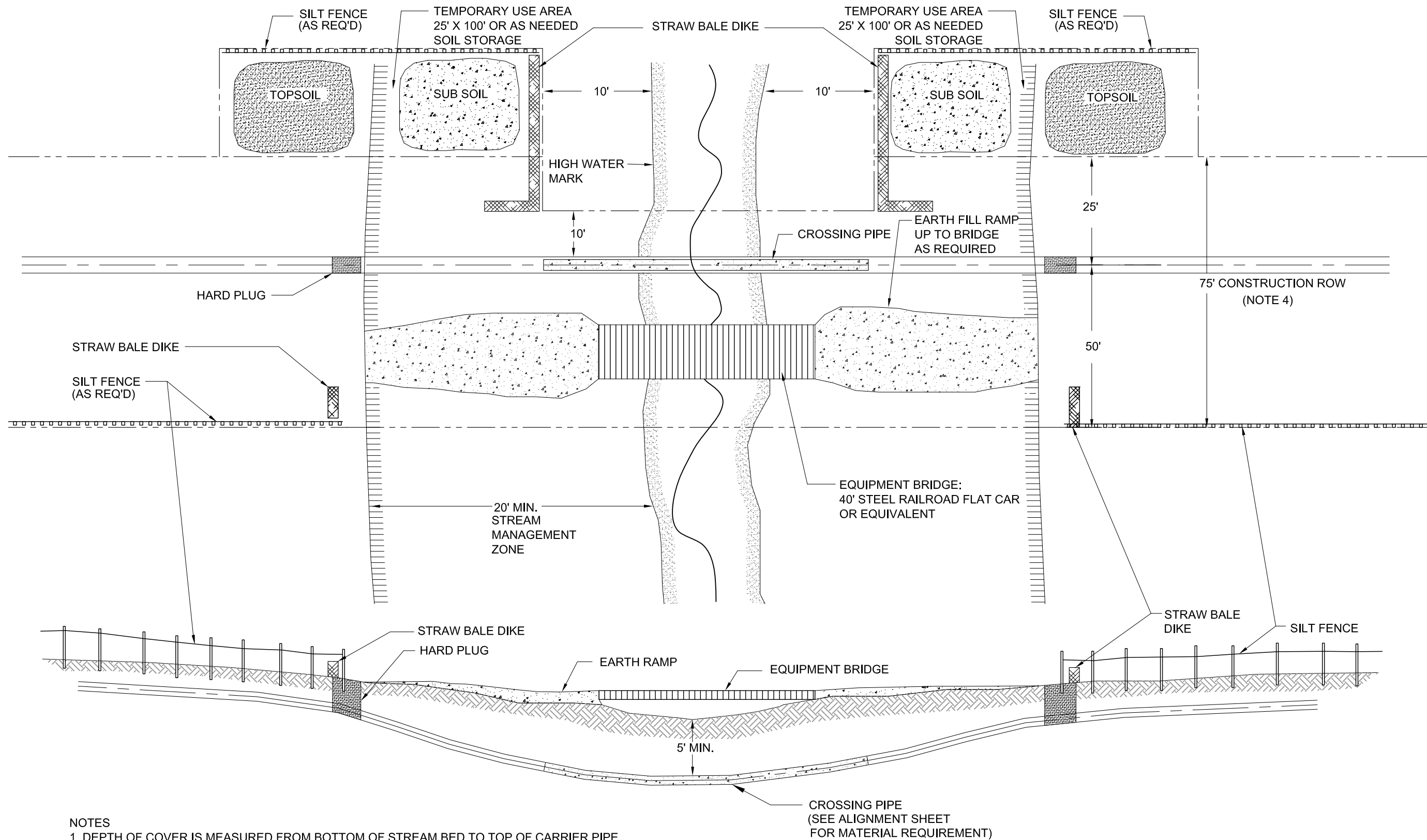
REV.	DATE	APP#	DESCRIPTION	APPROVAL
A	06/07/13	-	ISSUED FOR REVIEW	BP BLT QLB



SUNOCO MARINER EAST
TYPE 1 FLUMED STREAM
STREAM CROSSING DETAIL

DWG. NO.
S-2896-STDS-R015


REV. NO.
A



NOTES

1. DEPTH OF COVER IS MEASURED FROM BOTTOM OF STREAM BED TO TOP OF CARRIER PIPE.
2. TOPSOIL AND SUB SOIL TO BE STORED SEPARATELY TO PREVENT CONTAMINATION OF TOPSOIL.
3. STREAM MANAGEMENT ZONE SHALL EXTEND 20' MIN. BEYOND HIGH WATER MARK OR 20' BEYOND ADJACENT, MARKED WETLAND LIMIT.
4. FOOTAGES ARE BASED ON 75' ROW. ADJUSTMENT WILL BE MADE FOR DIFFERENT ROW WIDTH.

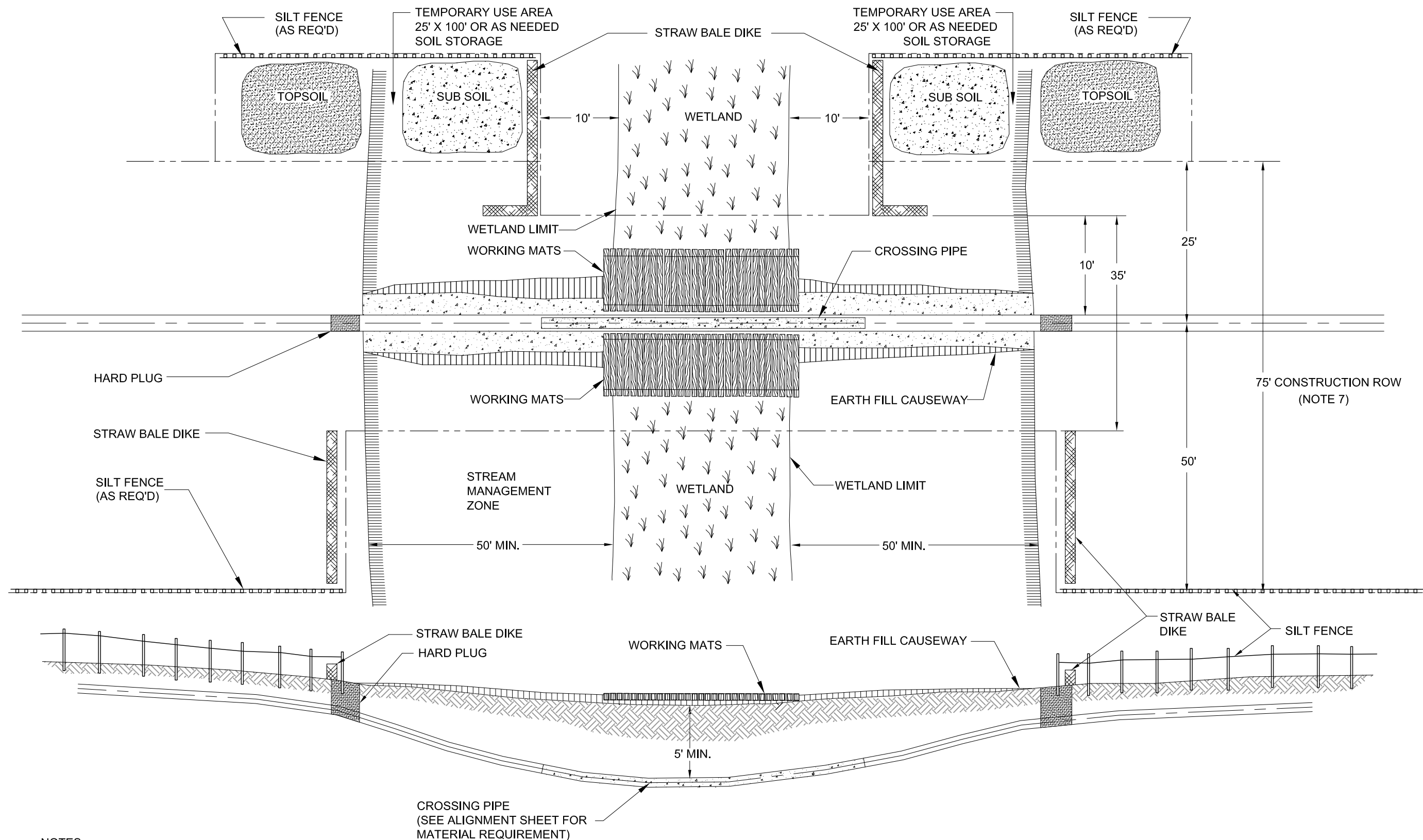
ENGINEERING RECORD				
DRAWN BY	B. PHILLIPS			
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APPROVED BY	QLB			
DATE	06/05/13			
SCALE	NONE			

A	06/07/13	-	ISSUED FOR REVIEW	BP	BLT	QLB
REV.	DATE	APP#	DESCRIPTION	APPROVAL		
	<div><div>Sunoco Logistics Partners L.P.</div></div> <div>SUNOCO MARINER EAST TYPE 2 LOW WATER/WET SAND/ LOW IMPACT CROSSING DETAIL</div>					
DWG. NO.			REV. NO.			
S-2896-STDS-R016			A			

LAST EDIT: 6/21/13



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NOTES


1. WORKING MATS SHALL EXTEND PAST HIGH MARK.
2. REDUCED ROW WIDTH SHALL MEET PERMIT REQUIREMENTS.
3. DEPTH OF COVER IS MEASURED FROM LOWEST POINT IN STREAM BED.
4. TOPSOIL AND SUB SOIL TO BE STORED SEPERATELY TO PREVENT CONTAMINATION OF TOPSOIL.
5. STREAM MANAGEMENT ZONE SHALL EXTEND 50' MIN. BEYOND HIGH WATER MARK OR 50' BEYOND ADJACENT, MARKED WETLAND LIMIT.
6. STRAW BALES SHALL BE PLACED ON DOWNSTREAM SIDE OF CAUSEWAY. (STRAW BALES MAY BE PLACED ON UPSTREAM SIDE AS REQUIRED BY EIS).
7. FOOTAGES ARE BASED ON 75' ROW. ADJUSTMENT WILL BE MADE FOR DIFFERENT ROW WIDTH.
8. SEGREGATED SPOIL MAY BE PLACED IN THE WETLAND WHEN OUTSIDE PLACEMENT IS NOT PRACTICABLE.

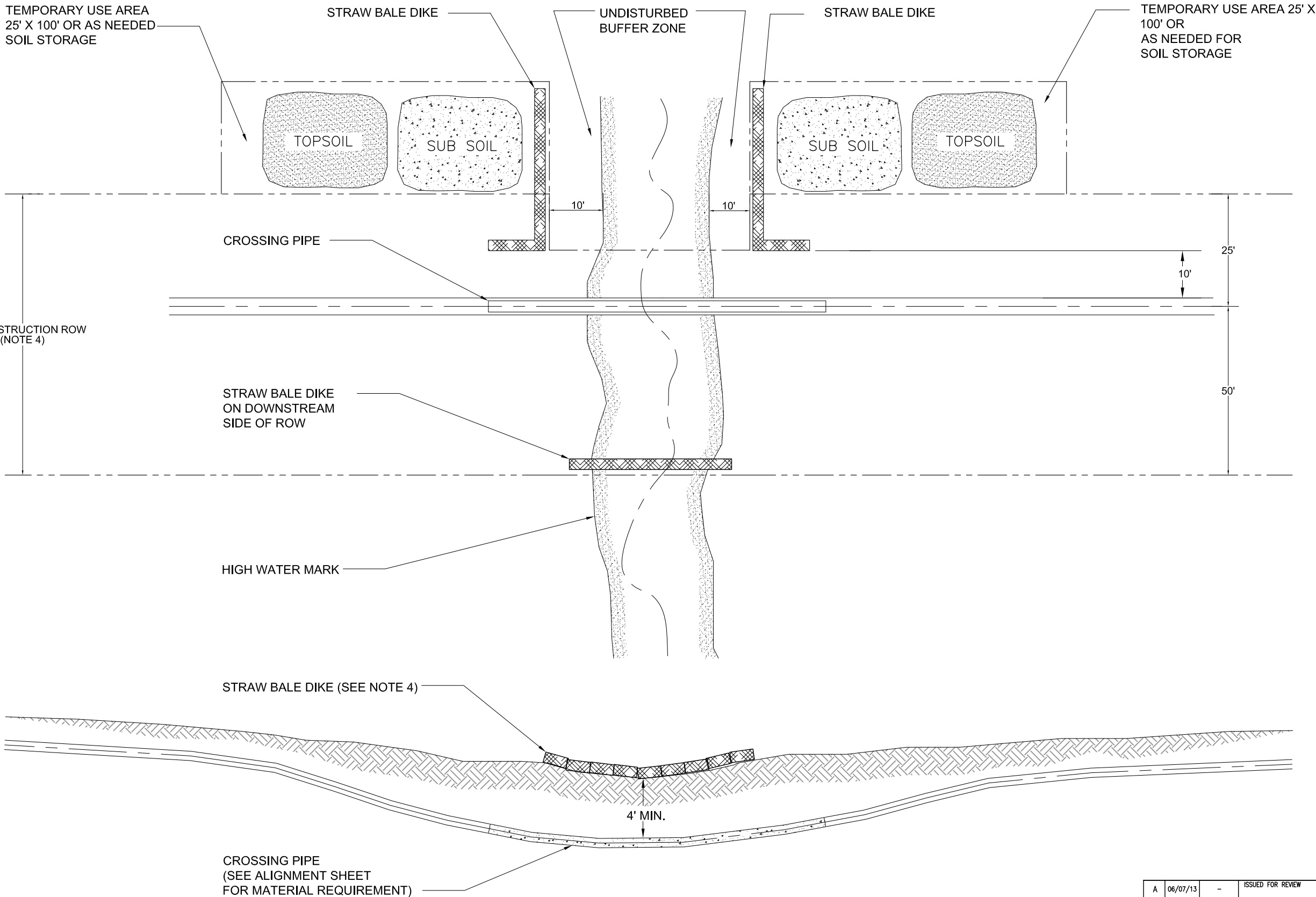
LAST EDIT: 6/21/13



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APPROVED BY	QLB
DATE	06/05/13
SCALE	NONE

A	06/07/13	-	ISSUED FOR REVIEW	BP	BLT	QLB
REV.	DATE	APP#	DESCRIPTION	APPROVAL		
			SUNOCO MARINER EAST TYPE 4 WETLAND CROSSING DETAIL			
Sunoco Logistics Partners L.P.						
DWG. NO.			REV. NO.			
S-2896-STDS-R017			A			



NOTES


1. DEPTH OF COVER IS MEASURED FROM LOWEST POINT IN DRAINAGE.
2. TOPSOIL AND SUB SOIL TO BE STORED SEPERATELY TO PREVENT CONTAMINATION OF TOPSOIL.
3. STRAW BALES SHALL BE PLACED ON DOWNSTREAM SIDE OF CROSSING. STRAW BALES MAY BE PLACED ON UPSTREAM SIDE AS REQUIRED BY EIS.
4. FOOTAGES ARE BASED ON 75' ROW. ADJUSTMENT WILL BE MADE FOR DIIFERENT ROW WIDTH.

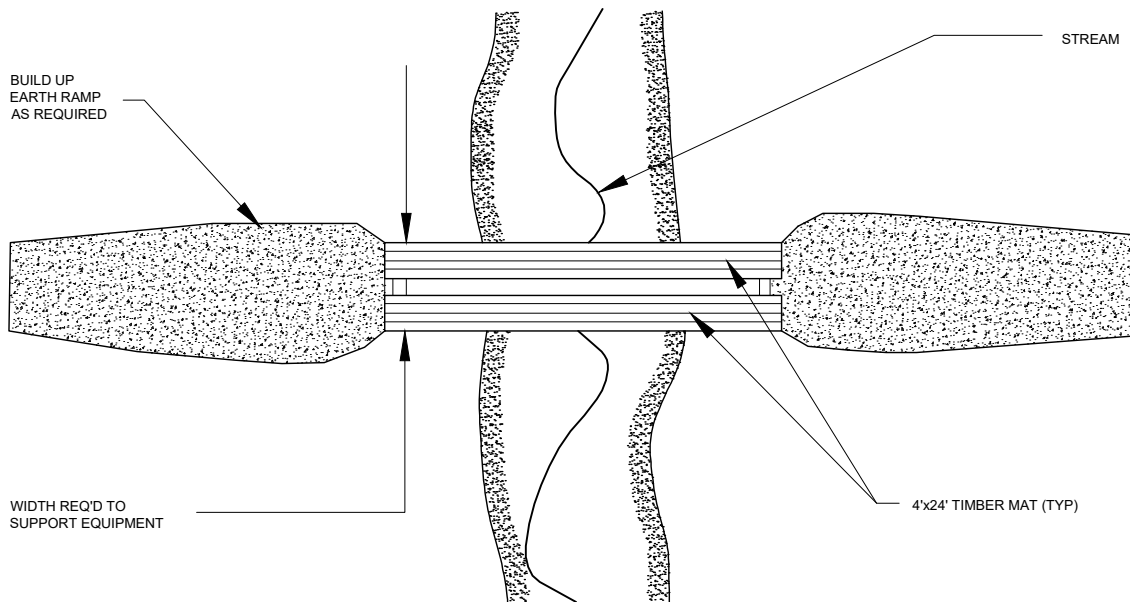
LAST EDIT: 6/21/13



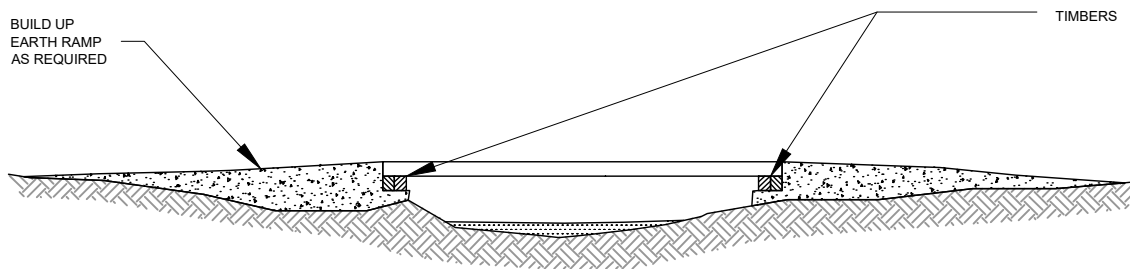
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ENGINEERING RECORD	
DRAWN BY	B. PHILLIPS
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DATE	06/05/13
SCALE	NONE

A	06/07/13	-	ISSUED FOR REVIEW		BP	BLT	QLB
REV.	DATE	APP#	DESCRIPTION		APPROVAL		
 Sunoco Logistics Partners L.P.			SUNOCO MARINER EAST TYPE 3 DRAINAGE CROSSING DETAIL				
DWG. NO.			S-2896-STDS-R018		REV. NO. A		



PLAN



SECTION

A	06/07/13	-	ISSUED FOR REVIEW	BP	BLT
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ENGINEERING RECORD	
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APPROVED BY	QLB
DATE	06/05/13
SCALE	NONE



Sunoco Logistics
Partners L.P.

**MAT BRIDGE
OVER STREAM**

OLD DRAWING NO.

DWG. NO.
S-STDS-R019

REV. NO.
A

Exhibit SPLP MG-6

SPLP
MG-6



Sunoco Logistics



OHIO/PENNSYLVANIA PIPELINE PROJECTS

ENGINEERING DESIGN BASIS MEMORANDUM

D	REVISED PER CLIENT COMMENTS	FK	ZBB	AARO	2/22/2018
C	REVISED PER CLIENT COMMENTS	ZBB	ZBB	DCM	4/5/2016
B	ISSUED FOR CONSTRUCTION	FK/SR/US	ZBB	DCM	3/22/2016
A	ISSUED FOR REVIEW	FK/SR/US	ZBB	DCM	8/29/2014
REV	DESCRIPTION	BY	CHECK	APRVD	DATE

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1.0 INTRODUCTION

1.1 PURPOSE OF THE DESIGN BASIS MEMORANDUM

The Design Basis Memorandum has been prepared to define the operating requirements and design criteria for the project. After approval by Sunoco Logistics, L.P. ("Sunoco") and ENGINEER, the memorandum will provide the final basis for design which ENGINEER is to follow for the Ohio Pipeline Project (OPP) and the Pennsylvania Pipeline Project (PPP), including all above ground surface sites.

1.2 REVISIONS TO THE DESIGN BASIS MEMORANDUM

The Design Basis Memorandum may be revised if Sunoco and ENGINEER representatives agree and approve these revisions in writing. The Sunoco representative for this project is Matthew Gordon. The designated representative for the ENGINEER shall be Mike Mathwig (pipeline design) and Zachary Bauer (facility design).

2.0 SCOPE OF WORK

The scope of this project is to work with Sunoco Logistics to engineer and design one (1) 20" diameter, 352 mile long pipeline, originating in Scio, Ohio, and terminating at the Twin Oaks Station, Pennsylvania. Existing dual 12" pipelines at the Twin Oaks station will take product to the final destination which is Marcus Hook Industrial Complex, Pennsylvania. This pipeline is expected to transport only liquid propane or butane purity product, at an initial flowrate of 280,000 barrels per day (BPD) and a future maximum flowrate of 350,000 barrels per day (BPD). This propane/butane pipeline will have a maximum operating pressure of 1480 psig. The second pipeline, a 16" diameter, 300 mile long pipeline originating at Houston, PA and terminating at Twin Oaks, PA will transport only liquid ethane, at an initial flowrate of 100,000 BPD. A 250 mile portion, from Houston, PA to Montello, PA is expected to be built at the same time as the 20" pipeline, but the balance of the 16" pipeline is expected to be built at some point in the future. This 16" ethane pipeline will have a maximum operating pressure of 1480 psig.

2.1 20" DIAMETER PROPANE AND BUTANES PIPELINE

On the pipeline, Emergency Flow Restrictive Device (EFRD) sites will allow for automated shutdown, should it be required. Other valve sites will be manual valves or manual/check valve combinations. See ME2 Project Valve Matrix for the valve type, location, and spacing. The pipeline will have valve sites spaced approximately 10 miles apart in rural locations, and approximately 7.5 miles apart in commercial, industrial and urban locations. The downstream side of any major water crossing will have a manual block and check valve riser site to prevent product from flowing toward the water body should a release occur.

There are many locations where this new pipeline will cross existing pipelines, electric power, roads, railroads and other features that require boring or horizontal directional drills. Each of these crossings will be reviewed and the appropriate method of crossing will be determined and designed.

Every attempt will be made to co-locate this pipeline adjacent to the existing Mariner East 1 pipeline within Sunoco's existing right-of-way from the Houston MarkWest site through the Twin Oaks station, unless an alternate route is deemed appropriate.

2.2 16" DIAMETER ETHANE PIPELINE

For block valve sites, a 16" diameter ethane pipeline will be included on the mechanical vicinity drawing to determine how much land should be purchased. Including the extra land for the ethane line at the time of purchase will make it easier to co-locate the pipelines at some point in the future.

A 16" diameter ethane pipeline will be installed from Houston, PA to Montello, PA, utilizing pipe purchased by Sunoco. It will be placed in the same right-of-way as the 20" propane pipeline, and will have the same block valve locations. From preliminary hydraulic studies, shipping 100,000

BPD of ethane in the line will require one mainline pump station at Delmont. This pump station is not currently included in the scope of this project.

2.3 STATIONS

This project includes multiple new above ground facilities, as summarized below.

➤ Scio (Harrison Hub)

UEO has an existing fractionation plant located in Scio, Ohio called the Harrison Hub. SXL will install a station on the existing site which would include a pressure control valve, a filter, one (1) dual Coriolis meter skid (for a total of two meters), one (1) small volume prover, one (1) gas chromatograph, two (2) composite samplers, one (1) 20" pig launcher, one (1) flare knock out vessel, one (1) enclosed flare and all associated piping and equipment enclosures.

➤ Hopedale

MarkWest has an existing fractionation plant located near Hopedale, Ohio. Sunoco has leased land for a new pipeline injection facility on land adjacent to MarkWest's rail loading facility. SXL will install a station on the site which will include four (4) pressure control valves, two (2) filters, three (3) dual Coriolis meter skids, one (1) single Coriolis meter skid (for seven total meters), four (4) booster pumps, two (2) Injection pumps, one (1) small volume prover, two (2) gas chromatographs, two (2) composite samplers, two (2) 20" main line valve assemblies, one (1) flare knock out vessel, one (1) enclosed flare, one (1) fired butane vaporizer skid, tie-ins to two (2) liquid storage spheres (spheres to be constructed by others), and all associated piping and equipment enclosures. The station also includes a fire water deluge system, which includes two diesel fire water pumps, fire water main, deluge valve house, hydrants, and monitors.

➤ Follansbee

An existing pipeline operated by Blue Racer and located near Follansbee, West Virginia will connect to Sunoco's ME2 pipeline to facilitate additional product movement. The facility in Follansbee will be constructed to include one (1) pressure control valve, one (1) filter, one (1) dual Coriolis meter skid (for a total of 2 meters), one (1) small volume prover, one (1) gas chromatograph, two (2) composite samplers, two (2) 20" main line valve assemblies, one (1) flare knock out vessel, one (1) enclosed flare and all associated piping and equipment enclosures.

➤ Houston Injection

Sunoco has acquired land for a new pipeline injection facility near Houston, PA. The injection location will inject product from MarkWest's Houston fractionation plant, as well as Sunoco's proposed Houston Tank Farm. The facility includes three (3) 20" pig traps, one (1) 12" pig trap, one (1) 20" main line valve assembly, one (1) flare knock out vessel, one (1) enclosed flare and all associated piping and equipment enclosures. The construction of this site also includes a new 12" launcher and tie in piping inside the Houston MarkWest Plant, adjacent to the Mariner East Phase 1 meters.

➤ Houston Tank Farm

MarkWest has an existing fractionation plant located near Houston, PA. Product received from this and other plants will be shipped to a new Sunoco batching storage facility called Houston Tank Farm. The station will include three (3) pressure control valves, three (3) filters, six (6) dual Coriolis meter skids (for twelve total meters), eight (8) booster pumps, four (4) Injection pumps, one (1) small volume prover, three (3) gas chromatographs, three (3) composite samplers, one (1) 20" pig launcher, one (1) 12" pig receiver, two (2) 10" pig receivers, one (1) flare knock out vessel, one (1) enclosed flare, two (2) fired LPG vaporizer skids, tie-ins to four (4) liquid storage spheres (spheres to be constructed by others), and all associated piping and equipment enclosures. The station also includes a fire water deluge system, which includes two diesel fire water pumps, fire water main, two (2) deluge valve houses, hydrants, and monitors.

➤ **Delmont**

The existing site at Delmont will be expanded to connect to Sunoco's ME2 pipeline. The Project will install two (2) 20" pig traps, two (2) filters, two (2) mainline pumps with VFDs, one (1) flare knock out vessel, one (1) enclosed flare and all associated piping and equipment enclosures.

➤ **Ebensburg**

The existing site at Ebensburg will be expanded to connect to Sunoco's ME2 pipeline. The Project will install two (2) 20" pig traps, two (2) filters, two (2) mainline pumps with VFDs, three (3) dual Coriolis meter skids (for a total of six meters), one (1) small volume prover, one (1) flare knock out vessel, one (1) enclosed flare and all associated piping and equipment enclosures.

➤ **Mt Union**

The existing site at Mt Union will be expanded to connect to Sunoco's ME2 pipeline. The Project will install two (2) 20" pig traps, one (1) 20" main line valve assembly, one (1) flare knock out vessel and all associated piping and equipment enclosures.

➤ **Middletown**

The existing site at Middletown will be expanded to connect to Sunoco's ME2 pipeline. The Project will install two (2) 20" pig traps, two (2) filters, two (2) mainline pumps with VFDs, three (3) dual Coriolis meter skids (for a total of six meters), one (1) small volume prover, one (1) flare knock out vessel, one (1) enclosed flare and all associated piping and equipment enclosures.

➤ **Beckersville**

The existing site at Beckersville will be expanded to connect to Sunoco's ME2 pipeline. The Project will install two (2) 20" pig traps, one (1) 20" main line valve assembly, one (1) flare knock out vessel and all associated piping and equipment enclosures.

➤ **Twin Oaks**

The existing site at Twin Oaks will be expanded to connect to Sunoco's ME2 pipeline. The Project will install one (1) 20" pig receiver, two (2) 12" pig launchers, two (2) filters, three (3) dual Coriolis meter skids (for a total of six meters), one (1) small volume prover, one (1) flare knock out vessel and all associated piping and equipment enclosures.

- 2.4 Sunoco has contracted ENGINEER to provide hydraulic analysis of the new system. Base line cases will be developed for the following:

- One (1) Twenty inch pipeline: Design flow rate of 280 MBPD, Maximum of 350 MBPD.
- Products:
 - 100% Propane
 - 100% N-Butane
 - 55% N-Butane minimum / 45% Iso-butane maximum
 - C3+ Mixture
- Injection points:

Mile Post	Facility name	Injection Rate
0.0	Scio, OH	25 mbpd C3/14.5 mbpd C4
10.6	Hopedale, OH	85 mbpd C3/40 mbpd C4
33.0	Follansbee, WV	35.5 mbpd C3/17 mbpd C4
53.5	Houston, PA	30 mbpd C3/5 mbpd C4

- 2.5 Sunoco has contracted ENGINEER to provide services for the engineering, design and drafting to prepare equipment specifications, piping bills of materials, material requisitions and a complete set of drawings for bidding and constructing the pipeline, EFRD sites, Injection stations, mainline booster pump stations and meter stations that will comprise the pipeline system.
- 2.6 Permanent record files (Job Books) are to be assembled for this project. These files will include the following items:
- 2.6.1 Project Drawings
 - 2.6.2 Engineering Calculations
 - 2.6.3 Equipment Data Sheets
 - 2.6.4 Vendor Drawings / Material Test Reports
 - 2.6.5 Installation, Operating and Maintenance Instructions
 - 2.6.6 Parts Lists
 - 2.6.7 Reports / Studies
 - 2.6.8 Construction Inspection Reports
- 2.7 PIPELINE DESIGN
- 2.7.1 DESIGN STANDARDS: The pipeline will be designed to meet the requirements of CFR 49, Part 195 and ASME B31.4 (2016), unless noted otherwise.
- 2.7.2 PIPE: Pipeline MOP will be 1480 psig. The pipe will be designed utilizing API 5L PSL2 ERW material with a maximum grade of X-65. Minimum wall thickness shall be determined using the design factor of 0.60 for the main line pipeline. All road and stream crossing pipe will use a design factor of 0.50. All above ground facility piping shall use a design factor of at least 0.72, as required by the design codes. As an added safety precaution, the pipe wall thickness and grade will be selected to provide a design factor closer to 0.6. Pipe selection that provides a design factor of more than 0.6 will require approval from the Sunoco Project Manager. Design temperature shall be (-) 20°F to (+) 100°F.
- As required by ASME B31.4, Section 423.2.3, all piping and materials must be CVN impact tested at the minimum design temperature of the system since the system will operate above 20% of pipe material specified minimum yield strength (SMYS).
- 2.7.3 PIPELINE COATING: Pipeline coating will be 14 – 16 mils of fusion bond epoxy. Girth weld coating will be fusion bond epoxy to match the main pipe coating. Coating of all crossings will be fusion bond epoxy with 40 mils of Powercrete.
- 2.7.4 MAINLINE VALVES: Mainline valves consist of one of three types: Manual block, manual block and check, or EFRD. Mainline block valves will be installed with approximately 10 mile spacing between valves in rural locations, and approximately 7.5 miles apart in commercial, industrial and urban locations. Closer spacing shall be considered based on population density and type of development. Valves shall be installed on both sides of major water crossings. This will include the Ohio, Monongahela, Youghiogheny and Conemaugh Rivers, and Loyalhanna and Raystown Lakes. Valves downstream of water bodies will be ANSI 600 ball valves and thru conduit check valves with raised face flange end connections. All other valves will be ANSI 600 ball valves and be installed above grade and protected by chain link fencing. All gates shall be chained and locked.
- Mainline Block valves at EFRD sites will be pneumatically operated and remotely controlled. Mainline Block Valves at pump station/injection sites will be electrically

operated and remotely controlled via existing power and control systems. Control Enclosures will be located at each EFRD site.

NOTE: Mainline block valves shall be installed to facilitate operational control, limit the duration of an outage, and expedite repairs and may exceed a 7.5 mile (12 km) spacing where appropriate. Valve placement and spacing shall consider safety consequences separately.

- 2.7.5 COMMUNICATION: Detailed communication design for each station and EFRD site will be completed by Sunoco. Provisions for each type of communication (Radio, Satellite, Phone, etc) are provided as part of the engineering package.
 - 2.7.6 PIPELINE FITTINGS: Manufactured bends in the pipeline system will be segmentable 3R elbows to allow the passage of smart pigs. Manufactured bends will be used for all sag and overbends at valve sites and pig traps. Manufactured bends will also be used in general pipeline construction as required to conform to the Right-of-Way (ROW).
 - 2.7.7 CATHODIC PROTECTION: Cathodic protection test stations will be installed at nominal ½ mile spacing. Two cathodic protection anode beds will be located along the pipeline ROW. Final locations and system design will be determined by Sunoco operations personnel. Detailed design is not provided by TTR, however provisions for rectifier power/mounting locations will be part of the engineering package.
- 2.8 The main aspects of the pump stations design include
- 2.8.1 Foundations for all electrical enclosures, pumps, vessels, flares, metering equipment, miscellaneous structures, and yard piping at each pump station.
 - 2.8.2 Enclosures to be installed on each site include:
 - 2.8.2.1 Power Distribution Center (PDC) enclosure (pre-fabricated)
 - 2.8.2.2 Gas Chromatographs (where applicable)
 - 2.8.3 All station yard components including:
 - 2.8.3.1 Pig receivers and pig launchers (as required)
 - 2.8.3.2 Horizontal Liquid Filters
 - 2.8.3.3 Mainline NGL pumps, including electrical connections
 - 2.8.3.4 NGL meters, as required for system leak detection
 - 2.8.3.5 High pressure NGL piping, valves and equipment
 - 2.8.3.6 Pipe Supports
 - 2.8.3.7 Instrumentation and related equipment
 - 2.8.3.8 Vent and drain piping, and related equipment, including flare
 - 2.8.3.9 Electrical equipment, wiring and conduit, lighting and grounding
 - 2.8.3.10 Standby power supply, UPS system, VFD, MCC, and panels
 - 2.8.3.11 Cable Tray

3.0 DESIGN PARAMETERS

3.1 LIQUID PHYSICAL PROPERTIES

3.1.1 100% Propane

Fluid	100% Propane (assumption for design purposes)
Piping Design Pressure	ANSI/ASME 600 – 1,480 psig
Piping Design Temperature	85°F / -20°F
Design Viscosity @ 90°F	0.1911 cSt
Fluid Specific Gravity	0.4873 @ 85°F @ 140 psig
Fluid Vapor Pressure – 85°F	140 psig

3.1.2 Butane Blend

Fluid	55% N-Butane Min, 45% Isobutane Max
Piping Design Pressure	ANSI/ASME 600 – 1,480 psig
Piping Design Temperature	85°F / -20°F
Design Viscosity @ 85°F	0.2666 cSt
Fluid Specific Gravity	0.5598 @ 85°F @ 34 psig
Fluid Vapor Pressure – 85°F	34 psig

3.1.1 100% N-Butane

Fluid	100% N-Butane
Piping Design Pressure	ANSI/ASME 600 – 1,480 psig
Piping Design Temperature	85°F / -20°F
Design Viscosity @ 85°F	0.2675 cSt
Fluid Specific Gravity	0.5700 @ 85°F @ 26 psig
Fluid Vapor Pressure – 85°F	26 psig

3.1.1 C3+ Blend

Fluid	C3+ (64.6% Propane, 8.8% Isobutane, 16.7% N-Butane, 3.3% N-Pentane, 3.2% Hexane and Heavier by Mole %)
Piping Design Pressure	ANSI/ASME 600 – 1,480 psig
Piping Design Temperature	85°F / -20°F
Design Viscosity @ 85°F	0.2215 cSt
Fluid Specific Gravity	0.5245 @ 85°F @ 98 psig
Fluid Vapor Pressure – 85°F	98 psig

3.2 STATION HIGH PRESSURE FLARE AND RELIEF SYSTEMS

Piping Design Pressure	ANSI/ASME 600 – 1,480 PSIG
Piping Design Temperature	100° / -100°F
Vessel Design Pressure	1,480 PSIG
Vessel Design Temperature	100° / -100°F

3.3 EQUIPMENT

3.3.1 Pig Receivers / Pig Launchers

Design Pressure	1,480 psig
Design Temperature (Max/Min)	100°F / -20°F
Type	Capable of Launching Smart Tools
Design Standard	Sunoco Launcher & Receiver for Liquid Service Design Standard

3.3.2 Horizontal Liquid Filters

Type	Horizontal Liquid
Design Pressure	1,480 psig
Design Temperature (Max/Min)	100°F / -20°F
Efficiency	99.98% of solids 10 micron & larger
Maximum Pressure Drop	35 psid (10.0 psid clean)

3.3.1 Flare Knock Out Drum

Design Pressure	1,480 psig
Design Temperature (Max/Min)	100°F / -20°F
Type	ASME Pressure Vessel

Design Standard	ASME Div VIII
3.3.2 NGL Pumps (Rated Conditions)	
3.3.2.1 Scio, OH (supplier will provide product at 1480 psig, no pump in REI scope)	
3.3.2.2 Hopedale (injection pumps)	
Type	API 610 BB3
Quantity	Two (2) pumps to pull from storage and inject into mainline
Design Flow	190,000 BPD (max batch)
Design Suction Pressure	220 psig
Design Discharge Pressure	1480 psig maximum
Driver	2,250 hp
3.3.2.3 Hopedale (booster pumps)	
Type	API 610 BB2
Quantity	four (4) pumps to pull from storage and boost into injection pumps
Design Flow	190,000 BPD (max batch)
Design Suction Pressure	10 to 30 psig
Design Discharge Pressure	220 psig maximum
Driver	500 hp
3.3.2.4 Follansbee (supplier will provide product at 1480 psig, no pump in REI scope)	
3.3.2.5 Houston Tank Farm (injection pumps)	
Type	API 610 BB3
Quantity	Four (4) pumps to pull from boosters and inject into mainline
Design Flow	280,000 BPD (max)
Design Suction Pressure	220 psig
Design Discharge Pressure	1480 psig maximum
Driver	2,500 hp
3.3.2.6 Houston Tank Farm (propane/butane booster pumps)	
Type	API 610 BB2
Quantity	Four (4) pumps to pull from storage and boost into injection pumps

	Design Flow	103,000 BPD (max batch)
	Design Suction Pressure	10 to 30 psig
	Design Discharge Pressure	220 psig maximum
	Driver	300 hp
3.3.2.1	Houston Tank Farm (C3+ booster pumps)	
	Type	API 610 BB2
	Quantity	Four (4) pumps to pull from storage and boost into injection pumps
	Design Flow	280,000 BPD (max batch)
	Design Suction Pressure	10 to 30 psig
	Design Discharge Pressure	220 psig maximum
	Driver	450 hp
3.3.2.2	Delmont (mainline booster pumps)	
	Type	API 610 BB3
	Quantity	Two (2)
	Design Flow	350,000 BPD
	Design Suction Pressure	240 psig (confirm)
	Design Discharge Pressure	1480 psig maximum
	Driver	4,500 hp
3.3.2.3	Ebensburg (mainline booster pumps)	
	Type	API 610 BB3
	Quantity	Two (2)
	Design Flow	350,000 BPD
	Design Suction Pressure	240 psig (confirm)
	Design Discharge Pressure	1480 psig maximum
	Driver	4,500 hp
3.3.2.1	Middletown (mainline booster pumps)	
	Type	API 610 BB3
	Quantity	Two (2)
	Design Flow	350,000 BPD
	Design Suction Pressure	240 psig (confirm)
	Design Discharge Pressure	1480 psig maximum
	Driver	4,500 hp

3.3.2.2 Meters

Metering will be installed for each custody transfer injection point (Scio, Hopedale, Follansbee, and Houston Tank Farm). Meters will also be installed at Ebensburg, Middletown, and Twin Oaks for leak detection. Each site will have a permanent prover and connections for a temporary prover.

Design conditions for the meters are as follows:

3.3.2.3 NGL Meter Design Basis:

Type	Coriolis
Model	6" CMFHC2M
Design Flow	800 to 3600 BPH
Tube Velocity	< 42 ft/sec
Design Pressure	1,480 psig
Operating Pressure	50 psi above vapor pressure
Design Temperature	100°F / -20°F
Operating Temperature	60°F

3.3.3 Station Vent/Flare System

The pressurized drain system at each site will flow to a permanent flare. The following are the design parameters for the flares:

Type:	Enclosed Flare
Flare Capacity – Scio, Follansbee, Houston Injection:	10 MM BTU/hr
Flare Capacity – Delmont, Ebensburg, Middletown:	30 MM BTU/hr
Flare Capacity – Houston and Hopedale:	70 MM BTU/hr
Vent Size	2" SCH 40S Pipe
Minimum Clear Radius	100 feet from operating equipment and property line unless approved by Sunoco due to constrained conditions.

3.4 ELECTRICAL POWER

Pump Main Service	4160 V, 3-phase, 4-wire, wye- HI resistance grounded neutral
Main Service	480 V, 3-phase, 60 Hz grounded WYE
Uninterruptible Power System and Controls	480 Volt UPS for Motor Operated Valves 120 Volt UPS for Critical loads 24 Volt DC Lamarche system for PLC system

3.5 ENVIRONMENTAL CONDITIONS

Outdoors

Ambient min/max design temperatures are -20°F / 100°F

Annual average relative humidity 65%

1. International Enclosure Code 2009 Seismic Design Parameters:
 - 0.2 Second Spectral Response Acceleration (Site Class B) = $S_s = 0.128g$
 - 1.0 Second Spectral Response Acceleration (Site Class B) = $S_1 = 0.059g$
2. Site wind loading per IBC is for a speed of 90 mph, exposure C.
 - Predominant wind direction – Southwest with a mean speed of 6 mph
3. Annual average precipitation is 38.2 inches.
 - Total snow is 41 in/yr.
4. Snow load: 25 psf
5. Frost depth: 40 inches
6. Platform loading is 100 psf live load.
7. Electrical classification – per API Article 500.
8. Noise Level Allowed – 85 dBA at 1 meter

4.0 PROCESS, MECHANICAL, PIPE DESIGN**4.1 CODES, STANDARDS AND SPECIFICATIONS**

The project piping shall be designed and constructed in accordance with the applicable portions of the latest editions of the following industry codes and standards:

- 4.1.1 Code of Federal Regulations ("CFR")
 - 49 CFR 195 "Transportation of Hazardous Liquids by Pipeline"
- 4.1.2 American Society for Testing and Materials ("ASTM")
 - ASTM A105 "Standard Specification for Carbon Steel Forgings for Piping Applications"
 - ASTM A106 "Seamless carbon steel pipe for high temperature service"
 - ASTM A193 "Alloy-steel and stainless steel bolting materials for high temperature service"
 - ASTM A194 "Carbon A-D alloy-steel nuts for bolts for high pressure"
 - ASTM A234 "Specification for piping fittings of wrought carbon steel and alloy-steel for moderate and elevated temperatures"
 - ASTM A350 "Standard Specification for Low-Alloy Steel Forgings, Requiring Notch Toughness Testing for Piping Components"
 - ASTM A694 "Standard Specification for Carbon and Alloy Steel Forgings for Pipe Flanges, Fittings, Valves and Parts for High Pressure Transmission Service"
- 4.1.3 American Society of Mechanical Engineers ("ASME")
 - ASME B16.5 "Pipe Flanges and Flanged Fittings"
 - ASME B16.9 "Factory – made wrought steel butt welding fittings"
 - ASME B16.11 "Forged steel fittings, socket – welding and threaded"
 - ASME B16.34 "Valves – flanged and butt welding ends"
 - ASME B31.4 "Pipeline Transportation Systems for Liquid Hydrocarbons and other Liquids"
 - ASME BPV, Div. 1, Sect. IX "Boiler and Pressure Vessel Code"
- 4.1.4 American Petroleum Institute ("API")
 - API 5L "Specification for Line Pipe"
 - API 6D "Specification for Pipeline Valves (Gate, Plug, Ball, and Check Valves)"
 - API 610 "Centrifugal Pumps for Petroleum, Petrochemical and Natural Gas Industries"
 - API 682 "Pumps-Shaft Sealing Systems for Centrifugal and Rotary Pumps"
 - API 1104 "Welding of Pipelines and Related Facilities"
 - API RP 1110 "Pressure Testing of Steel Pipelines for the Transportation of Gas, Petroleum Gas, Hazardous Liquids, Highly Volatile Liquids or Carbon Dioxide"
- 4.1.5 Manufacturer's Standardization Society ("MSS")
 - MSS SP-44 "Steel Pipeline Flanges"
 - MSS SP-75 "High Test Wrought Butt Welded Fittings"
- 4.1.6 National Association of Corrosion Engineers ("NACE")
 - NACE SP-0175 "Sulfide Stress Cracking Resistant Metallic Materials for Oilfield Equipment"

4.2 SUNOCO COMPANY SPECIFICATIONS

The Mariner East Phase 2 Project shall be designed and constructed in accordance with the applicable portions of the latest revisions of the following Sunoco Company Specifications:

S_STDS_INDEX "Standard Drawings and Documents"

S_STDS_M300001	"Device Numbering Convention"
S_STDS_M300000	"Standard Instrument List"
S_STDS_M300010	"Standard Pipe Material Schedule"
S_STDS_TBD	"Pipe Material Schedule – NGL"
E_TPLT_E200506	"Standard Motor Operated Valve Datasheet"
SP-04-0001	"On Shore Steel Line Pipe"
PR-11-0004	"Pressure Testing of Pipelines"
PR-11-0006	"Pipeline Repair"
PR-11-0010	"Determination of the Maximum Operating Pressure (MOP), Maximum Allowable Operating Pressure (MAOP), or Current Operating Limit (COL) for a Pipeline Systems"
PR-11-0030	"Pipeline Integrity Test"
PR-11-0032	"Pipeline Assessment Method Selection"
PR-11-0033	"Vendor Reporting of Pipeline Restrictions and Anomalies Based on ILI Geometry Tool Data"
PR-11-0034	"Vendor Reporting of Pipeline Defects Based on Magnetic Flux Leakage (MFL) or Ultrasonic (UT) Intelligent Pig Data"
PR-11-0036	"ILI Data Analysis and Generation of Dig Lists"
PR-11-0037	"Activating and Deactivating Pipelines"
PR-11-0038	"Bolted Flange Joint Assembly"
PR-11-0039	"Management of Change"
Welding Manual	"Sunoco Logistics Welding Manual"
Construction Spec 100	"General Requirements"
Construction Spec 101	"Construction Scope of Work Outline"
Construction Spec 300	"Site Preparation"
Construction Spec 301	"Demolition"
Construction Spec 302	"Earthwork"
Construction Spec 303	"Excavation"
Construction Spec 304	"Geologic Conditions"
Construction Spec 305	"Foreign Lines"
Construction Spec 307	"Aggregate Base"
Construction Spec 308	"Pipe Padding and Backfill"
Construction Spec 310	"Chain Link Fence"
Construction Spec 311	"Soil Erosion and Sediment Control"
Construction Spec 312	"Site Drainage"
Construction Spec 313	"Pipe Abandonment"
Construction Spec 314	"Site Clean-up and Restoration"
Construction Spec 315	"Horizontal Bore"
Construction Spec 316	"Directional Drill"
Construction Spec 317	"Crossing Installations"
Construction Spec 318	"Pipeline Line Markers Installation"
Construction Spec 321	"Blasting"
Construction Spec 400	"Piling Installation"
Construction Spec 403	"Galvanizing Structural Steel and Plate"
Construction Spec 404	"Structural Steel"
Construction Spec 405	"Other Steel and Metal Fabrications"

Construction Spec 406	"Reinforcing Steel Fabrication"
Construction Spec 502	"Underground Pipe Installation"
Construction Spec 503	"Piping and Equipment Installation"
Construction Spec 504	"Protection of Equipment"
Construction Spec 505	"Machinery Alignment Procedure"
Construction Spec 506	"Maintenance Pigging Procedure"
Construction Spec 507	"Machinery Commissioning and Startup"
Construction Spec 508	"Grouting of Machinery"
Construction Spec 509	"Final Tie in to Existing Pipelines"
Construction Spec 511	"Welding or Hot Tapping on Equipment in Service"
Construction Spec 512	"Pressure Testing of Terminal Piping"
Construction Spec 600	"Electrical Installation"
Construction Spec 601	"Electrical Testing"
Construction Spec 602	"Electrical Pole Line Installation"
Construction Spec 700	"Field Instrument Installation"
Construction Spec 701	"Instrument Testing, Calibration, and Commissioning"
Construction Spec 702	"Process Instrumentation and Control"
Construction Spec 801	"Welding Requirements for DOT Facilities"
Construction Spec 1000	"Installation of Insulating Joints"
Construction Spec 1001	"CP Test Stations"
Construction Spec 1002	"Conductor Attachment to Pipe"
Construction Spec 1100	"Painting of Tanks, Piping, Equipment, and Steel Structures"

4.3 GENERAL PIPING DESIGN

4.3.1 Velocities

The table below lists the maximum design velocities for system piping:

<u>System</u>	<u>Maximum Velocity</u>
Station ESD Bypass	15 fps
High Pressure NGL	15 fps
High Pressure Drains	15 fps

4.4 HIGH PRESSURE NGL SYSTEM

4.4.1 General

The high pressure NGL system shall be designed to achieve the desired station operation as described in Section 3.0, Design Parameters.

4.4.2 Pumps

- 4.4.2.1 The pumps to be installed at both the four (4) injection stations and three (3) mainline booster stations will be API 610 BB3 and BB2 pumps driven by electric motors capable of VFD service.
- 4.4.2.2 Peripheral equipment for the pump packages includes a forced oil lubrication system for each pump. There are no provisions for oil storage on-site other than the oil surge tank included.

- 4.4.2.3 Filters will be installed on the suction lines to each pump to prevent large particles from entering the pump. Two (2) permanently installed filters shall be installed in parallel to allow one filter to be maintained while the other is operating.

4.4.3 Station Piping

All high pressure piping shall be stress analyzed to ensure that stress levels and nozzle loadings during operation are within acceptable levels. Piping design shall be in accordance with Sunoco's piping specifications.

4.4.4 Valves

All valves in the main NGL flow path shall be full-bore valves to minimize pressure loss in the piping system. All valves shall be API 6D monogrammed.

4.4.5 Thermal Relief

Thermal relief valves shall be installed in piping sections that can be blocked in and exposed to heat sources. The thermal relief valves can discharge into a downstream or upstream pressurized piping system as long as the relief valves are designed to be balanced against backpressure effects on the set pressure.

4.4.6 Piggings & Inspection Tools:

The project shall be designed to accommodate In-Line Inspection (ILI) tools. The 20" pig traps will be designed for the longest anticipated ILI tools that are expected to be used. Features of a piggable pipeline system include, but are not limited to:

- Length Between Fittings: A minimum of one pig length of straight run pipe shall be installed between bends, tee's, and valves. Through conduit gate and ball valves can be treated as straight runs of pipe.
- Pipeline Bends: The bend radius of all piggable elbows shall be no tighter than 3 times the pipe nominal diameter. Only 45° and 90° Segmentable Elbows will be purchased by the Company. The Contractor shall segment the fittings to the proper angle. The 3R Segmentable Elbows shall be manufactured according to MSS SP-75. These are forged fittings, and not induction bent pipe. Modern ILI tools are capable of navigating 3D bends.
- Pipeline Valves: All valves through which pigs pass shall be specified for pig passage. These valves shall be full port/through conduit API 6D design.
- Trap Elevation: The standard Sunoco pig trap design typically has a 3 degree cold bend to elevate the door end of the trap barrel, to facilitate fluid drainage. This is not required for propane and butane (due to their vapor pressures) and will not be included in this project.
- Barred Tees: Branch fittings shall have pig guide bars installed when the opening is greater than 50 percent of pigged line size.
- Pig Passage Indicators: Pig passage indicators (pig sigs) shall be installed at various locations to assist with pig tracking and to confirm that the tools have cleared pig trap valves and other features. The pig sigs shall be bi-directional, flush with the internal pipe wall, retractable and replaceable under pressure. Bi-directional pig passage indicators shall be installed on both sides of all laterals and pump stations and on the bidirectional pig traps where required to confirm the pig has cleared the trap valve. They shall be located a minimum of one pig length from the valve.
- Pig Trap Features: In general, the pig traps will include the following features:

- The pig trap closure shall be a hinged, quick opening design with a pressure lock safety device to prevent opening under pressure. The closures shall include an integral davit or other device, for ease of opening and closing.
- The barrel shall be oversized by a minimum of (4 in.). The barrel length shall be at least the length of the pig,
- The reducer shall be the eccentric type, installed flat side down, to facilitate launching and pig handling.
- Two bi-directional pig signal indicators are required. The receiver indicator shall be located at the reducer end of the trap nominal pipe section. The launch indicator shall be located one pig length past the mainline valve.
- A (2 in.) drain lines shall be installed at the closure end of the trap, which will not generally be used due to the vapor pressure of the fluid.
- A 2" equalizing line and valve shall be required on launchers. It shall be located on the side of the trap and connect the nominal pipe section to the oversized pipe section.

4.5 HIGH PRESSURE DRAIN SYSTEM

- 4.5.1 All drains from piping and equipment containing NGL's shall be connected to the high pressure drain system. The high pressure drain system will be used to collect NGL from the main piping and route it to a safe place for handling the vaporized product.
- 4.5.2 The high pressure drain system will include a flare knock out vessel which will capture and contain any liquids to ensure they are not sent to the flare. The flare knock out will have a level transmitter and an outlet MOV, which will shut upon a high level alarm.
- 4.5.3 The high pressure drain system will discharge to a flare stack that is located a safe distance away from operating equipment and the station property line.
- 4.5.4 A single, above-ground flanged connection shall be provided from the high pressure drain system for connection to a flare system that is located a safe distance from operating equipment and surrounding properties.
- 4.5.5 LEL monitors will be installed around the station to monitor for the presence of flammable vapors.

4.6 PIPING AND EQUIPMENT INSULATION

The Construction Contractor will provide and install the following types of insulation for this project per Sunoco specification. The insulation requirements are shown on the drawing packages.

- 4.6.1 Freeze Protection (FP)
Calcium silicate insulation (Manville T-12 or equal for all applications) shall be used for this application along with electrical heat tracing.
- 4.6.2 Heat Conservation (H)
Calcium silicate insulation shall be used for this application on above ground piping.
- 4.6.3 Personnel Protection (PP)
Calcium silicate insulation shall be used for this application.

4.7 VENDOR DRAWING REVIEW

4.7.1 Conformance to Purchase Specifications

All drawings and data submitted by vendors must be reviewed to ensure conformance to Purchase Specifications. Specifically, the following items must be checked by comparison to the Equipment Data Sheets and to Vendors Drawings and Data Requirements:

- 4.7.1.1 Tag number, materials of construction, code conformance, performance, customer connections, and accessory items.
- 4.7.1.2 Sufficient information must be presented to permit a complete installation of the items covered

4.8 DRAWINGS AND DOCUMENTS

4.8.1 Process Flow Diagram (PFD)

The process flow diagram is a simplified graphic representation of the flow of product through piping and equipment to the discharge of the plant or station. The diagram shows all of the major equipment symbolically indicating the process scheme.

4.8.2 Process and Instrumentation Diagram (P&ID)

The P&ID is the primary document defining the scope of the project. The drawings describe pipe specifications and line sizes, valves, strainers, insulation, all the controls, instrumentation, equipment, and customer connections. References are indicated on the drawings to assist with working back forth between the various drawings.

4.8.3 Piping Material Specification

The documents include all project piping specifications pertinent to the project. Material and grades are included for all piping, fittings, bolts, gaskets, and memorandum valves.

4.8.4 Piping Plans and Sections

The piping plans show specific routing and elevations for the pipe and accessories within a certain grid area. Sections and details to assist with the fabrication and installation are included as part of the drawings.

4.8.5 Data Sheets

Data sheets contain specification information for the procurement of mechanical equipment, relief valves, and piping specialty items.

5.0 CIVIL / STRUCTURAL DESIGN

5.1 CODES, STANDARDS AND SPECIFICATIONS

The civil and structural design of each pump station shall comply with the latest edition of all applicable local, state and federal regulations, codes and specifications listed herein.

- 5.1.1 IBC, International Building Code.
- 5.1.2 OSHA, Occupational Safety and Health Association.
- 5.1.3 ASCE 7-10, "Minimum Design Loads for Buildings and Other Structures".
- 5.1.4 ACI318-11, "Building Code Requirements for Structural Concrete".
- 5.1.5 AISC, "Manual of Steel Construction", 14th Edition, ASD.
- 5.1.6 MBMA, Metal Building Manufacturer's Association
- 5.1.7 ASTM, American Society for Testing and Materials
- 5.1.8 AWS, American Welding Society

- 5.1.9 NAAMM, National Association of Architectural Metal Manufacturers
- 5.2 MATERIALS
- 5.2.1 Concrete compressive strength for precast concrete to be determined by precast designer.
- 5.2.2 Cast-in-place concrete shall have a minimum 28 day compressive strength of 4000 psi.
- 5.2.3 Reinforcing to be ASTM A-615, Grade 60
- 5.2.4 Welded Wire Fabric to be ASTM A-185, Grade 60.
- 5.2.5 Structural steel and plate to be ASTM A-36, Shop or Field Painted per the Project Paint Specifications. Structural tubing shall be ASTM A-53, Grade B.
- 5.2.6 Primary bolted connections ASTM-325, Type N
- 5.2.7 Secondary bolted connections (stair treads, ladders, handrails and handrail posts) ASTM A-307
- 5.2.8 Anchor bolts shall be ASTM A-36 or A 307
- 5.2.9 Grating for access platforms shall be welded steel bar grating conforming to ASTM A-569 and NAAMM. Exterior grating shall be serrated. All grating shall be 1 – 1 / 4" x 3/16" bearing bars with cross bars at least 4" ctr. To ctr. (NAAMM designation W-19-4). Grating shall be primed and painted in accordance with the Project specification.
- 5.2.10 Galvanizing (where specified) to be in accordance with the following:
- 5.2.10.1 Structural Steel ASTM A-123
- 5.2.10.2 Bolts, Nuts and Washers ASTM A-153, Class C
- 5.3 LIVE LOADS
- 5.3.1 Minimum Uniform Loads
- 5.3.1.1 Office Areas 50 psf
- 5.3.1.2 Operating Areas 75 psf
- 5.3.1.3 Platforms / Stairs / Walkways 100 psf
- 5.3.1.4 Roof Areas 20 psf
- 5.3.1.5 Control Room Floors 100 psf; 200psf@equip.
- 5.3.2 Minimum Concentrated Loads
- 5.3.2.1 Office areas shall be designed also for a concentrated force of 2000 lbs.
- 5.3.2.2 Stairs shall be designed for a concentrated force of 300 lbs over an area of 4 square inches.
- 5.3.2.3 Ladder Rungs 500 lbs (applied at center)
- 5.3.2.4 Laydown Area Crane Rating plus 25% Impact
(applies over an area 2.5' x 2.5')
- 5.4 SNOW LOADS
- 5.4.1 Applied per IBC and local codes
- 5.4.1.1 Building Roof Snow Load (PR) = See Environmental Criteria Sheet for data related to the individual sites
- 5.5 WIND LOADS

- 5.5.1 Wind loads on enclosures and other structures to be designed in accordance with the ASCE 7-10
- 5.5.2 See Environmental Criteria Sheet for data related to the individual sites for Basic Wind Velocity and Exposure.
- 5.5.3 Importance Factor = See Environmental Criteria Sheet for data related to the individual sites.
- 5.6 SEISMIC LOADS
 - 5.6.1 Seismic loads on enclosures and other structures to be designed in accordance with the ASCE 7-10.
 - 5.6.2 See Environmental Criteria Sheet for data related to the individual sites for Seismic Zone.
 - 5.6.3 See Environmental Criteria Sheet for data related to the individual sites for Importance Factor.
- 5.7 COLLATERAL LOADS
 - 5.7.1 PDC Enclosure
 - 5.7.1.1 Roof 0 psf
- 5.8 CRANE AND HOIST LOADS

Crane loading shall be considered as the crane in an operating mode with maximum wheel loads, vertical and horizontal impact loading occurring simultaneously.

 - 5.8.1 Impact loads, hand powered cranes and hoists
 - 5.8.1.1 Vertical 15%
 - 5.8.1.2 Lateral 10%
 - 5.8.1.3 Longitudinal 5%
 - 5.8.2 Impact Loads, Power Operated Cranes and Hoists
 - 5.8.2.1 Vertical (cab) 25%
 - 5.8.2.2 Vertical (pendent) 10%
 - 5.8.2.3 Lateral 20%
 - 5.8.2.4 Longitudinal 10%
- 5.9 THERMAL LOADS
 - 5.9.1 Design of structures shall take into consideration temperature differentials between fabrication, erection and operating conditions.
 - 5.9.2 Thermal pipe loads shall be defined by pipe stress analysis. If pipe stress analysis is not available, use 30% of operating vertical pipe load as a longitudinal expansion / contraction force for the design of individual support beams. Cumulative longitudinal pipe rack loads for strut and bracing design shall be 10% of total vertical pipe load on the rack.
- 5.10 LOAD COMBINATIONS
 - 5.10.1 Design Load Combinations shall be in accordance with ASCE 7-10 and ACI for concrete foundations.
 - 5.10.2 For Design of Structural Steel follow the provisions of ASCE 7-10 and AISC 360-10 codes"
- 5.11 FOUNDATIONS

- 5.11.1 Foundations shall be designed in accordance with available site geotechnical reports.
- 5.11.2 Minimum depth of foundations below grade shall be below estimated frost depth, as recommended by geotechnical report.
- 5.11.3 Dynamic analysis will be performed for all pump foundations, if appropriate dynamic loading data can be obtained from the Vendor.
- 5.12 SITE SURVEY AND GEOTECHNICAL INVESTIGATION
 - 5.12.1 Sunoco will provide a site survey that will extend to the property lines bounding each station on all sides. The survey shall contain sufficient detail to allow the plotting of ground contours at 1' intervals. Two permanent benchmarks shall be established for use during the construction.
 - 5.12.2 A geotechnical investigation shall be provided by Sunoco to establish foundation design criteria, site grading and compaction requirements.
- 5.13 SITE PLANNING
 - 5.13.1 General

The site layout shall allow access for maintenance and manpower at all facilities, including appropriate equipment and vehicles.
 - 5.13.2 Access Roads, and Fencing
 - 5.13.2.1 At the pump stations, no roads inside the station shall be provided to access the station equipment.
 - 5.13.2.2 Station access roads from main community roads for pump stations shall be provided. Horizontal and vertical alignments shall be designed such that vertical slopes are limited to no more than 6% and horizontal curves will provide easy access for large vehicles. Horizontal turning radii are not to be less than 40' for the access road at the centerline. Corrugated steel or reinforced concrete pipe culverts may be provided to allow for proper drainage of ditches.
 - 5.13.3 Site Grading and Drainage
 - 5.13.3.1 For the pump station sites, site drainage (minimum of 1%) and above grade, high pressure NGL piping requirements shall dictate the pad grading. Generally, the grading shall conform to the existing topography, depending on the relative relief. The grading design shall attempt to balance the cut and fill on-site.
 - 5.13.3.2 Storm water shall be surface runoff carried in open swales, buried piping and ditches into the natural drainage pattern or retention/infiltration ponds. Culverts shall be provided to carry flow under roads and walks.
 - 5.13.3.3 Minimum swales and ditch slopes shall be 1%
 - 5.13.3.4 Run-off shall be based on 25 year recurrence, run-off quantities will be calculated using the rational formula as follows:

$$Q = CIA$$

Where: Q = Peak discharge, ft³ /s

C = Run-off coefficient (Table)

I = Rainfall intensity, in / hr

A = Drainage Area, Acres

- 5.13.4 Site grading shall include the removal of all organic materials. With the exception of the access road, the site shall be either gravel covered or landscaped. Areas not covered by gravel shall be hydro seeded. In the area where existing slopes may erode, matting shall be provided.
- 5.13.5 All finished floor elevation shall be set 6" (minimum) above finished grade. A minimum slope of 3% for 10' from all enclosures shall be provided.
- 5.14 PDC ENCLOSURE
- 5.14.1 The PDC enclosure will be a prefabricated enclosure shipped to the site and attached to a foundation. The foundation shall be elevated sufficiently to allow cable tray access underneath the PDC enclosure. Stairs and landing platforms shall be provided with the enclosure for access to personnel doors.
- 5.14.2 The enclosure will contain an electrical room for all new electrical equipment (e.g. VFD, MCC, switchgear) and a separate small control room.
- 5.14.3 The enclosure will be fully insulated, with the roof slightly sloped to drain, and fitted with gutters and downspouts. Exterior doors will be insulated metal doors.
- 5.15 MISCELLANEOUS FOUNDATIONS
- Concrete foundations shall be used for all yard equipment, above ground high pressure NGL piping, valves, etc. All concrete pipe supports shall have removable shim type supports under the pipe to allow for inspection of the full circumference of the pipe at the supports. Structural steel stairs, platforms and frames shall be employed when ground level access to the equipment is insufficient.
- 5.16 MISCELLANEOUS STEEL
- Steel support frames shall be provided for electrical cable trays, conduit, piping and other miscellaneous equipment as required. Miscellaneous steel shall include grating, floor plate, steel walkways and stairs. All supports and equipment shall be painted to Sunoco standard specifications.
- 5.17 VENDOR DRAWING REVIEW
- 5.17.1 Conformance to Purchase Specifications
- All drawings and data submitted covering civil / structural items must be reviewed to ensure conformance to Purchase Specifications. Specifically, the following items must be checked by comparison to the Equipment Data Sheets and to Vendors Drawings and Data Requirements
- 5.17.1.1 Tag number, materials of construction, loads (live, snow, wind, seismic, collateral, crane and hoist, thermal), overall dimensions, and accessory items.
- 5.17.1.2 Sufficient information must be presented to permit a complete installation of the items covered.
- 5.18 DRAWINGS AND DOCUMENTS
- 5.18.1 Site Civil Plan / Drawing Index
- The site civil plan shows the overall layout of the site including property coordinates, grid, enclosure, major equipment, pipeline, topographical information, fences, gates and roads. Notes deal with vegetation, earthwork construction, grades, and slopes.
- 5.18.2 Civil Miscellaneous Details
- The civil miscellaneous detail drawings contain information regarding roadway cross sections, detailed road and fence plan, yard surfacing, spill containment, and topography.

5.18.3 Concrete Drawings

The concrete drawings contain general notes and details, reference specifications pertaining to material and installation, define compressive strength requirements, and anchor bolt information. There is also information regarding design loads, joint details, door apron and stoop details, footing reinforcement, embedded trench angle details, light pole foundations pipe support detail, and thrust block schedule and detail.

5.18.4 Foundation Location Plans

The foundation location plans include a dimensioned plan layout or coordinates of all the foundations. References are made to find the section and detail drawings for the individual foundations.

5.18.5 Enclosure Foundations

Plans and sections depicting the layout and design of piers (as necessary) and concrete foundation systems. The plans include a dimensioned plan layout of all the foundations associated with enclosures. References are made to other drawings which show foundation sections and details floor slab thickness and top-of-floor elevations are given.

5.18.6 Enclosure Sections and Details

The enclosure sections and detail drawings show top-of-concrete elevations, foundation sections, all foundation dimensional information, rebar detail and grouting information.

5.18.7 Miscellaneous Pipe Supports

The miscellaneous pipe support drawings indicate sections and details for all of the pipe supports, embedded plate details, schedule of footing details, reinforcement, dimensions and anchor bolt details, and foundation elevations, Pipe support tag numbers, their respective coordinates and reference drawings are indicated.

5.18.8 Structural Steel General Notes and Details

The general notes and details cover codes and standards to be used for the supply of structural steel material including steel members, bolting, gusset plates, grating, checkered plate, handrails, posts, ladders, and stairs. Design loads are indicated as well as typical stair elevations, grating tread, dogleg stringers, various types of bolted connections, concrete connections, welded connections, handrail elevations, safety gates and hinges, kickplate details, and caged and cageless ladder details.

5.18.9 Data Sheets

Data sheets contain specification information for the procurement of equipment and enclosures.

6.0 INSTRUMENTATION AND CONTROLS DESIGN

6.1 GENERAL

6.1.1 Instrumentation shall be designed to the following codes or models:

P & ID's	ISA S5.1
Data Sheets	Sunoco / ENGINEER Standard Instrumentation Data Sheets

6.1.2 The following general design concepts shall be used for all primary instrumentation:

- 6.1.2.1 Yard instruments shall be designed for full ambient range (normally no heated enclosures will be used):
- | | |
|-------------|--------------|
| Temperature | 0°F to 100°F |
| RH | 10 to 95 % |
- 6.1.2.2 Enclosure instruments shall be designed for 32°F to maximum ambient range:
- | | |
|-------------|-------------|
| Temperature | 32 to 100°F |
| RH | 10 to 95 % |
- 6.1.2.3 Yard and enclosure instruments shall be specific to meet the area classification of that particular area.
- 6.1.2.4 Spares Design shall normally be as follows:
- | | |
|-------------|---------------|
| I / O | 30% |
| Panel Space | 20% |
| Terminals | 30% |
| Bulk items | 1 unit or 20% |
- 6.1.2.5 Process design operating value shall be between 30% and 70% of gauge manufacturer standard range.
- 6.1.2.6 Primary process gauges shall be 4 ½ or 5" in diameter. Secondary gauges shall be 2" or 3". All gauges to be liquid filled.
- 6.1.2.7 Instrumentation accuracies shall be specified as follows:
- | | |
|---------------------|--|
| Gauges | 1% Full Scale |
| Remote Transmitters | Per Sunoco/ENGINEER data sheet typical |
- 6.1.2.8 Switch contacts shall be selected and rated to meet the required application.
- 6.1.2.9 Enclosure ratings for field instruments shall be NEMA 4 and / or 7
- 6.1.2.10 Process materials shall be specified as follows, unless manufacturer standard is superior:
- | | |
|--------------------------|------------------|
| Instrument Body | WCB Carbon Steel |
| Sensor | 316 SS |
| Moving Parts | 316 SS |
| Parts Subject to Erosion | 416 SS |
| Soft Parts | Teflon |
- 6.1.2.11 A 24VDC volt Lamarche system shall be used for control and instrument power.
- 6.1.2.12 Instruments requiring calibration shall be located at ground level or provided with reasonable access such as catwalks, ladders and platforms, etc.
- 6.1.2.13 Panel relay logic shall be designed as "fail-safe". Alarm switch contact opens on alarm and relays de-energize to alarm or shutdown.

- 6.1.2.14 Trouble alarm and shutdown signal dry contacts from major packaged equipment shall be run to the Station PLC to generate station alarms, with local read-out of specific alarm at the equipment.

6.2 FLOW MEASUREMENT

- 6.2.1 Flow meters shall be designed and selected as follows:

- 6.2.1.1 The NGL flow meters shall be Coriolis meters designed to meet API measurement standards for custody transfer.

6.3 TEMPERATURE INSTRUMENTS

- 6.3.1 The following design concepts shall be used for temperature instruments:

- 6.3.1.1 Normal thermowell design shall be $\frac{3}{4}$ " x $\frac{1}{2}$ " tapered 316SS. Only one piece thermowells manufactured from solid bar stock are acceptable.

- 6.3.1.2 Platinum – 100 ohm RTD.

6.4 STATION PLC AND CONTROL PANEL

- 6.4.1 The design shall be based on Sunoco requirements and the following:

- 6.4.1.1 Preferred mounting methods shall be commercially available racks and panels

- 6.4.1.2 NEMA 1 Panels

- 6.4.1.3 Miscellaneous items which include:

- Maintain minimum 3" from wire way to terminals
- Diodes installed across all 24 VDC relay coils as near as possible to the coil.
- The enclosure back panel and one side panel will be used to install equipment. The other side panel will be reserved for future use.

- 6.4.1.4 Wiring will enter from the bottom or top of the enclosure.

- 6.4.1.5 30% spare I/O points will be made available.

6.5 TELEMETRY / SCADA INTERFACE

- 6.5.1 All data and station alarms will be sent from the station control system to Sunoco's SCADA system via Modbus-TCP industrial Ethernet protocol.

- 6.5.2 The design of the SCADA system and its auxiliary equipment will be by Sunoco.

6.6 VARIABLE FREQUENCY DRIVE (VFD) INTERFACE

- 6.6.1 Start / stop signals and speed controls from the PLC control equipment to the VFD shall be via PLC I/O circuits.

- 6.6.2 Motor control circuits at the VFD shall include an HOA switch on the cubicle door.

6.7 VENDOR DRAWING REVIEW

- 6.7.1 Conformance to Purchase Specifications

All drawings and data submitted covering instrument items must be reviewed to ensure conformance to Purchase Specifications. Specifically, the following items must be check by comparison to the Instrument Data Sheets and to Vendors Drawings and Data Requirements:

- 6.7.1.1 Model number, tag number, piping connection-size and rating, materials of construction, electrical ratings, enclosures and connections, specified settings, ranges, overall dimensions, and accessory items.
- 6.7.1.2 Sufficient information must be presented to permit a complete mounting and hook-up design for the proper application of items covered.
- 6.7.1.3 Sufficient information must be supplied to permit routine trouble-shooting and maintenance.
- 6.7.1.4 Insure proper orientation is being provided for those items that have an optional orientation, such as, three way valves and double acting piston actuators.

6.8 DRAWINGS AND DOCUMENTS

6.8.1 Instrument List

The instrument list contains the instrument and control devices that are shipped loose to the site or to the panel fabrication shop for installation and instrumentation wired by the contractor or panel fabricator. The list is intended primarily as a construction tool to readily identify loose items for installation. It usually contains the tag number, service description, P&ID number, manufacturer name and model number, organization furnishing the item, and data sheet number.

6.8.2 I / O List

The I/O list is derived from the instrument database and contains the instrument and control devices that are wired to the Plant Control Systems (PCS). The list is intended as tool to define the I/O requirements for the PCS. It usually contains the tag number, service description, P&ID number, I/O type, associated controller and hardware address. The specific requirements vary between projects and will be defined in the design guides for the project.

6.8.3 P&ID Input / Review

This task assigns instrument tag numbers to bubbles on the P&ID, shows the conceptual control philosophy for each control loop and any interaction between control loops.

6.8.4 Loop Drawings

Instrument loop drawing are configured with multiple loops per page. The drawing shows the point-to-point interconnections with identifying numbers or colors of electrical cables and conductors. This identification of interconnections includes junction boxes, terminals, bulkheads, ports, and grounding auxiliary equipment, rack, termination cabinet, cable spreading room I / O cabinet, etc. is also shown.

6.8.5 Panel Layout / Arrangement Drawing

Panel drawings depict the physical location and relationship between controllers, indicators, hand switches and other control devices. The panel layout is dimensional drawing or a proportional drawing depending on the specific project requirements. The drawing shall also include nameplate and tagging information, any special access requirements, locations of cable entry, and graphic displays if required. Since the control room ultimately becomes the focal point of the project, the control panels and / or operator interface become the most visible aspect of control systems work. For this reason a multitude of factors must be considered in the design of control rooms and any associated panels. The design must address space relationships, human factors, physical installation requirements, lighting and compatibility with operating criteria.

6.8.6 Data Sheet

Data sheets contain specification information for the procurement of instruments and controls.

7.0 ELECTRICAL DESIGN

7.1 CODES, STANDARDS AND SPECIFICATIONS

7.1.1 In addition to Sunoco Design Standards, the latest edition of following codes and standards shall be adhered to for the electrical design.

ANSI	American National Standards Institute
FM	Factory Mutual
IEEE	Institute of Electrical and Electronic Engineers
	As required
NACE	National Association of Corrosion Engineers
	Standard RP-0169-92
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
	ANSI C2
NFPA	National Fire Protection Association
	National Electrical Code
UL	Underwriters Laboratories
API	American Petroleum Institute

7.2 DISTRIBUTION SYSTEM

7.2.1 The station electrical system shall be supplied by utility company. In many cases, due to lead-time issues, the substation will need to be provided by Sunoco. The main power shall feed the station electrical network through the station Power Distribution Center (PDC).

7.2.2 The following voltage levels shall be utilized within the station:

7.2.2.1 Distribution:

480 VAC, 3-phase, 60 Hz, grounded neutral
208 VAC, 3-phase, 60 Hz, grounded neutral
240/120 VAC, 1-phase, 60Hz, grounded neutral

7.2.2.2 Control:

120 VAC, 1-phase, 60 Hz, grounded (for VFD and PLC control)
24 VDC, grounded (for process control and instrumentation equipment)

7.2.3 Main Power

The main power source for the stations shall be 4160 volt, 3-phase, 4-wire, wye- HI resistance grounded neutral (less than 5 amps leakage current), supplied from purchased power. The main power transformer or substation will be owned by Sunoco. The Contractor will be responsible for the transformer pad, setting the transformer, connecting the primary and secondary sides of the transformer. The Contractor will be responsible for the primary and secondary duct banks and conductors. The Contractor will be responsible for connecting the Hi Resistance Ground. The Utility will make-up the final connection to the Utility Power.

7.3 AREA CLASSIFICATION

7.3.1 The hazardous area classification drawings shall be developed by using the following references:

7.3.1.1 National Electrical Code (NFPA 70)

7.3.1.2 Classification of Locations for Electrical Installations at Petroleum Facilities (API RP 500)

7.4 WIRING METHODS

7.4.1 In general, all electrical installations shall be with conduit and cables. Metal clad cable or armored cable will not be used, with the exception of some power cables. Minimum conduit size shall be $\frac{3}{4}$ " above grade and 1" below grade.

7.4.2 Within the PDC Enclosure, EMT conduit is permitted. All other enclosures shall be rigid galvanized steel. All conduit within the yard shall be rigid galvanized steel, and if below grade, shall be PVC coated. Duct banks constructed of PVC conduits encased in red concrete shall be used for underground conduit runs of more than four conduits.

7.4.3 To meet NEC requirements, a circuit grounding conductor shall be run with AC power feeds, rather than relying on the metallic raceway bonding.

7.4.4 Approximately 20% spare underground conduit runs and stub-outs shall be installed to allow for unidentified future station expansion.

7.5 CONDUCTORS

7.5.1 All conductors shall be stranded copper per ANSI C33-80; sizing shall be in accordance with NFPA-70. Conductor sizes for DC circuits shall be based on a maximum voltage drop of two volts. The following minimum conductor sizes shall be used:

7.5.1.1 Power No. 12 AWG

7.5.1.2 Discrete Signal No. 14 AWG

7.5.1.3 Discrete Control No. 14 AWG

7.5.1.4 Analog Signal No. 18 AWG Single Pair;

7.5.1.5 Triads No. 18 AWG

7.5.1.6 120V Control No. 14 AWG

7.5.2 All signal and control wiring shall be routed in separate conduits from power wiring. Separate raceways must be provided for AC and DC circuits. Separations must be maintained through man-holes.

7.5.3 Cable properties shall be as follows:

7.5.3.1 Incoming service conductors (transformer secondary):

Cross-linked polyethylene insulation (EP), UL listed, type MV-105 (wet or dry), 8 KV minimum.

7.5.3.2 AC Power feed to motor from VFD:

Cross-linked polyethylene insulation (EP), UL listed, type MV-105 (wet or dry), 8 KV minimum.

7.5.3.3 AC Power and AC Control

Cross-linked polyethylene insulation (XLP), UL listed, type XHHW, 75/90°C (wet / dry), 600V minimum.

7.5.3.4 DC Power and DC control single conductors

Cross-linked polyethylene insulation (XLP), UL listed, type XHHW, 75/90°C (wet / dry), 300V minimum.

7.5.3.5 Multi-conductor control cables

Polyethylene insulation, UL listed with overall PVC jacket, 300V minimum.

7.5.3.6 Individual or multi-pair / triad instrumentation cables (analog, RTD, thermocouple)

Polyethylene insulation, UL listed with overall PVC jacket, 300V minimum.

7.6 GROUNDING AND LIGHTNING PROTECTION

7.6.1 General

7.6.1.1 A grounding network system shall be installed which will provide protection against faults in electrical equipment, lightning and static electricity.

7.6.1.2 All equipment on the site with the potential to become energized electrically as a result of the above conditions shall be grounded. Generally this includes:

- Metal enclosures and structures
- Electrical equipment enclosures and conduits
- Motor control center
- Motors frames
- Pump frame
- Mechanical equipment frames
- Vessels, stacks, and tanks
- Piping and process skids
- Outdoor Lighting poles

Note – NEC dictates that valve actuator shall be grounded, but Sunoco direction is to not ground motor operated valves, as it interferes with the cathodic protection system.

NFPA 780, "Standard for the Installation of Lightning Protection Systems" will be followed for lightning protection considerations of the LPG storage spheres.

7.6.1.3 A ground network shall be installed consisting of a sufficient number of ground beds interconnected with insulated cable, to give 5 ohms or less resistance to ground.

7.6.2 Area Grounding

7.6.2.1 Rods shall be $\frac{3}{4}$ " diameter x 10' maximum length, galvanized steel, interconnecting cables shall be soft-drawn stranded insulated copper, No. 2/0 AWG minimum. Connecting ground wire for all equipment shall be sized in accordance with NFPA 70, but shall be minimum No. 4 AWG for mechanical integrity.

- 7.6.2.2 All buried cable to cable connections shall have mechanical ground connectors Burndy type GX or equal. Above ground connections to equipment shall be bolted, Burndy Servit Post or Burndy Hylug. Rods shall be connected with exothermic method, Cadweld or signal connections to below ground.
- 7.6.2.3 All ground beds shall be tied together to complete a single station grounding grid.
- 7.6.3 Service Grounding
 - 7.6.3.1 Transformer neutrals shall be solidly connected to the ground grid at the transformer set respectively.
 - 7.6.3.2 The Power Distribution Center (PDC) shall have the ground bus solidly connected to the ground grid. The neutral lug point shall be connected to ground at the service only. Connection of the main power company transformer neutral to the station ground grid shall be defined according to the local utility and the cathodic protection requirements. The PDC ground tap shall be the same size as the service ground tap.
- 7.6.4 Lightning Protection

All enclosure frames and steel structures shall be connected to the ground grid in two or more places. The first incoming power panel at each site will have TVSS protection modules included in their design. The only lightning protection air terminals required are where weather stations are installed.
- 7.6.5 Others
 - 7.6.5.1 Flammable liquids tanks shall be designed with provisions for transport vehicle bonding to ground during loading operations.
 - 7.6.5.2 The station perimeter fence shall be grounded at 100' intervals and gate entrances, depending on a resistivity test taken after the fence is installed. Overhead power lines that cross fencing shall require the fence to be grounded on both sides of the crossing.
 - 7.6.5.3 All control panels shall have a shield ground bus insulated from the cabinet connected via insulated No. 6 cable to a dedicated signal triad, 3-rod ground bed. The shield ground bed shall be connected to the station ground network.
- 7.7 YARD LIGHTING
 - 7.7.1 Yard lights shall be 480 volt LED light fixtures mounted on 30' poles. The poles shall be hinged to permit the fixtures to be lowered for maintenance. The yard lighting and enclosure exterior lights shall be turned on and off manually by contactors located at the MCC in the PDC enclosure.
 - 7.7.2 The following levels of illumination shall be provided at ground level in the yard area:
 - 7.7.2.1 Walkways and parking areas: 2 fc
 - 7.7.2.2 Equipment working areas: 5 fc
 - 7.7.2.3 Truck loading areas: 5 fc
 - 7.7.2.4 Tank area: 2 fc
- 7.8 PDC ENCLOSURE LIGHTING
 - 7.8.1 The interior of the finished enclosure areas shall be illuminated with 120 volt LED fixtures.

- 7.8.2 The following levels of illumination shall be provided at a height of three feet in this enclosure:
- 7.8.2.1 Office / Control Room areas 70 fc
- 7.8.3 The enclosure interior lighting shall be switch controlled in each room of the office area. Fixtures in each of the workshop and equipment rooms shall be switch controlled.
- 7.8.4 Emergency lighting units will be installed at exit doors and other locations to allow egress from the enclosure during power failure.
- 7.9 PDC ENCLOSURE CENTER (PDC)
- 7.9.1 The PDC shall house all VFD's, yard lighting, contractor, feeder breakers and miscellaneous control units required by the facility.
- 7.9.2 All control circuits within the PDC shall be 120 VAC, supplied by a control transformer or UPS located inside the PDC. To interface all equipment to the PLC control units, interposing relays with 24 VDC coil shall be furnished in the PLC for starters and VFD units.
- 7.9.3 Starters, contactors, breaker sizes and relay settings shall be coordinated to withstand present and foreseeable short circuit levels while protecting downstream equipment and giving reasonable selectivity should a fault occur. Circuit breakers for motor control units shall be magnetic only, motor circuit protectors. The main breaker shall be fixed as opposed to draw-out.
- 7.9.4 PDC shall be designed for bottom entry wiring.
- 7.10 DISTRIBUTION PANELS
- Distribution panels shall be 480 volts AC 3-phase, 3-wire or 208 / 120 volts AC 3-phase, 4-wire. When possible, distribution panels shall be located in a non-hazardous area.
- 7.11 MOTORS
- 7.11.1 All motors ½ HP and larger shall be 3-phase, 460 VAC. Motors smaller than ½ HP shall be single phase 115 VAC, with automatic internal overload protection.
- 7.11.2 All motor insulation shall be NEMA Class B temperature rise, NEMA Class F insulated where practical. All motors shall have 1.15 service factor minimum.
- 7.11.3 Motors for Class I, Division 2 areas permit the use of weather proof (WP/II) approved for the area classification.
- 7.11.4 Motors for outdoor non-hazardous locations shall be weather proof (WP/II).
- 7.11.5 All motors controlled by a VFD shall be inverter duty motors.
- 7.11.6 Motors for indoor non-hazardous locations shall generally be open drip (ODP).
- 7.12 UPS POWER SYSTEM
- 7.12.1 The UPS power system shall include battery charger, battery(s) and AC distribution panel. The system shall be located in the PDC enclosure.
- 7.12.2 The UPS system shall provide 120 VAC to the station and process control panels, interposing relays, and ESD system.
- 7.12.3 The batteries shall be sized to provide 72 hour standby. The 120 VAC UPS system shall be grounded.
- 7.13 CORROSION PREVENTION / CATHODIC PROTECTION
- 7.13.1 Cathodic protection design will be completed by Sunoco.

- 7.13.2 Insulation kits will be installed at the first flange set at the station inlet and discharge to separate the station piping from the pipeline piping.
- 7.14 HEAT TRACING
 - 7.14.1 Heat tracing will be utilized as-required for Gas Chromatograph tubing to keep the process at an appropriate temperature.
- 7.15 UNDERGROUND MAN-HOLES AND TRENCHES
 - 7.15.1 Use of man-holes will be minimized.
 - 7.15.2 Trenches shall be abbreviated. Conduit will be routed under enclosure walls and stub-up vertically in trenches below panels and MCC. Trenches will be designed to include room for two additional MCC sections or panels.
- 7.16 DRAWINGS AND DOCUMENTS

Drawings and documents produced as part of the electrical and instrument design are described:

- 7.16.1 Electrical One-Line Diagrams

One-lines described the connections of the major electrical equipment in the plant such as incoming lines, main buses, power transformers, circuit breakers, fuses, disconnects, current and voltage transformers, meters, relays. The master one-line diagram shows the overall layout and interconnection of the plant buses, power transformers, and load centers. The one-line diagram shows the 600 V power centers and associated electrical loads.

- 7.16.2 4160 and 480 Voltage Schematics

Schematics show the control of each 4160 volt VFD and 480 volt valve motor starter with its associated 120 volt control. These diagrams include equipment device symbols, terminal numbers, wire numbers, device location tables and control switch contact developments. They interface with the PLC input/outputs and control schematics for equipment vendor supplied control systems.

- 7.16.3 Wiring and Connection Diagrams

The wiring and connection diagrams show wiring and connections to equipment. On this project this includes, but is not limited to, junction boxes, electrical control panels, equipment termination boxes, plant control system I/O terminals, control panel, and termination boxes. AC power panel schedules are included in this series of drawings.

These drawings show all the wiring connections, terminal block numbers, wire, and cable numbers.

- 7.16.4 Circuit Schedule / Conduit Schedule

The circuit schedule is a list of all wiring that the Contractor installs. This list is a cable list, not a wire list, and includes the cable number, cable type (a code which designates rated voltage and insulation type), number of conductors, conductor size, , from and to systems equipment references including routing in underground and cable trays. The conduit schedule is a list of all major designed conduit that the contractor installs. This list includes conduit number, conduit type and conduit size. This list is incorporated into the circuit schedule data base.

- 7.16.5 Physical Plan Drawings

The complexity of the overall physical electrical installation design shall be divided into three portions. An overall site plan will be used to show overall area classification, lighting and underground raceway routings. Minor area drawings will depict grounding / lightning protection, underground conduit, lighting, power and control plans together.

If areas are too crowded to show the intended purpose, for clarity, individual details may be generated to break out required design.

7.16.6 Power and Control Plans and Sections

These plans show a diagrammatic representation of the above ground conduits, cables, motors, panels, and instruments and controls, and routing of all circuits. Above ground to underground connections are referenced.

7.16.7 Lighting Plans

These plans show the location and physical installation of lights, lighting panels and transformers within the plant. The drawings show fixture designations, mounting heights, and circuiting information. Lighting Panel Schedules are included in this series.

7.16.8 Grounding Plans / Lightning Protection / Underground Conduit

These plans show the location and physical installation of grounding and lightning protection within the plant. The ground grid is part of the underground utility plan and is referenced as necessary to the grounding plans.

7.16.9 Area Classification

This plan shows the locations of hazardous areas and the type of class and division of the hazardous areas.

7.17 DATA SHEETS AND MATERIAL PROCUREMENT

7.17.1 Specifications will be provided by ENGINEER for large electrical purchases including Motor Control Centers, NEMA Frame Motors, Charger and Battery Systems, Variable speed drives for NEMA Frame Motors and Electrical Mechanical Equipment packages.

7.17.2 Data sheets will be prepared by ENGINEER on Sunoco format or ENGINEER format for the purchase of major electrical equipment including:

7.17.2.1 Power Distribution Center containing the Main disconnect, Variable Frequency Drive, Power & Lighting Panels, Power & Lighting Transformer, UPS Unit, PLC Panel,

7.17.3 Each additional component for the electrical installation is the responsibility of the Contractor including, but not limited to conduit, cable, all hardware and designed pull / termination cabinets which are fully detailed on the plan drawings and schedules.

Exhibit SPLP MG-7

SPLP
MG-7

**EXHIBIT A
STATEMENT OF WORK**

[Complete if applicable and known at execution or attach other acceptable SOW including appropriate provisions from the Prime Contract.]

CONTRACTOR: PULS	STATE: PA	COUNTY:	DATE / SOW VERSION: 9/24/15
<p>PROJECT/OWNER: Mariner East Phase II/Sunoco Logistics PRIME CONTRACT DATE: June 1, 2012 (we believe this to be the prime contract date between Sunoco and REI)</p>			
<p>CONTRACTOR SHALL PERFORM THE FOLLOWING OBLIGATIONS AND DUTIES SET FORTH HEREIN, WITH SUCH OBLIGATIONS AND DUTIES TO BE GOVERNED BY THE TERMS SET FORTH IN THIS SERVICES AGREEMENT:</p> <p>Description of work to be done (including schedule, if applicable):</p> <p>Contractor shall: Provide electromagnetic and ground penetrating radar locating and optional air vacuum excavation with survey and computer drafting services for the referenced project. This includes the scope and effort needed to detect, mark, sketch, survey and computer draft active and abandoned underground utilities and specific types of structures within the project area. All underground utilities, as well as utility structures and underground storage tanks, will be investigated and marked when possible within the project limits. The marking of gravity sanitary and storm sewers is included.</p> <ul style="list-style-type: none">▪ PULS, Inc. will attempt to locate and mark any underground utilities in the area of the horizontal directional drill entry and horizontal directional drill exit locations for thirty-one (31) sites.▪ The area to be scanned at each site is approximately as follows:<ul style="list-style-type: none">— Entry HDD – 125' x 30'— Exit HDD – 75' x 30'▪ PULS, Inc. will perform vacuum excavation services upon request when needed in areas of HDD to be exposed for depth. PULS, Inc. staff will also perform test holes at the locations shown on the provided plans. Utility field sketches will be provided upon completion of the mark out. SEE ATTACHED SUBCONTRACTOR PROPOSAL DATED SEPTEMBER 25, 2015, FOR MORE DETAILS.			
<p>COMPENSATION: \$28,800</p> <p>PURSUANT TO THIS SERVICES AGREEMENT, UPON SATISFACTION OF CONTRACTOR'S OBLIGATIONS AND DUTIES SET FORTH ABOVE, CONTRACTOR SHALL BE COMPENSATED IN THE FOLLOWING MANNER:</p> <p>() LUMP SUM OF (X) CONTRACT PRICE SCHEDULE September 24, 2015 to December 31, 2015 () LABOR RATE AND EQUIPMENT RENTAL SCHEDULES () OTHER: <u>See attached subcontractor estimate for more details</u></p>			
<p>CONTRACTOR'S DATE OF COMPLETION: _____</p>			
<p>ACCEPTED: PULS</p> <p>BY: <u>Melissa Braxmeier</u> NAME: <u>Melissa Braxmeier</u> DATE: <u>10/1/15</u></p>		<p>Rooney Engineering, Inc.</p> <p>BY: <u>Mandy Medcalf</u> NAME: <u>Mandy Medcalf</u> DATE: <u>10/1/2015</u></p>	

PULS

INTERNATIONAL UNDERGROUND SOLUTIONS

Electromagnetic/GPR Utility Locating and Air Vacuum Excavation with Survey and CAD

Proposal for



3242 Farmersville Rd., Suite 1, Bethlehem, PA 18020

Phone: 800-883-6855 • Fax: 610-868-6175 • Email: Info@PULSInc.com • www.PULSInc.com

PULS PROPOSAL/CONTRACT

Pricing Proposal: Quality Level “B” Electromagnetic and GPR Utility Locating and Quality Level “A” Vacuum Excavation with Survey and CAD

Job Site Name & location: Several Locations – GPS Coordinates provided in table below

PULS Contract Number: PA081815REI-REV. 092315

CLIENT INFORMATION:

Organization: Rooney Engineering, Inc.

Address: 115 Inverness Drive East, Suite 300, Englewood, CO 80112

Contact Name: Aaron Coady **Email:** aaron.coady@rooney-eng.com

Phone: 303-792-5911 **Fax:** 303-792-0227 **Mobile:** 303-332-1417

As requested, we hereby offer a proposal for electromagnetic and ground penetrating radar locating and optional air vacuum excavation with survey and computer drafting services for the referenced project. This proposal includes the scope and effort needed to detect, mark, sketch, survey and computer draft active and abandoned underground utilities and specific types of structures within the project area. All underground utilities, as well as utility structures and underground storage tanks, will be investigated and marked when possible within the project limits. The marking of gravity sanitary and storm sewers is included.

- PULS, Inc. will attempt to locate and mark any underground utilities in the area of the horizontal directional drill entry and horizontal directional drill exit locations for thirty-one (31) sites.
- The area to be scanned at each site is approximately as follows:
 - Entry HDD – 125’ x 30’
 - Exit HDD – 75’ x 30’
- PULS, Inc. will perform vacuum excavation services upon request when needed in areas of HDD to be exposed for depth. PULS, Inc. staff will also perform test holes at the locations shown on the provided plans.

Optional Services: PULS, Inc. will survey the utility mark out, surface features, test holes and structures relative to the project control. Utility line work, symbols, test holes and structures will be computer drafted to the appropriate cad standards for inclusion or reference to the design plans.

Project Areas and Time Frame

Utility Locating Time Schedule

Site No.		GPS Coordinates		Estimated Time
1	Entry	40.085776	-75.720383	
	Exit	40.091897	-75.730239	
2	Entry	40.082884	-75.717376	1 day
	Exit	40.0791	-75.70975	
3	Entry	40.074308	-75.700527	
	Exit	40.071043	-75.694655	
4	Entry	40.062893	-75.679762	1 day
	Exit	40.069579	-75.69202	
5	Entry	40.062893	-75.679762	
	Exit	40.058474	-75.67281	
6	Entry	40.0568	-75.666771	1 day

	Exit	40.050549	-75.657271	
7	Entry	40.049876	-75.655696	
	Exit	40.044397	-75.643833	
8	Entry	40.039063	-75.635901	1 day
	Exit	40.044192	-75.643528	
9	Entry	40.038928	-75.635914	
	Exit	40.036764	-75.629063	
10	Entry	40.036614	-75.628566	1 day
	Exit	40.027147	-75.616513	
11	Entry	40.018813	-75.609836	
	Exit	40.02381	-75.614181	
12	Entry	40.010857	-75.594829	1 day
	Exit	40.016935	-75.605728	
13	Entry	40.010759	-75.594718	
	Exit	40.005085	-75.581251	
14	Entry	40.004708	-75.580736	1 day
	Exit	39.998379	-75.570735	
15	Entry	39.997445	-75.564959	
	Exit	39.998437	-75.570705	
16	Entry	39.99701	-75.564586	1 day
	Exit	39.990416	-75.55565	
17	Entry	39.986981	-75.543531	
	Exit	39.989632	-75.553218	
18	Entry	39.986981	-75.543531	1 day
	Exit	39.981818	-75.539729	
19	Entry	39.979409	-75.537856	
	Exit	39.981705	-75.539644	
20	Entry	39.970795	-75.530198	1 day
	Exit	39.979188	-75.537655	
21	Entry	39.970618	-75.529858	
	Exit	39.966127	-75.522071	
22	Entry	39.965338	-75.520853	1 day
	Exit	39.950131	-75.510477	
23	Entry	39.946174	-75.505768	
	Exit	39.943933	-75.501719	
24	Entry	39.940674	-75.495145	1 day
	Exit	39.939745	-75.491691	
25	Entry	39.940029	-75.479484	
	Exit	39.932585	-75.473874	
26	Entry	39.913063	-75.457024	1 day

	Exit	39.922582	-75.465534	
27	Entry	39.90846	-75.45025	
	Exit	39.904958	-75.446245	
28	Entry	39.901232	-75.437581	1 day
	Exit	39.893592	-75.431051	
29	Entry	39.872788	-75.411924	
	Exit	39.86125	-75.402217	
30	Entry	39.855079	-75.398425	1 day
	Exit	39.859205	-75.401048	
31	Entry	39.849658	-75.401964	1 day
	Exit	39.846076	-75.411306	

Scope

PULS, Inc. will perform electromagnetic and ground penetrating radar locating, as well as test holes in compliance with Quality Levels "B" and "A" of CI/ASCE 38-02, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, hereinafter referred to as Standard 38-02. Any non-locatable utilities discovered through record information or otherwise will be shown on the drawings at Quality Level "C" or "D".

Utility Records Research

PULS, Inc. personnel will contact the client and facility, as well as public and private utility owning agencies, in order to request and acquire records of the existing underground facilities. Utility record information will be used as an aid in the identification of the number, identity, size and material of utilities located in the field. Records will not be used as a substitute for actual geophysical location unless the system cannot be verified electronically using industry standard techniques for this level of investigation.

Standard Procedures - Electromagnetic Utility Locating

Designators will utilize a suite of utility locating instruments having differing frequencies and power settings to detect and follow locatable utility systems within the project site. The instruments will have the full gamut of characteristics to enable passive signal detection, as well as active signal application by induction, direct connecting and inductive clamping. The utility designations will be targeted for survey by marking the detected centerlines on the ground surface with paint at reasonable distances. Flags may also be installed as needed. Paint and flags will be in accordance with the APWA uniform color code guidelines where allowed.

Standard Procedures – Ground Penetrating Radar

Designators will utilize ground penetrating radar equipment as deemed appropriate to scan for underground utilities or structures as discussed in the opening paragraph(s). Either a targeted scan or a general grid sweep will be employed. When specific utilities or structures are known about and found non-locatable with electromagnetic instrumentation, a targeted approach to locate those facilities will be used. When a general sweep of an area is needed to discover utilities or structures that are not known about, a grid sweep will be used. The latter approach typically entails a 2' to 10' grid in two perpendicular directions with occasional diagonal sweeps. The grid sweep, if required, will typically take longer and shall be directed of PULS during proposal preparation to allow for the time needed on site within the budget. Typically the outline of detected or imaged structures will be marked or flagged on the ground surface.

Field Drafting

Designators will draft field sheets that show the location, trend and configuration of utilities, as well as structures detected. Field sheets will also show underground utility surface features and will be prepared with color to differentiate the utility types. Utilities will be annotated with size and material where available. Project specific field notes will be shown as deemed appropriate. Field sheets will be provided to in-house surveyors to assist them with the locating and coding of the utility mark out.

Optional: Standard Procedures – Vacuum Excavation

Test holes will be performed by air vacuum excavation or other non-destructive techniques on existing utilities. One call notification will be made prior to test hole excavation as necessary.

The test holes will be staked at the site by in-house personnel utilizing a tape, scale and engineering drawings. Utility locating instrumentation and accessories will be utilized to sweep the local area in order to detect the target underground utility. The instrumentation will be used to position the test hole to expose the desired portion of the target utility (typically crown and sides of pipes and edge of duct systems). White painted squares will be placed on the ground where test holes will be performed. In the event the utility cannot be detected, field crews will seek office assistance on how to proceed with that particular test hole. The test hole may be dug at the plan location, cancelled or moved depending on the situation.

Test hole openings will be a minimum 8" x 8" and typically not larger than 14" x 14". Excavation will proceed to expose the utility in a careful manner with the utmost concern for the safety of personnel, the public and surrounding property.

A field test hole form will be completed for each excavation and will contain at a minimum parameters required by the Standard 38-02 Quality Level A, which include: depth to the utility, outside diameter, height of conduits or encasement, utility material, pavement type/ thickness and general soil type.

A permanent marker will be placed over a reference point on the utility flush with grade. Typically this reference point is the centerline of pipes or the edge of concrete structures. A minimum of three (3) ties will be taken to the permanent marker. The depth to the reference point on the utility will also be measured plumb to the permanent marker.

The excavation will be backfilled utilizing excavated materials. Pavement restoration will be made with a high epoxy content bituminous cold patch and will be guaranteed for a minimum of one (1) year.

Note: This proposal assumes that cold patch will be allowed as a permanent repair for holes in pavement and that additional pavement cut back, milling, select backfill and/ or hot mix asphalt will not be required. Costs for those types of repair are not included in the scope of this proposal.

Optional: Utility and Structure Survey and CAD

Survey personnel will contact the client to acquire survey control information and determine the horizontal and vertical datum desired for the mapping. Reconnaissance will be performed to locate control monuments or points within the vicinity of the work. Survey control points shall be present within 500' of the project site, able to be occupied and found to balance. In the event, control points are not available, the survey crew will establish points relative to a published coordinate grid through use of real time kinetic global positioning survey equipment.

The utility mark out, utility surface features, test holes and structures will be located during the survey effort. Surveyors will occupy project control points and collect locations relative to the horizontal grid using a coded data collection system that will produce the appropriate line types and symbols when processed into a computer drawing.

Survey data will be processed into AutoCAD (.dwg) utilizing PULS, Inc. CAD standards. Translation to the client's cad standards will be made if needed. The processed data will be enhanced as necessary with Quality C and D line work. Utility lines will be annotated as needed to show size and type of utility. Final reviews will be performed on the project as needed.

Submittals

Utility field sketches will be provided upon completion of the mark out.

Optional: Test hole forms will be provided for each completed test hole. Test hole symbols will be shown in the AutoCAD drawing. The designating submittal will include an AutoCAD drawing (.dwg) of the utilities/ structures. A .pdf file will also be provided with a sheet layout for plotting.

Notes

The following conditions apply:

- Areas should be clear of debris, equipment or other surface obstructions.
- PULS, Inc. will need access to all utility boxes, mechanical/electrical/communication rooms, cleanouts, manholes/hand holes and other connection points during the field work.
- PULS requests that any available drawings are made available prior to the start of the field work and that utility knowledgeable site personnel are made available on site.
- If utilities are not available PULS will request the time necessary to contact the utility companies referenced within the scope of work for their records.
- Unless specified as part of the scope and assigned staff are equipped/ certified to do so, PULS, Inc. staff will not enter confined spaces.

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- The GPR work does not include the recording and post processing of data, or the generation of CAD drawings or logs.
- The GPR service does not provide type, size and/ or depth information about underground utilities or structures.
- Computer drafting will be in a two dimensional plane. Three dimensional survey and cad is not included within the scope unless specifically discussed and agreed upon.

Limitations

This service will be provided with due diligence and in a manner consistent with standards of the subsurface utility mapping industry. Every reasonable effort will be made to locate all systems of interest whether indicated on records available to us or not. However, we do not guarantee that all existing utility systems can or will be detected. It may not be possible to detect utilities without prior knowledge, such as systems that are not depicted on records made available to us. Further, this service is not intended to detect non-utility structures such as, but not limited to: foundations, irrigation systems, septic systems, wells, tunnels, concrete or metal structures, or the true size and limits of subsurface utility vaults and manholes. Use of this service does not relieve interested parties from their responsibility to make required notifications prior to excavation.

Marking services will reflect interpretation of electronic data collaborated with record and visual indications. Professional judgment will be used to reflect the underground utilities with the intended utmost accuracy and comprehensiveness. The results may be affected by numerous site conditions, including but not limited to utility materials, joint types, fittings, density of underground utilities, interference with above ground conductors and soil characteristics. There is no guarantee that all facilities can be found and shown.

The utility designating service as per ASCE 38-02 QL-B is intended to allow for fairly accurate and comprehensive mapping of underground utilities, active and abandoned, when the utilities can be electronically detected or known about from record or verbal recollections. The intent of the mark out and survey is to delineate the centerline of pipes or one single cable. When marking multiple cables or cables within duct systems, marking may be the result of the location of any cable within the system or an average electromagnetic field from a group of cables. The service is not intended to provide engineering grade data about a utility or to provide corridor marking for plant protection of a utility. Additional work would be needed by PULS, Inc. to acquire exact size, location and material of underground utilities, as well as to mark the actual width of a utility to ascertain clearance during mechanical excavation or for structure design purposes. It is the client's responsibility to notify PULS, Inc. in the event the mark out will be used for excavation purposes or detailed design work so that additional location recommendations can be made.

Mapping of sanitary and storm sewers is typically performed at quality level (QL) C. When lines can be proven to be on straight line between manhole and/ or other types of gravity structures, the line will be correlated with record information and shown at QL C. When needed, a fish tape or traceable duct rodder will be inserted into pipes to detect and follow the piping. Insertion of the tape/ rodder will only be attempted from the ground surface without entering the manhole.

Piping detected in this fashion will be mapped at QL B. Obstructions may limit the distance the fish tape or rodder can travel; therefore, preventing further mapping of the pipe. The location of the obstruction will be noted with an EOI (end of information) at that point. Sewer inspection with a camera or excavation may be needed to further investigate the piping. Sewer camera inspection is excluded from the scope of this proposal.

The diameter of most pipes greater than 24" cannot be recovered directly from a single test hole. The diameter of pipes less than 24" is determined by exposing half of the pipe or the entire pipe, as needed, and directly measuring the outside diameter with a rule to the nearest 1/2". If pipe diameter is critical on larger than 24" pipes, it may be necessary to perform additional holes. This type of investigation falls outside of the normal scope of test hole services.

Test holes on concrete encased duct systems and other concrete structures are typically setup to excavate down the side of the structures in order to measure the top and bottom covers. Additional holes will often be necessary if widths of duct systems are needed, as well as top and bottom covers on the opposite sides.

A high water table may prevent excavation to the depth desired or prohibit visual inspection below water level. Rock layers, large rocks and miscellaneous demolition rubble may prevent excavation to desired depth.

Exclusions

Obtaining inverts on gravity storm and sanitary sewers is excluded from the scope of this proposal.

The mark out does not include the provision of any depth information for the utilities. Depths will only be reported where test holes are excavated.

Health & Safety

PULS, Inc. will strive to execute and comply with all laws, orders and regulations with respect to Health & Safety. Site specific Health & Safety Plans if required shall be provided "by others" unless stated in writing in this proposal. It is assumed that all work is to be performed in a level "D" protection, any other level needs to be agreed upon in writing prior to starting or signing of the proposal/contract. Level upgrades required will be in writing and will require additional compensation.

Hazardous Materials

Prior to commencing work, PULS, Inc. shall be informed in writing of all known wastes or hazardous materials to be encountered on-site during the execution of our services covered in this proposal. All waste handling, disposal, air monitoring and/or transportation will be the sole responsibility of the client including any fees & costs incurred by PULS, Inc.

Project Schedule

The work will be scheduled concurrent with authorization to proceed.

Effort for Electromagnetic/GPR Utility Locating, Survey and CAD with Optional Air Vac Services

The following cost reflects the effort needed to acquire record drawings, mark out utilities and prepare designating sketches, as well as to stake out the test holes, make one call notification, excavate test holes, document the findings and draft the test hole forms, if vacuum excavation services are selected. Survey and computer drafting is also included if survey option is selected. The time and quantities needed shall be considered an estimate unless specifically provided in writing or indicated herein that a lump sum is required.

<u>Services</u>	<u>Days</u>	<u>Rate</u>	<u>Cost</u>
EM and GPR Locating (two-tech crew)	16.0	\$1,800.00	\$ 28,800
Lodging and Per Diem	Included		\$ -
Mobilization and Demobilization Fee	Included		\$ -
Subtotal			<u><u>\$ 28,800</u></u>

Optional Services:

Air Vac Excavation (two-tech crew)	TBD	\$1800/day	TBD
Survey Crew (two-tech crew)	TBD	\$1500/day	TBD
CAD Technician (per day-up to 8 hrs.)	TBD	\$500/day	TBD
Subtotal			<u><u>TBD</u></u>
Total			<u><u>TBD</u></u>

- **Rates are valid for 30 days from date of proposal.**
- Overtime rates of time and a half per hour will apply after 8-hours on site or for weekend shifts.
- The estimated days referenced above are based on the information provided by the client at the time of creation of proposal. Any **variation** to the estimated days will be reflected as an adjustment to the pricing provided.
- Client is responsible for all permitting, traffic control and/or road closing arrangements unless discussed, agreed upon and documented that PULS, Inc. will provide those services.

Standard Terms of Payment

This proposal does not include any costs for the paying of prevailing wages or supplemental benefits to the PULS, Inc., Inc. field or office employees. Subsurface utility engineering services are typically considered professional services and exempt from prevailing wages. In the event that prevailing wages and/ or supplemental benefits must be paid, the client must inform PULS, Inc., to have those costs included in this proposal and help PULS, Inc. select classifications for applicable personnel.

In the event the effort becomes part of a subconsultant agreement, the terms provided therein will apply. Otherwise payment terms shall be as stated below.

PLEASE COMPLETE THE FOLLOWING:

Accounts Payable Contact Information:

Contact Name: _____

Address: _____

Phone Number: _____

Email: _____

Terms

Client's accounts payable department will be billed as per the rates listed above. Please complete the following payment information:

What form of payment will you be using: ☐ EFT ☐ Credit Card ☐ Check

☐ **Credit Card**

TYPE OF CARD (circle one): VISA MASTERCARD DISCOVER

CREDIT CARD NUMBER _____

EXP DATE _____

CVC CODE _____

NAME AS IT APPEARS ON CARD: _____

BILLING ADDRESS FOR CARD: _____

☐ **Check**

NUMBER _____

We offer a 5% discount for payments made in full prior to or on the day of service, otherwise invoices are due within ten (10) days of the invoice date. If you will not pay in ten (10) days- what are your payment terms?

☐ Subcontract Agreement with own terms

☐ No discount – Pay When Paid

☐ Other (you must list payment terms or payment will default to ten (10) days): _____

Preferred Method of Invoicing: ☐ E-mail ☐ Mail

Late Charge Fee

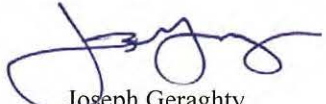
A late payment service charge equal to 1.5% per month or the maximum charge allowed by applicable law, whichever is lower, shall be assessed on all amounts not paid when due. All accounts are net 10 days unless specifically agreed upon in writing.

We anticipate you will find the information in good order. However, do not hesitate to contact me in the office if you have any questions or desire any additional information. We look forward to hearing from you in the near future.

IN WITNESS WHEREOF, the parties named above have caused this Agreement to be executed by affixing their signatures and dates below.

Proposal must be signed and returned before work can begin or be scheduled.

For PULS, Inc.


Joseph Geraghty
PULS, Inc. President
Mobile: (267) 549-2517

For Client


Signature

Print Name

Date

Exhibit SPLP MG-8

SPLP
MG-8

ATTACHMENT A SCOPE OF WORK

PENNSYLVANIA 20" AND 16" NGL PIPELINE PROJECT, SPREAD 6

GENERAL SCOPE OF WORK

1.0 GENERAL

Pennsylvania 20" and 16" NGL Pipeline Project, Spread 6 Work to be performed consists of all activities necessary to complete the installation of a 20-inch and 16 inch high-pressure natural gas liquid pipelines with ancillary facilities for Company. The Work includes all items set forth in this section and as detailed in the complete Scope of Work ("Attachment A"), Plans and Specifications ("Attachment B"), Company Furnished Materials ("Attachment C"), and Company furnished Drawings.

The Work shall be constructed in multiple spreads and is more fully described herein below, and includes the complete satisfactory performance of Contractor's construction services, including all things described herein as well as any other Work not explicitly described below but reasonably inferred as being Contractor's responsibility, including, without limitation, fabrication and installation of the following Work:

1.1 Pennsylvania 20" and 16" NGL Pipeline Project Spread 6 ("Spread 6") commences at Mile Post 324.2 at the county line in Berks/Chester counties, Pennsylvania and ends at approximate Mile Post 359.2 at the Twin Oaks site in Delaware County, Pennsylvania.

The Work the construction and installation of the following Work:

- 1.1.1 **20-inch and 16-inch high-pressure natural gas liquid pipeline** – Installation of approximately 189,010 linear feet (35.0 miles) of a 20-inch and 16-inch diameter coated line pipe. The 20-inch pipeline will be and include appurtenances as set forth in Attachment C with a 1480 MOP design;
- 1.1.2 **Uncased Bore Crossings** - Total of thirty-eight (38) uncased bore crossings;
- 1.1.3 **HDD Crossings** - Total of thirty-five (35) horizontal directional drill ("HDD") crossings.
- 1.1.4 **MLV Site at M.P. 324.5** – The Work involves the complete, turn-key construction and installation of one (1) pre-fabricated 20" main line valve and one (1) 16" main line valve assemblies. The Work further includes, without limitation: all associated interconnect piping systems and valves; coating and painting all above ground piping; Site Work for an approximate 125' x 125' Site, which includes, clearing, rough grading, fill dirt required to level Site, rocking, temporary fencing and one (1) permanent access road; and civil Work, which includes, concrete sleepers and reinforced piers in accordance with Company's Drawings.
- 1.1.5 **MLV Site at M.P. 330.4** – The Work involves the complete, turn-key construction and installation of one (1) pre-fabricated 20" main line valve and one (1) 16" main line valve assemblies. The Work further includes, without limitation: all associated interconnect piping systems and valves; coating and painting all above ground piping; Site Work for an approximate 125' x 125' Site, which includes, clearing, rough grading, fill dirt required to level Site, rocking, temporary fencing and one (1) permanent access road; and civil Work, which includes, concrete sleepers and reinforced piers in accordance with Company's Drawings.

- 1.1.6 **MLV Site at M.P. 332.8** – The Work involves the complete, turn-key construction and installation of one (1) pre-fabricated 20” main line valve and one (1) 16” main line valve assemblies. The Work further includes, without limitation: all associated interconnect piping systems and valves; coating and painting all above ground piping; Site Work for an approximate 125’ x 125’ Site, which includes, clearing, rough grading, fill dirt required to level Site, rocking, temporary fencing and one (1) permanent access road; and civil Work, which includes, concrete sleepers and reinforced piers in accordance with Company’s Drawings.
- 1.1.7 **MLV Site at M.P. 339.6** – The Work involves the complete, turn-key construction and installation of one (1) pre-fabricated 20” main line valve and one (1) 16” main line valve assemblies. The Work further includes, without limitation: all associated interconnect piping systems and valves; coating and painting all above ground piping; Site Work for an approximate 125’ x 125’ Site, which includes, clearing, rough grading, fill dirt required to level Site, rocking, temporary fencing and one (1) permanent access road; and civil Work, which includes, concrete sleepers and reinforced piers in accordance with Company’s Drawings.
- 1.1.8 **MLV Site at M.P. 342.1** – The Work involves the complete, turn-key construction and installation of one (1) pre-fabricated 20” main line valve and one (1) 16” main line valve assemblies. The Work further includes, without limitation: all associated interconnect piping systems and valves; coating and painting all above ground piping; Site Work for an approximate 125’ x 125’ Site, which includes, clearing, rough grading, fill dirt required to level Site, rocking, temporary fencing and one (1) permanent access road; and civil Work, which includes, concrete sleepers and reinforced piers in accordance with Company’s Drawings.
- 1.1.9 **MLV Site at M.P. 348.4** – The Work involves the complete, turn-key construction and installation of one (1) pre-fabricated 20” main line valve and one (1) 16” main line valve assemblies. The Work further includes, without limitation: all associated interconnect piping systems and valves; coating and painting all above ground piping; Site Work for an approximate 125’ x 125’ Site, which includes, clearing, rough grading, fill dirt required to level Site, rocking, temporary fencing and one (1) permanent access road; and civil Work, which includes, concrete sleepers and reinforced piers in accordance with Company’s Drawings.
- 1.1.10 **MLV Site at M.P. 353.1** – The Work involves the complete, turn-key construction and installation of one (1) pre-fabricated 20” main line valve and one (1) 16” main line valve assemblies. The Work further includes, without limitation: all associated interconnect piping systems and valves; coating and painting all above ground piping; Site Work for an approximate 125’ x 125’ Site, which includes, clearing, rough grading, fill dirt required to level Site, rocking, temporary fencing and one (1) permanent access road; and civil Work, which includes, concrete sleepers and reinforced piers in accordance with Company’s Drawings.

2.0 PROJECT TIMING

2.1 COMMENCEMENT OF WORK

Contractor agrees to commence Work within receipt of Notice to Proceed (“NTP”) from Company.

2.2 PROSECUTION AND COMPLETION OF WORK

The Contractor shall, after commencement of the Work, prosecute the Work with due diligence, and shall not neglect or discontinue the Work at any time. The Contractor shall perform all Work in a

thorough workmanlike and substantial manner in accordance with the terms of the Master Terms and Conditions, accepted industry and Sunoco Logistics Construction Specifications, and with the utmost regard for safety of life and property. The Work shall be conducted in such a manner and with such machinery, equipment, tools, labor, and supervision as is deemed necessary and sufficient to insure satisfactorily completion of the Work and achievement of the In-Service and Final Completion Dates referenced in Section 2.3.2.

2.3 CONSTRUCTION SCHEDULE

2.3.1 Contractor shall develop a construction schedule for the Work that provides the most efficient and cost effective installation. Contractor shall begin planning and other preparatory work upon execution by both parties of the agreement. Contractor agrees it has examined and is familiar with the project scope of Work, Web-Based GIS Map, Construction Drawings, landowner line list and restoration requirements, environmental permit requirements, and the terms and conditions and as a result, hereby certifies that it has sufficient information to prepare an accurate schedule of the timing and events required for performing the Work in an efficient and cost effective manner.

Contractor shall provide an HDD drill schedule. Company will require a 2 weeks' notice prior to the commencement of individual HDD drilling activities.

2.3.2 **Work milestone dates are as follows:**

Commencement Date:	May 15, 2016
Tree Clearing Window:	October 1 st to March 31 st *
Anticipated Construction Start:	May 15, 2016
In-Service-Date:	November 1, 2016, with time being of the essence at all times
Final Completion Date:	November 15, 2016, with time being of the essence at all times

The term "Commencement Date" shall be defined as the date of mobilization to the pipeline ROW by the CONTRACTOR.

The term "In-Service Date" shall be defined as the date that all hydrostatic tests have been completed successfully, the pipeline cleaned and dried, COMPANY acceptance of a caliper tool which indicates no pipeline flaws, and the pipeline is able to commence commercial operations.

The term "Final Completion" shall be defined as complete ROW restoration (final grading, permanent waterbar installation, seeding, and land owner acceptance of restoration work. Permanent fencing and painting is excluded from this contract.

Contractor shall fully and finally complete, to the Company's satisfaction, all Work related to coating and painting of all above ground piping prior to the achievement of the In-Service Date.

All timber cutting shall be fully and finally completed within October 1st and March 31st project-wide. If E&S permits are not issued upon notice-to-proceed hand-cutting and felling in place will be allowed between October 1st and March 31st except where noted on relevant project documents and plans.

For the purposes of this RFP, the term "Final Completion Date" shall mean that date on which the Contractor has fully and finally completed, to the Company's satisfaction, all

Work under the agreement including, without limitation, the achievement of the In-Service Date, clean-up, reseeding, restoration, and has fully demobilized from the Site.

- 2.3.3 Contractor shall provide a construction schedule utilizing either Microsoft Excel ®, Microsoft Project ®, or similar software approved by Company, within seven days from execution of the Agreement, to complete all Work and shall include at a minimum its Work commencement date and all Work milestone dates referenced in Section 2.3.2, as well as the duration of all major tasks to perform the Work as follows:
 - 2.3.3.1 Preparation of Work plans and pre-mobilization planning, including appropriate engineering tasks such as installation and contingency procedure delivery;
 - 2.3.3.2 Contractor OQ testing;
 - 2.3.3.3 Weld procedure and welder qualification testing;
 - 2.3.3.4 Mobilization of equipment spreads, including dedicated manpower;
 - 2.3.3.5 Installation of pipeline in accordance with Company Specifications;
 - 2.3.3.6 Fabrication, as required, and installation of pre-fabricated 20" and 16" main line valves and all Site fabrications;
 - 2.3.3.7 Clearing, removal of all debris, grading, and leveling of the Site locations as shown on each appropriate Site Drawing;
 - 2.3.3.8 Hydrostatic Pipeline testing in accordance with Company specifications.
 - 2.3.3.9 Caliper pig survey;
 - 2.3.3.10 Final cleaning / drying of the completed pipeline to -40 degrees Fahrenheit specific dew point and no more than one quarter (1/4) inch penetration or less visible on a 2.5lb/ft3 density foam pig. After cleaning and drying the line it shall be purged and loaded with one hundred fifty (150) PSIG Nitrogen;
 - 2.3.3.11 Final grading to pre-construction contours that will prevent slips, washes, erosion, and ROW restoration and Site cleanup;
 - 2.3.3.12 Demobilization; and
 - 2.3.3.13 Project documentation.
- 2.3.4 Contractor's submission of any Work schedule that deviates from the Work milestone dates referenced in Section 2.3.2 is hereby rejected by Company unless accepted in writing by Company after Contractor has provided a recovery Work Plan.
- 2.3.5 Contractor shall report progress reports as listed below to Company.
 - 2.3.5.1 Daily Report Schedule
 - 2.3.5.2 Key Milestone Schedule (within 7-Days of execution of the agreement)
 - 2.3.5.3 Weekly 3 Week Look-Ahead Schedule (Weekly or as required by Company).

The Contractor shall prepare and submit to the Company a Weekly 3 Week Look-Ahead Schedule showing the activities planned, manpower requirements, and any

other special requirements including, but not limited to, permits, material receipts, material shortages, etc. for the upcoming three (3) week period. The 3 Week Look-Ahead Schedule shall be submitted on a day and time agreed upon between Company and Contractor, throughout the performance of the work.

2.3.5.4 Weekly Progress Report (Weekly as Agreed Upon)

The Contractor shall prepare and submit to the Company a Weekly Progress Report showing the scheduled progress versus actual progress from the previous week, including an itemized breakdown of the percent complete of key milestones within the execution of the Scope of Work as detailed by the initial Key Milestone Schedule. The Weekly Work Schedule shall be submitted to the Company on a day and time agreed upon between Company and Contractor, throughout the performance of the work. The Company shall use these reports for progress tracking and documentation of the project.

- 2.3.6 Within fifteen (15) days of award, the Contractor shall develop and coordinate with Company and submit to the Company for approval, a detailed network and schedule of activities for the term of the agreement that conform to the Completion Dates.

3.0 MATERIALS FURNISHED BY COMPANY

Company will supply all piping and any materials that become a permanent part of the completed pipeline unless otherwise indicated in the Specifications and Drawings. Company furnished material is generally listed in "ATTACHMENT C" MATERIALS TO BE FURNISHED BY COMPANY.

The following requirements apply to Company furnished materials:

- 3.1 Prior to starting Work, Contractor shall discuss material and supply necessities 48 hours prior to mobilizing to the Site. It is the Contractor's sole responsibility to make sure all materials and equipment are on the Site to execute the Work.
- 3.2 All materials shall be accompanied with a completed Company's B9 Form (Material Receiving / Transfer Report).
- 3.3 Materials shall be quantified and assessed as surplus or as scrap and reported accordingly by the appropriate materials person on location.
- 3.4 Any pipe or materials returned that do not have MTR's or certification shall be considered scrap. Contractor shall be responsible for returning of all "scrap" materials and shall be clearly and boldly marked as "scrap" and returned to the Company's construction storage yard to be sold from field yard. Contractor shall be responsible for acquiring invoice receipt from Company for such material.
- 3.5 All 20" pipe, valves, fittings and additional materials as listed in Attachment C shall be available for pick-up at the Company's yard located in Cornwall, PA and Contractor shall be responsible for pre-loading inspection, loading, transporting, unloading, stringing, and storing/securing of all Company supplied materials to/at the Site.
- 3.6 The Contractor shall return all surplus pipe, fittings and any other surplus materials to Company's designated storage areas near Cornwall, PA. The cost for these services shall be included in the base lay price. All legal pups 10' and longer will be placed into the pipeline, all pups (non-legal) 10' or less and 10' and longer that are not placed in the pipeline shall be charged to the contractor at the Purchase Order price. All piping negligently damaged by the Contractor (i.e. buckled, flat ends, dents) that can be contributed to the Contractor will be charged to the Contractor at the Purchase Order price.

- 3.7 Any 20" pipe less than 25 feet and greater than 10 feet shall be required to be carried forward and installed into the line as nonconsecutive pups. Any pipe less than 25 feet and greater than 10 feet that is not installed into the line shall be purchased by the Contractor at (\$xxxxx) Dollars per foot for 20" pipe.
- 3.8 Contractor shall be responsible for providing all materials not listed in Attachment C.

4.0 CUSTODY OF MATERIAL

The Contractor shall insure that all Company provided materials as listed in Attachment C are properly stored and protected from damage. Any damage to materials after Contractor's acceptance and installation shall be the Contractor's responsibility in accordance with the terms of the Master Construction Agreement. Any damage to materials shall be reported to the Company as soon as it is detected.

5.0 CONTRACTOR SUPPLIED ITEMS

Contractor shall furnish all machinery, tools, transportation, labor, and supervision necessary to complete the Work and all incidental and/or expendable material necessary to complete the Work (excluding materials specifically listed in Attachment C "Company Furnished Materials" herein). Cost of Contractor supplied items not identified in a specific pay item will be included in Contractor's firm offer, Subpart A, Pay Item #1.0. Major items (described in depth within Contractor Submittal Document) to be furnished by the Contractor shall include, but may not be limited to:

- 5.1 Any additional yard deemed necessary by Contractor for staging of Company supplied materials beyond the yard space provided by Company;
- 5.2 Yard for Contractor's equipment and personnel;
- 5.3 Three (3) double-wide office trailers (with conference room) at a Site location approved by Company, which includes but may not be limited to two (2) phone lines and one (1) fax line, a minimum of DSL or cable modem (Hi-Speed Internet), color printer and copy machines capable of printing, scanning and copying up to 11" x 17" documents, fax machines, utilities including men's and women's bathroom facilities with running water, office furniture and file storage cabinets, fire extinguisher, first aid kits, and dedicated parking spaces for Company's project personnel. Cleaning services shall be done daily at office trailers.
- 5.4 All materials and supplies for forming and casting 5,000 lbs. dry saddlebags or concrete coated pipe for negative buoyance;
- 5.5 All temporary pipe for boring tubes as required for dry boring;
- 5.6 All welding electrodes and welding consumable materials;
- 5.7 Contractor shall furnish heat applied FBE powder coating (SPC 2888, Denso Protal 7125, or equivalent) as specified in Company Coating Manual or equivalent and approved by Company for coating girth welds (minimum of 14-16 MILS FBE). All girth welds to be sandblasted to near-white for coating application per Company Specifications;
- 5.8 For HDDs and bores, the field applied FBE will be overlain with a field applied Powercrete R95 (minimum of 40 MILS) per field applied Powercrete R95 specification. The Contractor shall supply all coating material, supplies and required equipment.
- 5.9 Contractor shall supply and use heat applied FBE powder coating and finalized by coating with Powercrete with the approved drying time for coating on directional drill sections, approved coating will be used for coating on fabrication and tie-ins where heat applied epoxy powder is not

appropriate. Contractor will provide coatings as specified in Company's Coating Manual;

- 5.10 Sandblasting equipment, abrasive blast media, paint, painting supplies, and all necessary equipment for painting pipe and equipment per Company Specifications, including right-of-way fences and gate posts;
- 5.11 Coating and painting color shall be a Company black color per the Company Coating Manual. Prefabricated material will be supplied with a prime coat only;
- 5.12 All fencing materials required by Company Specifications or found in "Right of Way Special Conditions" under the Landowner Line List or listed on Web-Based GIS Map, to install temporary gaps for construction, replacement of fences damaged by construction activities, and installation of permanent steel pipe H-braces and tubular gates prior to completion of construction;
- 5.13 Any crossings of wildlife/gaming fenced areas, Contractor shall be responsible for installing fence gaps equivalent to the existing fences. A game type camera is required at all cut cross fences and Contractor is required to maintain camera and data records. Gate guards may be required at the gates of all perimeter high game fences, exterior gates bordering state highway, township roads, county roads, and public access roads and may be required on interior fences, as required by landowner stipulations.
- 5.14 All concrete, anchor bolts, forming materials, and reinforcing materials as necessary for the installation of all facilities and associated piping supports, and concrete caps across electric transmission line right-of-way as indicated on standard Drawing details and the Construction Drawings or bid documents;
- 5.15 Galvanized steel pipe culverts or concrete culverts and Safety End Sections (aprons) per requirements and/or Township, County, or State requirements as set forth in the road crossing and permanent access permits and Contractor submittal documents if required, including any asphalt approaches as required by permit;
- 5.16 If required by permits or as listed on Company Drawings, Contractor shall be responsible for permanent black top covering (asphalt) on any permanent gate entrances to State highways or major roads;
- 5.17 Backfill material shall consist of a flowable, excavatable, self-compacting and self-leveling material will be required on any open cut crossing performed;
- 5.18 All traffic control signs, barricades, flagmen, equipment, and trained or state certified personnel;
- 5.19 All material, fabrication, installation and painting of required safety bollards and posts;
- 5.20 Caliper pig for inspection run and inspection results within 24 hours of completing caliper pig run and a final report shall be submitted to Company within 21 days of completion. Tool must be a high resolution caliper tool approved by Company;
- 5.21 Geotextile material, gravel, and road base materials for all new surface Sites locations. Geotextile material, gravel, and road base materials for all ground cover and to repair and maintain all private access roads used to complete the Work;
- 5.22 Materials to run a minimum of four (4) cleaning pig runs prior to pressure testing to remove rust scale, dirt, and other contaminants from line due to normal construction activities to no more than one quarter (1/4) inch penetration or less visible on a 2.5lb/ft³ density foam pig. After cleaning and drying the line it shall be purged and loaded with one hundred fifty (150) PSIG Nitrogen, which includes, but may not be limited to, water, brush pigs, foam pigs, swabs, materials for fabricating all test heads including temporary valves and weld fittings (which will be furnished by Company);

pumps, compressors, all temporary piping, hoses, frac tanks, sock filters, hay bales, connectors to fill and dewater the pipeline, including fuel for all equipment;

- 5.23 Materials needed for pressure testing, including water, pigs, materials for fabricating all test heads including temporary valves and weld fittings (except for pipe which will be furnished by Company); pumps, compressors, deadweights, pressure and temperature chart recorders and certified gauges, all temporary piping, hoses, frac tanks, sock filters, hay bales, connectors to fill and dewater the pipeline, fuel for all equipment;
- 5.24 Materials needed for drying the pipe and cleaning the line of all water, which includes, but may not be limited to pigs, swabs, air compressors, dryers, hoses, testing equipment, fuel, etc.;
- 5.25 Contractor will furnish all miscellaneous materials as required for installation of Company supplied cathodic protection test stations, including all necessary wire for test lead and foreign pipeline crossings, excavation and shall installed at nearest fence line and road crossing. Contractor shall prepare one complete wrap of pipeline with test lead, pulling test lead "back through" wire loop for all test station connections to the pipeline and soil tubes and shall be installed or as required at locations specified by Company Drawings;
- 5.26 Materials, equipment, and labor required to install pipeline markers and aerial markers at Sites located on Web-Based GIS Map and/or specified or as directed by Company;
- 5.27 Fire Retardant Clothing (F.R.C) outer wear apparel, which shall be made of Nomex III, Kevlar, or Fire Retardant Cotton and shall be either one-piece coveralls or pants and shirt, and must be worn as the outer layer of clothing. The F.R.C shall be worn by all Contractor personnel within the in service facility Sites. Contractor personnel shall wear hard hats, safety glasses with side shields, steel toe shoes, and any approved PPE that is required;
- 5.28 All other material necessary to complete the Work as may be called for elsewhere in the RFP documents, the attached specifications, and Drawings, other than and except material to be furnished by Company as expressly stated herein in Attachment C.

6.0 GENERAL REQUIREMENTS

Contractor has included in Contractor's Firm Offer, all associated costs to furnish all labor, equipment, material, consumables and supervision necessary to complete the following Work, which includes, but may not be limited to the following:

- 6.1 Coordinating with Company Right-of-Way agents ONLY and be and compliance with all terms and conditions stated in the "Right of Way Landowner Line List". Contractor shall have no direct contact with landowners. The contractor shall ensure that there is at least one Right-of-Way agent per every 25 miles to coordinate with Company ROW agents.
- 6.2 Coordinating with permitting agencies and compliance with all permits, foreign pipeline, and utility owners during the course of the agreement;
- 6.3 Coordination with other contractors working within and near the right-of-way. Contractor agrees to cooperate with any and all other contractors.
- 6.4 Signage required by safety and permits as well as signage required to mark permissible roads and non-permissible roads to right of way;
- 6.5 Testing of all welders per Company Procedures and Specifications;
- 6.6 Clearing, grubbing, grading, and maintaining the construction right-of-way;

- 6.7 Disposal of all timber, stumps, brush, and debris from pipeline easement, Sites, and temporary work space. All materials removed from the right-of-way easement, temporary workspace and facility locations shall be chipped, burned if allowed by local permitting agencies and land owners or hauled off and properly disposed. Contractor shall not allow for debris to remain on pipeline easement, temporary workspace, and facilities and shall be handled according to the terms and conditions stated in the "Right of Way Landowner Line List";
- 6.8 All 20" pipe, valves, fittings and additional materials shall be available for pick-up at the Company's yard located in Cornwall, PA and Contractor shall be responsible for pre-loading inspection, loading, transporting, unloading, stringing, and storing/securing of all Company supplied materials to/at the Site. All pipe negligently damaged by Contractor (i.e. buckled, flat ends, dents) that can be contributed to the Contractor will be charged at the Purchase Order Price.
- 6.9 All surplus pipes greater than 25 feet long shall be beveled on both ends and all coating shall be repaired prior to returning to the Company's yard located in Cornwall, PA.
- 6.10 Any 20" pipe less than 25 feet and greater than 10 feet shall be required to be carried forward and installed into the line as nonconsecutive pups. Any pipe less than 25 feet and greater than 10 feet that is not installed into the line shall be purchased by the Contractor at (\$xxxxx) Dollars per foot for 20" pipe.
- 6.11 Field bending utilizing bending machine with qualified personnel. Company shall allow field bends in accordance with Company's construction specifications;
- 6.12 Cutting, beveling, transitioning, line-up and welding of pipe and fittings;
- 6.13 Field joint coating; The Contractor shall sand blast and field apply FBE coating (SPC 2888, Denso Protal 7125, or equivalent) to all girth welds (minimum of 14-16 MILS FBE). Utilize flocking equipment to apply the FBE. Where FBE coating of the girth welds is not practical, CONTRACTOR may use approved two part epoxy (SPC 2888 or equivalent). Surface preparation shall be to SSPC Standard SP10 for all girth weld coatings.
- 6.14 In areas of HDDs and bores, where the pipe is coated with Powercrete R95, the field applied FBE will be overlain with a field applied Powercrete R95 (minimum of 40 MILS) per field applied Powercrete R95 specification. The CONTRACTOR shall supply all coating material, supplies and required equipment.
- 6.15 Trenching and excavation to provide the specified cover;
- 6.16 Construction mats, engineered excavation boxes, shoring, weld points, etc. required for installation of pipeline;
- 6.17 Installation and lowering in of mainline pipe including all bends and segmentable fittings;
- 6.18 Holiday detection (Jeeping) shall be performed by Contractor just prior to the lowering in operation and coating shall be closely inspected for possible damage from the lowering in operation. Sections of the coated pipe may not be dragged or pulled into position. The coated pipe shall be properly protected and handled in a manner to prevent damage to the pipe. A third party inspector must witness holiday detection.
- 6.19 The Contractor shall shade and backfill the pipeline with suitable material where the native material is not suitable for use as shading material as outlined in the Construction Documents. The Contractor shall include a mechanical padding machine (Ozzie Padder or equivalent) where native backfill is deemed unsuitable. Where it is not practical to use a padding machine, the Contractor shall locate, load, haul, and place as applicable COMPANY approved shading material.

- 6.19.1 A minimum of 8 in. of dirt shading (1" minus) shall be installed as cover on top of the line as protection prior to backfilling.
- 6.19.2 First stage of Backfill (12" above the 8" shading material) – Backfill material may include rock, 2" – 6" in diameter
- 6.19.3 Second stage of Backfill – Backfill material may include rock – Up to 12". No rock greater than 12" diameter will be allowed back into the pipeline trench line.
- 6.19.4 Large rock or boulders in excess of 12 in. in diameter, width or length, shall not be backfilled into the ditch. Such rock shall be disposed of properly. Rock disposal shall be in accordance with ROW Construction Line List requirements. Rock disposal in ditch line that is not specifically prohibited by the landowner (as described in the Construction Line List), shall be at the discretion of the COMPANY.
- 6.19.5 In most cultivated areas, all surface rock in excess of 3 inch diameter shall be removed from the ROW, per the ROW Construction Line List requirements.
- 6.19.6 Topsoil shall be restored in accordance with Clause 10.5.18.
- 6.20 Directional drilling and installation of drilled crossings;
- 6.21 River, stream, canal, pond, and wetland crossings per permit and license requirements or as required on Company's alignment Drawings;
- 6.22 Set-on weights as required by Company or listed on Company Drawings and shall consist of 5,000 lbs. dry saddlebags or concrete coated pipe for negative buoyance on the pipeline;
- 6.23 Boring of highways, roads (public and private), foreign utilities, and railroad crossings as described in bid documents/permits;
- 6.24 Contractor shall test an additional approximately 180 linear feet of each line pipe, which includes but may not be limited to test headers on any additional items to test these joints within the pipeline hydrotest with supporting documentation;
- 6.25 Foreign pipeline and utility crossings with clearances in accordance with permits or Specifications. Contractor to locate and verify depth and location and stake all Company owned and foreign line crossings prior to excavation. Contractor will provide all construction matting materials required to cross foreign pipeline and easements;
- 6.26 Trench dewatering, well points, trench shoring, sheet piling and construction matting required for the pipeline construction and installation of all associated piping assemblies including transportation and disposal of materials.
- 6.27 The CONTRACTOR shall furnish adequate padding equipment to pad both bottom of ditch, side, and top of pipe. Dirt padding (1" minus) shall be installed in the bottom of the ditch to a minimum depth of 8 in., prior to lowering-in the pipeline. If rock shield is required, rock shield shall be approved by Company prior to installation.
- 6.28 Construction and installation, which includes all Work associated with the civil and mechanical for the prefabricated pigging and valve assemblies, which includes platforms and ladders; thrust blocks, bollards posts and concrete support blocks;
- 6.29 Facility Sites finishing including repair of existing access drives to their original condition prior to construction activities , which includes, but may not be limited to culverts, rock surfacing, fencing, and cattle guards, as required;
- 6.30 All Site Work, which includes, clearing, grading, fill dirt required to level Site, Site compaction to 95% proctor, rocking, fencing and permanent access roads.
- 6.31 If required by permits or as listed on Company Drawings, Contractor shall be responsible for

- permanent black top covering (Asphalt) on any permanent gate entrances to State highways or major roads;
- 6.32 Hydrostatic testing of the pipeline and facilities per Company requirements and certified by a third party PE registered in the appropriate State, then reviewed and approved by Company approved PE;
 - 6.33 Company will furnish one complete set of bolts and gaskets as required, Contractor is responsible for any additional bolts and gasket sets; no bolts from China are permitted to be used.
 - 6.34 Following initial dewatering operations, the Contractor shall conduct a geometry verification survey. The caliper pig will be provided by Contractor and approved by Company. Contractor shall provide all required labor and support to execute the pig run. The caliper Pig will be run after the completed sections are cleaned and hydrostatic tested. Results of the caliper Pig run will be reviewed with Company to determine possible locations for excavation and verification of any identified anomalies. Should none exist, Company will authorize Contractor to proceed with drying. Company fully intends for pipeline to be constructed free of dents, gouges, and other mechanical damage. Contractor personnel will assist Company in the visual inspection of each joint of line pipe during welding operations, coating operations, and lowering-in. Should indications of mechanical damage or excessive ovality of the line pipe be detected in the caliper pig reports, Company will determine the standards of acceptability for natural gas liquids pipelines to be applied. Company will determine the action to be taken to investigate or repair or replace the damaged areas. It is the Contractor's responsibility and obligation to complete the pipeline without any defects.
 - 6.35 Support and assist Company during commissioning of Work, which includes but may not be limited to, providing torqueing crews and any equipment and labor as required in support of all commissioning activities;
 - 6.36 Preparation and installation of any required transition pups;
 - 6.37 Concrete support and thrust blocks;
 - 6.38 Drying to -40 degrees Fahrenheit specific dew point and cleaning of the pipeline and facilities per Company requirements;
 - 6.39 The Contractor shall install coupon Cathodic Protection (CP) test stations for potential, current, and resistance measurements every half mile and at the following locations: all pipeline crossings, isolating joints, waterway crossings, road crossings, stray current areas, transformer-rectifier or other power supply installations. In addition to the above, standard test stations for pipe-to-soil potential measurements shall be installed at the following locations: along the entire length of the pipeline, connections with grounding systems, all pipeline crossings, and at locations where the pipeline route is in close proximity to foreign structures. This shall include, but not be limited to, providing all wires and pipe bonded connections and cadwelds, and coating bonded connections.;
 - 6.40 Pipeline warning signs and pipeline markers provided by Company including installing pipeline warning markers at each side of all public and private road crossings as well as all fence crossings;
 - 6.41 The Contractor shall continuously clean up the right of way to the satisfaction of the Company, landowner or tenant, in accordance with the permits, right-of-way agreements and Company Construction Specification. The Contractor shall haul away and dispose of all trash created during construction. The Contractor may leave mats out until clean-up and re-vegetation is complete. The Contractor shall dispose of brush as specified in the "Grant of Easement" and "Land Owner Line List." The Contractor shall re-vegetate the pipeline right-of-way as soon as possible in accordance with the requirements of the Land Owner Line List and Erosion and Sediment Control Plan ;
 - 6.42 All equipment furnished by Contractor shall be in sound and good working order. Any Work required to complete installation of the new pipeline but not listed as a pay item is no less included

in the scope of Work for installation of the new pipeline and is included in Contractor's Lump Sum Firm Offer;

- 6.43 Where joints of pipe are cut, it shall be the Contractor's responsibility to ensure that the pipe and heat numbers of the parent joint are transferred to the cut end or ends of the parent joint as well as to both ends of all pups resulting from the cutting;
- 6.44 The striking, cutting, damage, modification, destruction, or crushing of drain or irrigation tiles and required repairs associated with such damage in accordance with the Agricultural Mitigation Plan, Landowner requirements, and the terms of the Master Construction Agreement, whether or not such drain or irrigation tiles were known or unknown (mapped or not) at the time of execution of the Master Construction Agreement;
- 6.45 CONTRACTOR SHALL FIELD VERIFY ALL MEASUREMENTS; and
- 6.46 Items of Work that are not specifically identified, does not mean such Work is not included in Contractor's scope of Work. Any item of Work that is required for completion of the installation but not specifically identified is to be included in Contractor's Lump Sum Firm Offer.
- 6.47 The CONTRACTOR shall comply with the Company *Covered Task List for Operator Qualification Program* requirements and with all updates to the Operator Qualifications Program that is outlined in Sub Part N of 49 C.F.R. and Sub Part G of C.F.R. Part 195 where applicable. The Contractor shall utilize ISNetworld for record keeping of individual level qualifications. The Contractor shall ensure that all of its employees are operator qualified for the tasks he/she is assigned to, per the *Covered Task List*, included in Attachment B. Proof of Operator Qualifications must be submitted by Contractor and accepted by the Company prior to starting work.
- 6.48 After a contract has been awarded, the successful Contractor shall provide an Emergency Response Plan to the Company for approval. The plan shall be site specific for each Spread, and will include a response plan for medical and fire emergencies. The plan shall include the availability of an EMT in remote locations. The Contractor shall work with the local emergency response agencies when developing this plan.
- 6.49 The Contractor shall assist Company in preparing, maintaining, and filing of all documentation as required by 49 Code of Federal Regulations, Part 195 and ASME B31.4. The Contractor shall assist Company, as necessary, in the initial post construction DOT audit. All regulatory documentation shall be maintained on-site. The Contractor shall coordinate with Company representative on the assembly of documentation packages.
- 6.50 Contractor shall place orange safety fence in all necessary locations, as indicated Company plans.
- 6.51 Hydro-vac/pot holing to identify existing pipelines on the right-of-way as required by Company; the specific rules of pot holing are as follows:
 - All excavations within 15 feet of an existing Sunoco pipeline must be pot holed every 50 feet and at all Points of Intersection (PIs)
 - All excavations in the common Right-of-Way with an existing Sunoco pipeline must be pot holed every 100 feet and at all Points of Intersection (PIs)

7.0 SPECIFIC REQUIREMENTS

7.1 SURVEY

7.1.1 COMPANY PROVIDED SURVEY

- 7.1.1.1 The pipeline route and the location of valves and other appurtenances are shown

on the Company's construction Drawings furnished by Company and shall be surveyed by Company marked by stakes. Stakes will be set at approximately 200 foot intervals to mark the centerline of the proposed pipeline, survey control monuments, the location of pipe changes, HDD's, weights, valves, the right-of-way limits, temporary work space limits and all points of intersection (P.I.'s), left or right. **Contractor is to verify the location of any and all foreign pipelines and existing Sunoco pipelines and verify the depth and location of any such pipelines and make Contractor's employees aware of the location and depth of any such pipelines prior to excavation.**

7.1.1.2 Company survey crews and/or survey consultants and survey equipment will require access to the right-of-way and established survey monuments during the pipeline construction to determine the "as-built" location of the pipeline within the right-of-way and to record the longitudinal location of each component of the pipeline.

7.1.1.3 Company shall have the right to make minor deviations in the pipeline route and such changes shall in no manner alter the terms of compensation payable under the Agreement.

7.1.2 CONTRACTOR RESPONSIBILITY FOR SURVEY

7.1.2.1 The Contractor shall construct the Work in accordance with the stakes set by Company and shall be charged with full responsibility for conformity and agreement of the Work with stakes.

7.1.2.2 Contractor shall be held responsible for the preservation of all stakes and marks and survey monuments. If any of the stakes or marks or legal bars are carelessly or willfully destroyed or disturbed by the Contractor, its' employees or Sub-contractors, the cost of replacing them shall be borne by the Contractor. Where stakes are removed for clearing, grading, cutting, topsoil removal, to permit equipment to move along the route, or for any other reason, the Contractor shall be responsible for re-establishing the staked line.

7.1.2.3 The Contractor shall perform necessary field surveys for the proper grading of the trench and the bending of pipe, for locating and staking existing underground facilities, and for other pipeline installations except for such field survey Work as is specified to be performed by Company.

7.1.2.4 The Contractor shall cooperate with Company's surveyor in order to provide necessary access for performing "as-built" survey functions and shall take special precautions when working after dark or during inclement weather to ensure the safety of these individuals and their equipment. Where joints of pipe are cut, it shall be the Contractor's responsibility to ensure that the pipe and heat numbers of the parent joint are transferred to the cut end or ends of the parent joint as well as to both ends of all pups resulting from the cutting. Contractor shall be responsible for cost of any unusable pipe.

8.0 REQUIRED NOTIFICATIONS

8.1 The Contractor is required to notify Company's Representative prior to commencing any phase of the Work as detailed in these Specifications and to keep Company's Representative informed regarding the location of all work crews, on a daily basis, as well as immediately notifying Company's Representative regarding Work stoppages or shutdowns. Contractor shall provide Company scatter sheets of Contractor personnel daily and submitted no later than 4:00 PM the day before Work. Company shall provide Contractor scatter sheet sample forms.

- 8.2 The Contractor shall keep Company's on-site staff informed of the location and extent of Work it proposes to attempt daily in order that Company may make arrangements to have sufficient personnel at the Work location to keep pace with the pipe installation operation. Company will not be responsible; however, for any reduction in progress due to the Contractor's failure to keep Company's Representative informed.
- 8.3 The Contractor shall notify, in writing, both Company's Representative and the authority having jurisdiction over any road, railway, canal, drainage ditch, river, foreign pipeline, or other utility, at least 72 hours (excluding Saturdays, Sundays, and Statutory Holidays), or as specified on the applicable permit(s), prior to commencement of pipeline construction, in order that the said authority may appoint an Inspector to ensure that the crossing is constructed in a satisfactory manner. Federal or State Departments of Transportation and Township/County road departments may also require a certificate of insurance from the Contractor specifying certain minimum insurance coverage for Work at road crossing Sites.
- 8.4 Prior to starting any Work in accordance with required notification, the Contractor shall notify all utilities within the area using the respective state's One Call System and by calling direct all Producers, Utilities, utility districts and municipalities not a member of the One Call System.
- 8.5 The Contractor may be required by the Railway Companies to corporately execute an Acknowledgment of Liability to the Railway, Company and to third parties for damage, injuries, and death resulting from the Contractor's operations. The Railway Companies may also require a Certificate of Insurance specifying certain minimum insurance coverage for Work at the railway crossing Sites and that the Railway and Company be named as an Insured. The Contractor shall determine the Railway and be familiar with Company's requirements in advance to avoid unnecessary delays. Contractor shall immediately notify Company's Representative of any instance of non-compliance with these specifications.
- 8.6 The Contractor shall notify Company's Representative upon contract award where ramps across railways will be required for construction access. Application procedures will differ, depending on the railway owner. At no time shall the Contractor contact Railway Companies without first notifying Company's Representative. The Contractor is responsible for all costs associated with traffic control. If Contractor requires railroad crossing ramp the Contractor will be responsible for all costs associated with said ramp.
- 8.7 Contractor shall immediately notify Company's Representative of any spill of a potentially hazardous substance. Refer to the procedures outlined in the Spill Prevention, Containment and Countermeasure Plan ("SPCC").
- 8.8 Contractor shall immediately notify Company's Representative if potentially contaminated soils are encountered.
- 8.9 Contractor shall immediately notify Company's Representative of the discovery of a previously unreported historic property, other significant cultural materials, or suspected human remains uncovered during pipeline construction activities. Contractor shall cease Work at the Site of the previously undiscovered Site until the Company's archaeological consultant had inspected the Site and the Company has determined if the pipeline must be rerouted to avoid disturbance to the Site.
- 8.10 At least 30 working days prior to commencing testing activities, Contractor shall notify Company's Representative of any changes in their detailed test plan regarding intent to appropriate water from, or discharge water to, specific water bodies for the purpose of directional drilling. Contractor will be responsible for acquiring water usage permits and discharge permits if use and discharge points are different than originally permitted.
- 8.11 Contractor shall provide written notification to Company representative 48 hours prior to scheduling

pickup of material from Company's yards.

- 8.12 Contractor shall notify all underground utilities and municipal service providers including, but not limited to, the One-Call prior to performing any excavation activities. Contractor shall be required to present one-call verification numbers to **Chief Inspector** before excavation begins. Following initial One-Call, any updates to the One-Call tickets shall be delivered to **Chief Inspector**.

9.0 USE OF DESIGNATED PUBLIC AND PRIVATE ROADS

- 9.1 All approved access roads and routes, both public and private, and ancillary Sites shall be prepared and maintained by the Contractor. The Contractor, at his sole expense, shall restore State, County, Township, private and access roads, bridges and ancillary Sites to their original condition. This Work shall meet with the approval of the Company and applicable landowner(s) and/or agencies.
- 9.2 Company shall provide the required road use permits for all affected Township, County, and State roads. Contractor shall be responsible for abiding by all road use permits requirements.
- 9.3 Company shall provide all road bonds and pay all fees associated with road bonds. Contractor shall familiarize themselves and comply with all conditions of the road bonds, including any associated restoration. Contractor shall be responsible for all costs associated with performance of the restoration.
- 9.4 Prior to commencement of any transportation activities, Contractor shall perform all transportation analyses and design activities required to ensure safe transport of all project materials.
- 9.5 The Contractor shall ensure that it is aware of all state, county, and township weight restriction by-laws in force and that these by-laws are strictly adhered to and shall procure all hauling permits required for its operation and make arrangements for the movement of pipe, other materials and all equipment on Township/County/State roads with the appropriate Township/County/State officials before hauling commences.
- 9.6 The Contractor shall repair and pay for restoration of any damage done to any road.
- 9.7 The Contractor shall provide vehicle escorts for equipment haul trucks and flag persons where required and shall supply, install and maintain all temporary signs and other devices as required for warning public and private road users of construction activities. Such signs and devices and placement thereof shall conform to the specifications and requirements of the agency having jurisdiction over the crossing. In addition, the Contractor shall comply with all Township, County, and State regulations respecting such devices for the particular Township, County, and State in which the Work is being performed.
- 9.8 The traveled surfaces of roads, streets, highways, (and railways when applicable) shall be cleaned free of mud, dirt or any debris immediately after such material has been deposited by equipment traversing these said roads or exiting from the right-of-way.
- 9.9 Parking of vehicles along public roads shall not be allowed.
- 9.10 Company has obtained permission for Contractor to access the pipeline right of way and Work Sites on some private roads. Contractor must grade and repair with like road base materials all roads damaged as a result of Contractor's use so that such roads are left in a condition as good as or better than the condition to that in which the roads were initially found and/or to the specifications listed in the road use agreements. When crossing a wildlife/gaming fenced area, Contractor will be responsible for creating fencing gap equivalent to the existing fence. Gate security may be required in accordance with the landowner stipulation. A game type camera is required at all cut cross fences; Contractor is required to maintain camera and data.

- 9.11 Contractor should be aware of cattle guards, drainage culverts, bump gates, and gates utilized during access. Contractor is responsible for repair or replacement of such items if damaged by Contractor's operations.
- 9.12 Contractor will be responsible for creating fencing gap equivalent to the existing fence and gate security may be required.
- 9.13 Some gates may require welding securely after construction, specified on landowner line list.
- 9.14 Contractor should be aware that some landowners may require cattle guards installed as specified on landowner line list.

10.0 RIGHT-OF-WAY ACTIVITIES

10.1 Standard RIGHT-OF-WAY and Temporary Work Space Width (typical)

Company will provide a permanent right-of-way and temporary workspace for Contractor's construction operations. Generally the right-of-way (ROW) width for permanent and temporary workspace is shown in the Company's construction Drawings and/or in the "Right of Way Landowner Line List" and/or Web-Based GIS Map.

10.2 Additional Temporary Workspace

Company will provide additional temporary workspace at road crossings, water body crossings, railroad crossings, wetland crossings, and foreign pipeline crossings as indicated on the alignments. The workspace that has been arranged by Company is shown on the Company's construction Drawings and/or in the "Right of Way Landowner Line List" and/or Web-Based GIS Map. Contractor must limit the additional temporary workspace to only the extent that it is needed.

10.3 Right-of-Way Limitations

The Contractor shall also note that work space may be limited wherever physical barriers exist (i.e. trees, buildings, ponds, aboveground structures) or in sensitive areas such as wetlands as described in the Contract Documents, or as shown on the Company's construction Drawings and/or in the "Right of Way Landowner Line List" and/or Web-Based GIS Map. The Contractor shall allow for such partial restrictions and plan its operations accordingly. Any additional cost Contractor anticipates it may incur as a result of reduced workspace in these areas shall be included in Contractor's Lump Sum Lay Price.

10.4 Right-of-Way "Special Conditions"

The "Right of Way Landowner Line List" provided to Contractor provides "Special Conditions" or agreements that control, or at least impact, construction activities including access, ROW, clearing and restoration on a certain tract or group of tracts. Adherence to the "Special Conditions" is a part of Contractor's Work Scope and is included in Contractor's Lump Sum Pricing under Mainline Installation of the appropriate section. The Contractor shall be controlled and bound by any and all provisions or instructions contained in the Construction Drawings and/or in the "Right of Way Landowner Line List" and/or Web-Based GIS Map. Contractor is reminded and advised to review same.

10.5 Right-of-Way Pipeline Construction Specifications

Compliance with the Company's Pipeline Construction Specifications is a part of Contractor's Scope of Work and cost for completing the specified Work is to be included in Contractor's Lump Sum Lay Price. Compliance with "Standard Construction Specifications" is required by the "Right of Way Landowner Line List" and the "Erosion and Sediment Control (E&S) Plan", the following

requirements are common to all tracts: The Contractor shall be responsible for preparing the permanent right-of-way, the temporary workspace and any Site access for construction. This Work preparation includes but is not limited to clearing & removal of timber, brush and stumps, grading where required, erecting temporary fences, gaps and barricades and installing ramps and culverts. The Contractor shall perform the necessary cuts and fills, supplying additional fill material as required.

- 10.5.1 The Contractor shall maintain the right-of-way in a clean, neat condition at all times. At no time shall litter be allowed to accumulate for more than one day at any location on the right-of-way. The Contractor shall provide a daily garbage detail with each major construction crew to keep the right-of-way clear of trash, Waste from coating products, skids, defective materials, rocks and all construction and other debris immediately behind his operations to the satisfaction of Company, landowners, and tenants. Paper from wrapping or coating products or lightweight items such as tobacco products shall not be permitted to be scattered around by the wind.
- 10.5.2 Contractor to install pipeline with a minimum of 48" of cover in all areas with the exception of 60" of cover on all road crossing barrow ditches and creeks or as indicated on permits and stakeholder line list. Cover is measured from top of cut right-of-way grade to top of pipe.
- 10.5.3 The Contractor shall provide required portable restroom facilities for all personnel working on the location.
- 10.5.4 Ingress and Egress for construction is limited to pipeline ROW, public roads and approved private roads specifically provided by Company and shown on Web-Based GIS Map. **Contractor shall not use property-owners private roads without WRITTEN permission from landowner and approved by Company ROW agent or Company representative, verbal approvals are not acceptable to Company.**
- 10.5.5 Contractor shall provide chains and locks for each "construction access gate". Cost of chains and combination locks (limited to one lock per gate) will be included in Contractor's lump sum price. Contractor may remove and keep the locks for future use at the conclusion of final clean-up.
- 10.5.6 Rock construction entrance pads are required, as detailed in Standard Construction Drawings where equipment exits the construction area onto any roads. Tracking of sediment onto any roads is to be prevented. Geotextile fabric will be used beneath these pads to separate the rock from the underlying soils. Unless otherwise directed by Company, all rock and geotextile materials will be removed and disposed of in an approved off-site location after completion of construction activities.
- 10.5.7 Contractor transport and service vehicles parked along the right-of-way shall be located within the boundaries of ROW, so as not to impede progress of the Work, or in any way prevent ready access of Company's Representative, surveyors and third party inspection crews.
- 10.5.8 No clearing, grading or other ground-disturbing construction activities shall occur outside approved, surveyed and flagged or staked right-of-way and temporary extra workspace limits, or outside of pipe storage yards, borrow and disposal areas, access roads and other approved areas, as shown on the Company's construction Drawings and/or in the "Right of Way Landowner Line List" and/or Web-Based GIS Map work areas without prior written approval from Company. **These activities may also require approval from applicable federal and state agencies.** If the Contractor exceeds authorized workspace limits, Contractor is responsible for all costs resulting there from. All costs for damages of any kind or character whatsoever resulting from the use of unauthorized workspace shall

be borne by Contractor.

- 10.5.9 Any activities conducted outside the approved construction right-of-way may result in immediate TERMINATION of the parties involved.
- 10.5.10 Contractor shall be responsible for carefully dismantling and restoring all fencing at any existing fence line, foreign pipeline or utility facilities.
- 10.5.11 All fences are to be "H-Braced" prior to cutting and all temporary fencing and gates must be comparable to existing fencing. Temporary construction fences will be maintained to a condition that insures containment of livestock and exotic game for the duration of construction. Permanent fences and gates shall be constructed in accordance with Company's standard construction Drawings. Gate security is required at all game fences at all times and may be required at all gates as referenced in landowner line list.
- 10.5.12 The Contractor shall minimize the use of the full temporary workspace width to the extent practicable. Where wetlands are encountered, every effort shall be made to minimize the extent of workspace utilization through the wetlands with a view to minimizing the disruption of natural habitat. Temporary workspace may be cleared and prepared to the extent that it is needed to complete the Work.
- 10.5.13 The Contractor shall ensure that construction through livestock grazing and agricultural areas is completed in a manner that minimizes interference or inconvenience to landowners/tenants and their livestock and agricultural operations. Landowner/tenant access to their property shall be maintained at all times including providing openings in the topsoil and spoil piles and leaving ditch plugs across the trench at various locations as necessary for access to water & feed.
- 10.5.14 Certain trees along the right of way are not to be removed or damaged in accordance with right of way landowner line list. Contractor will mark these trees in a manner that his own personnel will know to avoid removal or damage to these trees. Cost incurred by Company as a result of the erroneous damage or removal of an identified tree will be reimbursed by Contractor, including any punitive damages that may be assessed.
- 10.5.15 Clearing of trees, shrubs, and brush shall occur project-wide where necessary within the LOD, unless specifically identified on project plans as restricted from this activity. Clearing of trees (>6 inches in diameter) project-wide is only to occur between October 1 and March 31. If E&S permits are not issued upon notice-to-proceed hand-cutting and felling in place will be allowed between October 1 and March 31, except where noted on project plans.
- 10.5.16 Trees cut or trimmed along the right of way to provide clearance for construction equipment will be trimmed with the proper tree cutting equipment and not broken off with excavation or construction equipment. Contractor will be charged for the cost of trees needlessly damaged during construction.
- 10.5.17 All Trees cut or pushed down and any brush or timber removed during construction of the pipeline by Contractor will be handled in a manner as specified and approved by the landowner(s) and as dictated in the Construction Drawings and/or in the "Right of Way Landowner Line List" and/or Web-Based GIS Map. Brush or timber may be removed from the pipeline ROW by hauling off for disposal by Contractor at a location and in a manner determined by Contractor and approved by Company. Chipping may be performed within the right-of-way but shall not impede restoration and shall comply with all permit conditions. Contractor shall grind all stumps. Burying of stumps and brush on Company's temporary work-space or permanent easement is prohibited. Contractor is permitted to haul merchantable timber from the ROW for sale, unless otherwise specified in the "Right of

Way Landowner Line List". Burning of all debris and or timber may be allowed with landowner permission only and proper permitting.

- 10.5.18 All excavation required for installation of the pipeline will be performed utilizing Top-Soil Segregation spoil placement. Top-Soil Segregation (double-ditch or triple ditch) may be required, full ROW top-soil segregation may be specified in the "Construction ROW Special Provisions" section or environmental permits. Topsoil segregation depth in other areas will be not less than twelve (12) inches. See "PA Notes and Details" for strict specific instructions.
- 10.5.19 Top-Soil Segregation will be employed at all times where cuts in soil banks for conventional installation of creeks, canals, water-ways, roads etc. require banks to be cut for approach or pipe installation. Topsoil will be segregated and placed back on top of the completed backfill.
- 10.5.20 The Contractor shall segregate the entire topsoil layer for the working width of the ROW (if less than 12 inches) or up to a maximum of 12 inches of topsoil (if topsoil layer is greater than 12 inches) from graded areas in the following areas **ONLY**:
- cultivated or rotated croplands, and managed pastures;
 - residential areas;
 - hayfields;
 - wetlands, non-saturated; and,
 - other areas as required by an individual landowner or land managing agency.
- 10.5.21 Topsoil shall be segregated from all other spoil. The methodology used by the Contractor shall be subject to approval by the Company. Any additional topsoil segregation requirements will be identified on the "Right of Way Land Owner Line List". Maintain separation of salvaged topsoil and subsoil throughout all construction activities. Segregated topsoil may not be used for padding the pipe, constructing temporary slope breakers or trench plugs, improving or maintaining roads, or as a fill material.
- 10.5.22 Stabilize topsoil piles and minimize loss due to wind and water erosion with use of sediment barriers, mulch, temporary seeding, tackifiers, or functional equivalents, where necessary per the "Erosion and Sediment Control Plan".
- 10.5.23 Contractor will leave ditch plugs or other means for livestock to travel across ditched areas for access to food and water.
- 10.5.24 No fishing in privately owned ponds; no firearms; no hunting; no pets allowed on Company's Right of Way.
- 10.5.25 No alcoholic beverages and/or 'energy drinks'; and no illegal and/or un-prescribed drugs, allowed on Company's Right of Way.
- 10.5.26 Trench Breakers will be installed on all terraces and steep slopes utilizing polyurethane foam having a minimum two (2) pound density.
- 10.5.27 Rocks 4-inches and larger disturbed by construction of the pipeline will be picked up and disposed of by Contractor at a location that is approved by the Company, except in AG areas where rock 3" and larger shall be removed.
- 10.5.28 Contractor will properly prepare ground and apply seed, fertilizer and agricultural lime to the easement and all temporary workspace area in accordance with specific seed mix and fertilizer specifications if specified by a landowner and listed in the ROW "Special Provisions" or as listed herein. The reseeding specifications shall meet the requirements of the local ASCS office or as required by landowner. Non-vegetated areas shall be

returned to preconstruction condition.

10.5.29 There shall be no smoking within any Company facilities.

10.5.30 There will be a speed limit enforced on the ROW, temporary access roads and permanent access roads of 20 MPH unless otherwise specified by the Landowner Line List.

10.5.31 There shall be no removal of artifacts.

10.5.32 All vehicles are subject to search.

10.5.33 There shall be no non-employee individuals allowed on ROW or Company facilities.

10.5.34 All employees are required to attend Environmental and Safety Training prior to commencement of Work.

10.6 All landowners require a minimum of 48 hour notice before Contractor entry, or as required in any landowner special conditions. Landowner notification will be made by a Company ROW agent, Contractor to provide notification requirements to Company agent a minimum of 96 hours prior to entry.

11.0 ENVIRONMENTAL PERMITS PLAN AND PROCEDURES

11.1 All construction activities shall be performed in accordance with all environmental plans and permits, included in Attachment B.

11.2 Contractor shall install temporary and permanent trench plugs and waterbars in accordance with the E&S Control Plan.

11.3 Prior to construction, the Contractor shall meet with Company environmental consultant to review all environmental concerns. All Contractor's employees and Subcontractors will be required to attend an environmental awareness review prior to any activities on the right-of-way. This orientation will be held daily for new personnel who have not attended the initial meeting. The Contractor's supervisory personnel will be required to attend an environmental orientation prior to construction

11.4 Company will provide Contractor with a copy of the Company's construction permits applicable for the Work. Contractor shall perform the Work hereunder in strict conformance with the Company's environmental permits and Company's environmental compliance plans.

11.5 Contractor will find enclosed within the Bid Documents, Company's Erosion and Sediment (E&S) Control Plan. Contractor shall adopt the E&S Control Plan and comply with all requirements included in the plan throughout the performance of the Work.

11.6 Contractor shall complete for Company's approval ten (10) days before commencement of Work, Attachment D-1 of the Spill Prevention Control and Countermeasures Plan (SPCC Plan), found in the *Construction Environmental Requirement*" Book. Company will provide a generic SPCC plan for Contractor to incorporate as part of their plan.

11.7 The Contractor shall employ its best efforts in accordance with common industry practices to return all areas disturbed during the Work to pre-construction contours, revegetated, and stabilized per the Erosion and Sediment Control Plan, ROW "Special Conditions" and all applicable permits.

11.8 The E&S Control Plan and/or the Environmental permit includes the Environmental details for each typical crossing. The Contractor shall install, maintain and remove temporary erosion and sediment controls as required, and shall include compliance with required erosion and sediment control in

Contractor's mainline installation lump sum price.

- 11.9 The Company Environmental Inspector, in compliance with the E&S Control Plan documents enclosed within these Bid Documents, will provide guidance to Contractor on required erosion and sediment control structures and the Contractor will be responsible for compliance with the E&S Control Plan and Environmental permit.
- 11.10 The E&S Control Plan with attached typical details shall be followed for all open trench "watercourse" crossings.
- 11.11 Open-cut water crossings will be constructed per the Erosion and Sediment Control Plan; methods Contractor to use best judgment as to crossing method and all costs must be included in the base installation price.
- 11.12 The Company shall provide an environmental monitoring inspection staff throughout the construction of the pipeline. The Company environmental inspection staff will verify contractor compliance with all received environmental permits, authorizations, and approved plans, including cultural resources. The Contractor is responsible for adhering to received environmental permits, authorizations, and approved plans and providing environmental crews specialized in the installation of environmental best management practices and project special conditions.

The Contractor shall adhere to the direction and guidance given by the environmental inspection staff. The Contractor shall coordinate and communicate with the environmental inspection staff on a daily basis

12.0 SAFETY

- 12.1 Contractor shall comply with Company's safety requirements as set forth in Attachment F "Company's Safety Procedures", with respect to conduct of its activities on Company's or other's property.
- 12.2 Company will provide Contractor with Company's Safety Manual for distribution to Contractor and its subcontractor personnel upon request.
- 12.3 Contractor shall be responsible for ensuring its personnel and those of its subcontractors have successfully completed safety training required by Company. No Contractor or subcontractor personnel will be allowed on Company's right-of-way without proper safety credentials.
- 12.4 The Contractor shall comply with all of the provisions included in the Company's "Contractor Safety Manual", included in Attachment F. The Contractor shall have a written Fire Protection Plan, and at a minimum shall include the following:
 - Fire Retardant Clothing (FRC) and fire retardant vests as outlined in the "Personal Protective Equipment (PPE)" section above.
 - One designated Fire Watch individual (with spark shield) on the firing line and one with the pipe gang, during all above ground welding or grinding, to be maintained for at least one-half hour after the work is completed.
 - One designated Fire Watch individual (with spark shield) during all trench (tie-in) welding or grinding, to be maintained for at least one-half hour after the work is completed.
 - Provision for two (2) fire extinguishers on hand with the pipe gang.
 - All other Fire Protection and Prevention provisions shall be in compliance with the COMPANY's "Contractor Safety Manual."

13.0 WELDING AND NON-DESTRUCTIVE EXAMINATION (NDE)

- 13.1 Contractor shall utilize Company welding procedures or prepare documented welding procedure(s) for Company review and approval. The final approved welding procedure shall govern the performance of all welds that become a permanent part of the Work. Welding procedure test shall meet the requirements outlined in API Standard 1104, latest edition and approved by DOT Part 195. Use of Company procedures shall not relieve Contractor of any liabilities to perform quality welds in accordance with Company's specifications nor will Company be liable for any delays and/or extra work attributed by Contractor from the use of Company procedures.
- 13.2 Contractor shall perform welder qualification tests in accordance with API Standard 1104, latest edition and referenced by DOT Part 195.
- 13.3 Unless otherwise approved by Company, all procedure and welder qualification tests shall be performed employing the same Company provided material for pipelay Work. Contractor shall be responsible for the preparation of pup pieces for testing.
- 13.4 Contractor shall make available sufficient number of proposed welders/welding operators at the time of qualification testing to allow achieving the required number of Company approved welders within seven (7) working days. Otherwise, Contractor shall be responsible for Company's further inspection and administration cost.
- 13.5 A Company qualified representative must be present during all procedure and welder qualification testing.
- 13.6 All welds and all welding operations shall be completed at the end of each day's production, unless otherwise approved by Company's Representative.
- 13.7 Contractor will provide NDE contractor for 100% inspection of welds and shall provide the necessary transportation along the ROW for NDE Contractor. All welds shall be subjected to 100 percent NDE inspection in accordance with API Standard 1104, latest edition and approved by DOT Part 195 and subject to 100 percent ongoing audit. Contractor is responsible for storage of all records until project is complete, and shall maintain a record of each weld.
- 13.8 CONTRACTOR SHALL FIELD VERIFY ALL MEASUREMENTS.
- 13.9 A qualified welding inspector shall witness all welding of all process, gas transmission, hazardous liquids, or other types of pressurized piping including temporary welds.

14.0 BURIAL AND SPECIFIC CROSSING REQUIREMENTS

- 14.1 The standard minimum cover of installed pipeline is 48-inches all areas, with the exception of 60-inches on road crossings. Cover is measured from top of cut to top of the pipe except for locations where the pipe has weight coating or weights added. In such locations the cover is measured to the top of the weight or weight coating.
- 14.2 The minimum cover in the ROW of most public roads from the lowest point of barrow ditches to the top of pipe in all public and private road crossings is 60-inches. All lease, private, public, township, county, state and federal roads are included.
- 14.3 The minimum cover below road surface at all public road crossings shall be not less than 60-inches or as shown on the Company's construction Drawings and/or in the "Right of Way Landowner Line List" and/or Web-Based GIS Map or any Permit Drawings.
- 14.4 The minimum cover below the base of rail for active railroad crossing shall be as specified on the Permit Drawings or 11-feet minimum below the base of the rail.

- 14.5 Contractor shall install the pipe in all open-cut water crossings with minimum 60-inches of cover.
- 14.6 The minimum clearance between Company's pipeline and foreign pipelines at foreign pipeline crossings shall be 24-inches if open cut, 36-inches if bored, 10-feet if HDD, or the minimum distance required by the foreign pipeline owner/operator, whichever is greater, unless otherwise approved by Company. Contractor will have no recourse against Company for the greater clearance distance required by the foreign pipeline owner/operators.
- 14.7 Where the proposed pipeline crosses or parallels existing foreign pipelines (and/or other utilities) the Contractor shall, prior to ditch excavation, locate them and flag their location. The Contractor shall include all foreign line crossings that are shown on the construction drawings in the base lay price. It is the responsibility of the Surveyor to fill out the COMPANY Foreign Line Crossing Form. The CONTRACTOR shall air bridge all foreign line crossings
- 14.8 The Contractor shall, at its own expense, confirm or determine in advance of actual construction the precise location and actual depth of all utilities and subsurface structures and pipelines that either cross or are in close proximity to the proposed pipeline. Contractor shall report to Company the discovery of any existing pipelines and other facilities not identified by Company furnished Web-Based GIS Map, maps and Drawings.
- 14.9 Contractor is to insure that the ditch is free from any rocks, limbs or any object or discontinuity in the ditch that may damage the coating or pipe wall. Contractor personnel cannot enter the ditch to remove rocks or debris unless the ditch excavation and ingress/egress ramps or ladders meet OSHA excavation standards for personnel entry.
- 14.10 The striking, cutting, damage, modification, destruction, or crushing of drain or irrigation tiles and required repairs associated with such damage in accordance with the Environmental Plans, Landowner requirements, and the terms of the Master Construction Agreement, whether or not such drain or irrigation tiles were known or unknown (mapped or not) at the time of execution of this Agreement.

15.0 PIPE BENDS

- 15.1 Contractor will field bend the new 20" pipe to the extent possible as set forth in Company's Pipeline Construction Specifications.
- 15.2 For the 20-inch and 16inch, at all PI locations less than 25°, a field (cold) bend will be used. At all PI locations 25° or greater, a segmentable elbow shall be used. The Company shall supply a sufficient number of 20-inch and 16-inch 3R segmentable elbows in 45° and 90° increments to be trimmed accordingly for use along the pipeline route.

For bends in excess of those that can be successfully made in the field within Company's specifications, Company has elected to provide Contractor with segmentable elbows or induction bends and are listed on Company's Web-Based GIS Map. The Contractor will be required to transition bevel the bend or the adjoining pipe bevel to within 0.093" of the adjoining line pipe or install a transition piece of pipe. The Contractor will not be granted additional payment if it elects to install additional bends in lieu of field bending. Contractor will provide experienced and skilled workman fully capable of installing such bends as required. Contractor should consider any cost associated and include such costs in the Contractor's lump sum firm offer.

- 15.3 The Contractor shall meet the requirements of ASME B31.4 Figure 434.8.6-2 "Acceptable Butt Weld Joint Design for Unequal Wall Thicknesses." In locations where the wall thickness transition is greater than 3/32", the Company will not supply transition pieces. In these locations, the CONTRACTOR shall cut a 14 to 30 degree taper on the thicker pipe. This includes, but is not limited to, transitions to road crossing pipe, HDD pipe, and facility piping.

- 15.4 Any field bends that do not meet minimum standards after the caliper pig run will be removed and replaced at Contractor's expense.

16.0 HORIZONTAL DIRECTIONAL DRILLS

- 16.1 Company shall review and approve Contractor's HDD plan and any subcontractor or vendor or supplier utilized to perform horizontal directional drills.
- 16.2 Company has determined certain water bodies and other crossings will be installed utilizing Horizontal Directional Drilling (HDD). The crossings shall be installed by HDD and shall be included in the lump sum pricing in the Contractor's submittal form in Part IV.
- 16.3 The Contractor shall perform all necessary One-Calls and notify the pipeline owners prior to any HDD activity in the vicinity of the crossings.
- 16.4 Company will provide 20-inch pipe coated with FBE coating and an abrasion resistant overlay (Powercrete R95) for the specified HDD. Powercrete R95 shall be applied per manufacturer's specification.
- 16.5 Travel through HDD alignments is not allowed in most cases and shall only occur only where designated on HDD drawings.
- 16.6 Implementation of the Inadvertent Return Contingency Plan (Attachment B).
- 16.7 Contractor shall perform a 4-hour pre-installation test at a minimum test pressure of 1850 psig as designated on the HDD drawing or as designated by a company representative. Hauling, transporting, pumping and metering of Contractor supplied water for HDD operation's and pretest of the HDD crossings is the responsibility of Contractor and shall be included in Contractor's lump sum pricing. All Directional Drill crossing water and drilling mud will be properly disposed of in accordance with regulatory and Company rules and regulations and is the responsibility of Contractor and shall be included in Contractor's lump sum pricing. Disposal within the Pipeline ROW is prohibited unless otherwise permitted by the Company.
- 16.8 Contractor is to flock all girth welds for the HDD pipe with FBE and Powercrete R95 coating as per Clause 6.13 above.
- 16.9 Any water body crossings, public and/or private road crossings or other locations not addressed specifically in the pay items of Part IV is to be installed by a method determined by the Contractor and is to be included in Contractor's lump sum price for each segment installation of the pipeline. Should Contractor encounter locations or conditions that Contractor deems would be a candidate for directional drilling, Contractor has the option to install the pipeline using directional drilling techniques, if the required line pipe is available. However, should Contractor decide to employ directional drilling techniques at locations and in situations where Company did not identify directional drilling as a requirement, cost of such directional drilling is at Contractor's expense and must be included in Contractor's lump sum firm offer. Company will not pay additional compensation for directional drilling installation after Contractor's bid is accepted and the construction contract is executed. If Contractor desires to use directional drilling in locations not identified by Company, Company supports Contractor in that decision, however, the cost of the installation on Contractor's lump sum price will be the total amount paid to Contractor for that Pay Item regardless of Contractor's method of installation.
- 16.10 Contractor will be responsible for all sound barriers, if required.
- 16.11 Contractor may be required to adhere to restricted working times in residential/urban areas.

- 16.12 The HDD Contractor shall mark the drill path on the surface with survey fuzz and pin flags for use by the Surveyor for as-built purposes. This can be done during drilling by placing markers when locating the line with a walk over or working the offset from the Tru Tracker wire.
- 16.13 The Contractor shall send a pig with a sizing plate of the correct size through the HDD following pull back.

17.0 PUBLIC ROAD AND RAILROAD CROSSINGS

- 17.1 Company has determined there are Township, County and/or State public, private lease roads that will be affected by this project. For the purpose of the lump sum pricing the road will be bored/installed per the applicable permit requirements. However there may be some private roads, lease roads, field roads, etc. that may require conventional boring based on landowner request. See landowner line list, GIS Web Based Tool or Part IV.
- 17.2 The Contractor shall comply with all state and local traffic control requirements including the development of traffic control plans and the use of warning signs and flagman. In doing so, the Contractor shall hire a Traffic Control Firm (in urban and suburban areas only) to develop a comprehensive Traffic Control Plan. The choice of Traffic Control Firm shall be mutually agreed upon by the Company, the Contractor and the government entity affected. The price associated with providing a Traffic Control Plan shall be included in the pipeline bid but rather will be considered an extra to this Scope of Work.
- 17.3 Company will provide pipe, as shown on the Web-Based GIS Map, coated with FBE coating and an abrasion resistant overlay (Powercrete R95) for the crossings specified to be bored. (Quantities indicated under materials furnished by Company under Attachment C).
- 17.4 The backfill for open cut road crossings shall use Controlled Density Fill (CDF). CDF shall be backfill material which is a flowable, excavatable, self-compacting and self-leveling material, which after solidifying will have the structural characteristics of a well-compacted load bearing soil. The CDF shall be installed to a point to allow two six (6) inch lifts of compacted fill on top of the CDF and the appropriate black top or asphalt thickness to grade. The compaction, type of fill and paving material shall be in accordance to County requirements where the crossing is located.
- 17.5 Boring will extend the full width of the crossing ROW.
- 17.6 Contractor is to flock all girth welds per Clause 6.13 above.
- 17.7 All road, railroad and other non-environmental permits shall be provided by the Company Right-Of-Way group.

18.0 STREAM AND WETLAND CROSSINGS

- 18.1 Contractor shall cross streams and wetlands in accordance with the E&S Control plan and permit restrictions. A listing of stream and wetland crossings is provided in Attachment B.
- 18.2 Wetland and Stream Crossings consist of all work necessary for the complete crossing construction of wetland and stream crossings of the listed as specified in the Contract Documents. This item shall include all mats, single layer, necessary for maintaining equipment and material during the course of work.

19.0 WEIGHT FOR BUOYANCY CONTROL

- 19.1 Contractor shall furnish and install all weights or weight coating required for buoyancy control across water crossings and wetlands as shown on the Construction Drawings and/or Web-Based GIS

Map. The Contractor is ultimately responsible for furnishing and installing all weights which are required to ensure the negative buoyancy of the installed pipeline.

- 19.2 The amount of weight coating or saddle bags used for weighting are specified in the table below:

Pipe Size	Concrete Coating Thickness (in)	Saddle Bag Spacing (ft) Per 5000lb Dry Saddle Bag
Line Pipe: 20", 0.380" Wt.	3.5	20
Crossing Pipe: 20", 0.456" Wt.	3.0	20
Crossing Pipe: 20", 0.594" Wt.	2.5	30
Line Pipe: 16", 0.375" Wt.	2.5	35
Crossing Pipe: 16", 0.438" Wt.	2.0	40
Crossing Pipe: 16", 0.562" Wt.	1.5	65

20.0 HYDROSTATIC TESTING

The following MUST be done before any test water is introduced into the system or any dewatering takes place:

- 20.1 The Contractor shall include a minimum of two (2) cleaning pig runs per hydrostatic test section prior to filling the pipeline with water for the hydrostatic testing.
- 20.2 The Contractor shall use Sunoco Construction Specifications procedures and forms.
- 20.3 The Contractor shall hydrostatically test the pipeline for a minimum stabilized test pressure of eight (8) hours to a minimum of % of MOP ($1.25 \times 1480 \text{ psig} = 1850 \text{ psig}$) at all points along the pipeline route.
- 20.4 The Company shall provide a hydrostatic test target pressures and elevation profiles. The Company shall provide the Contractor a site specific Hydrostatic Test Plan, as provided in Attachment B. The Company shall provide the water source. The Contractor shall be responsible for all documentation per CFR Title 49, Part 195.
- 20.5 Dewatering will be conducted through permit approved discharge structures. The Contractor shall comply with all governing authority rules and regulations, and the applicable Permits and Restrictions. The contractor shall comply with the environmental specifications.
- 20.6 The Contractor shall hydro test pipe for HDDs prior to pull back in accordance with Sunoco Specification PR-11-0004 which can be found in Attachment B. Contractor is responsible for providing the test water for these tests. The water will be recycled between tests. Contractor is responsible for transporting this water from test to test. The water can be discharged at the designated sites for the mainline hydro test.
- 20.7 The Contractor shall supply all Frac tanks, hoses, pumps, valves, fittings, plugs, necessary discharge piping, etc. necessary for the hydrostatic test, as part of the hydrostatic test cost. The Contractor shall provide all other instruments and equipment necessary to monitor and document the pressure test (i.e. dead weights, pressure & temperature recorders, valves, pumps, etc.).
- 20.8 The Contractor shall also provide documentation regarding the valid / current calibration of the test equipment. This documentation is listed in Sunoco Logistics Specification PR-11-0004. The Contractor will provide a designated individual solely responsible for coordination and providing all documentation to the Company or designee.

- 20.9 Hydrostatic test water shall be drawn only from hydrostatic permit approved sources or obtained from Contractor identified approved offsite providers. The Company will be allowed to test offsite provided hydrostatic test water in accordance with Company requirements and specifications. Discharge must be tested and returned to the source or an approved discharge location and in accordance with the stipulations identified within the Company obtain applicable Hydrostatic Discharge Permit. Discharge must be filtered as per Permit requirements.
- 20.10 Contractor is responsible for filling line with water, air removal, testing, de-watering, and drying as outlined in Company's Pipeline Construction Specifications, latest edition. Contractor is responsible to complete these tasks in accordance with all permits and engineering requirements.
- 20.11 Contractor to provide all temporary materials required for fabricating temporary pig launchers and receivers and shall fabricate and install temporary pig launchers and receivers, test headers, and supply all other temporary materials and all equipment, which includes, but may not be limited to fittings, valves, pigs, calibrated recorders and dead weights, hoses and enclosures with 3rd party certification of all test documentation necessary to complete all required testing of the completed pipeline. On all temporary test headers and/or temporary traps the MTR's must be supplied and on Site as well as all welds shall be x-rayed and MT on Site
- 20.12 Contractor shall, test an additional 180 feet of each line pipe and 180 feet of bore pipe, which includes but may not be limited to test headers on any additional items to test these joints within the pipeline hydrotest.

21.0 RECORDS

- 21.1 Pipeline Safety Regulations and Regulatory Agency's regulations require that Company preserve certain records. Contractor shall cooperate with development and documentation of records as requested by Company's Representative.
- 21.2 Contractor shall keep and furnish complete records of all phases of the testing program.
- 21.3 Contractor shall record and maintain a log on a daily and monthly basis of water used for horizontal directional drills (if utilized).
- 21.4 HDD documentation, profiles, charts, etc. shall be submitted in an AutoCAD 2010 or later version file within fourteen (14) days of completion of successful drill and pull back.
- 21.5 Contractor shall record and provide Company's Representative, the date, time, location, total volume, maximum rate, and methods of all water discharged to the ground or surface water in association with trench dewatering.
- 21.6 Contractor shall provide Company's Representative with copies of Material Safety Data Sheets (MSDS) for all chemicals used during construction of the pipeline.
- 21.7 Hazardous waste manifests will be provided to Company's Representative on a weekly basis or as appropriate.
- 21.8 Contractor shall provide an electronic (Latest Edition of AutoCAD) as-built report for each horizontal directional drill.
- 21.9 Contractor shall provide Company with a copy of all records and inspection reports required by the Erosion and Sediment Control Plan.
- 21.10 Contractor shall remove seed labels, as each bag is emptied, and submit the labels to Company's Representative at the time of seeding.

- 21.11 Contractor shall complete a caliper survey report detailing the time and activities for completing the caliper surveys. The report shall include a summary review/analysis of all findings and/or actions resulting from the caliper survey.
- 21.12 Contractor shall provide written acknowledgement from appropriate Township/County/State road and bridge authorities acknowledging their satisfaction with conditions of roads and bridges after movement of equipment by Contractor as a condition of retainage payment.

22.0 DOCUMENTATION

The CONTRACTOR shall note that certain documentation, submittals, and reporting requirements are required by this General Scope of Work. These shall include, but not be limited to:

Key Milestone Schedule (within 7-Days of signing the Agreement)

The CONTRACTOR shall prepare and submit to the COMPANY within 7-days after signing the Agreement, a Key Milestone Schedule detailing all phases of the Scope of Work. This schedule shall be prepared using either Microsoft Excel ®, Microsoft Project ®, or other COMPANY approved software and shall outline key milestones within the execution of the Scope of Work, including but not limited to, mobilization, key construction steps, hydrostatic testing, final tie-ins, commissioning, final clean-up and demobilization.

Weekly 3 Week Look-Ahead Schedule (Weekly as Agreed Upon)

The CONTRACTOR shall prepare and submit to the COMPANY a Weekly 3 Week Look-Ahead Schedule showing the activities planned, manpower requirements, and any other special requirements including, but not limited to, permits, material receipts, material shortages, etc. for the upcoming 3 week period. The 3 Week Look-Ahead Schedule shall be submitted on a day and time agreed upon between COMPANY and CONTRACTOR, throughout the performance of the work.

Weekly Progress Report (Weekly as Agreed Upon)

The CONTRACTOR shall prepare and submit to the COMPANY a Weekly Progress Report showing the scheduled progress versus actual progress from the previous week, including an itemized breakdown of the percent complete of key milestones within the execution of the Scope of Work as detailed by the initial Key Milestone Schedule. The Weekly Work Schedule shall be submitted to the COMPANY on a day and time agreed upon between COMPANY and CONTRACTOR, throughout the performance of the work. The COMPANY shall use these reports for progress tracking and documentation of the project.

Unpriced Copies of Purchase Orders (within 3-Days of Order)

The CONTRACTOR shall submit to the COMPANY un-priced copies of purchase orders for all CONTRACTOR'S furnished equipment and materials within 3-days of their purchase.

Hydrostatic Test Procedure (1-Week Prior to Hydrotesting)

The COMPANY shall submit a detailed hydrostatic test procedure to the CONTRACTOR. This procedure is outlined in the Sunoco standards.

Hydrostatic Test Records (within 24-hours following test)

The CONTRACTOR shall submit to the COMPANY all required hydrostatic test charts and test logs within 24-hours following completion of the test. When approved by the COMPANY, a complete package must be submitted by the CONTRACTOR within 2 weeks. Dewatering may NOT take place prior to approval of the hydrostatic test by the COMPANY. The hydrostatic test results shall include at a minimum: original hydrostatic test chart recorder wheel (with the following info on the front: signature of both the inspector and the test technician, name of the hydro test COMPANY, date, start and end points / location / name of piece(s) or part(s) being tested), the hydrostatic test equipment calibration certification, and the hydrostatic test technician operator qualification / certification.

As-Built Red Line Mark-Ups of Construction Drawings (within 2-weeks after completion)

The CONTRACTOR shall be responsible for maintaining an updated and accurate set of red lined drawings (for both the pipeline and the stations) during the execution of the Scope of Work. Red lined information shall include, but not be limited to, dimensional information for piping fabrication, depth of cover, orientation, materials, tag numbers, etc. Progress red line drawings shall be submitted to the COMPANY with each invoice. A completed clean and legible set of the red lined drawings shall be submitted to the COMPANY within 2-weeks following completion of the work as a record of the work performed and use in preparation of As-Built Drawings.

23.0 CONSTRUCTION OVERSIGHT

The CONTRACTOR shall be responsible for all construction oversight services as required in execution of the Scope of Work, including but not limited to, the following:

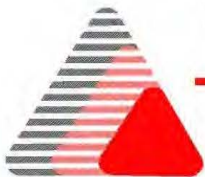
- Designated Construction Manager: The Contractor shall designate a full time, competent individual to serve as construction manager for the performance of the Work. This individual shall have full authority to act on behalf of the Contractor including, but not limited to, the authority to supply additional labor or equipment, procure materials and services, and make scheduling decisions as necessary for the execution of the Work.

The Contractor may not replace the individual designated as Construction Manager without prior consent of the Company. This is intended to ensure consistency and continued progress within the execution of the Work.

- Designated Construction Materials Manager: The Contractor shall designate a full time, competent individual to coordinate with the designated Materials Management Company, acting on behalf of the Company. This individual shall have full authority to act on behalf of the Contractor including, but not limited to, request for material release on the behalf of the Contractor, planning for materials needs for a 2 week look-ahead period, material inspection upon receipt by Contractor, and submitting all material rejections within a period of 2 weeks.
- Designated Hydrostatic Test Document Coordinator: The CONTRACTOR shall designate a full time, competent individual to coordinate all of the documentation necessary for all hydrostatic tests. This individual shall have full authority to act on behalf of the CONTRACTOR including, but not limited to, collection and organization of all documentation listed in the Sunoco Logistics – Construction and Maintenance Checklist and Sunoco Specification PR-11-0004, Pressure Testing of US DOT Part 195 Regulated Pipelines. This individual shall coordinate directly with an engineer designated by the COMPANY a minimum of 5 business days prior to the scheduled hydrostatic test.
- Designated Safety Officer: The Contractor shall designate a full time, competent individual to serve as safety officer for the performance of the work. The Contractor shall provide one safety officer per Spread.
- Designated Document Control Manager: the Contractor shall designate one or more full time document control individual(s) to manage and coordinate all construction document changes and updates to SharePoint. This individual shall be the interface between the Contractor and Company.

Exhibit SPLP MG-9

SPLP
MG-9



TRICO Surveying & Mapping, Inc.

441 West Gourley Pike, Bloomington, In 47404

Phone: 812-330-7030

Fax: 812-330-7035

Web: www.tricosurveying.com

October 7th, 2013

Scope of Work

PROJECT: Mariner East 2, Segments 2 & 3, 250 Miles of Centerline Survey

PROJECT OVERVIEW

- GPS Centerline survey of approximately 250 miles.
- It is expected that most of the 250 miles will be paralleling an existing Sunoco pipeline.
- Road and railroad profiles are not included in the first phase (Oct. 15th-Dec. 23rd, 2013). The road profiles and permit drawings will begin January, 2014.
- Proposed schedule for completion of Centerline survey (200' corridor), Oct. 15th-Dec. 23rd, 2013.

LOCATION OF EXISTING PIPELINE

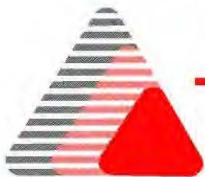
- The centerline of the existing Sunoco pipeline will be located, marked, and captured, (GPS coordinates) at intervals of 200' and at all P.I.'s. Also, an electronic depth will be taken and recorded. If there are any other pipelines that are adjacent to the Sunoco line, they will be located, marked, and captured at intervals of 500', but **without** electronic depths.

CONTROL NETWORK

- Horizontal and Vertical control will be established utilizing Rapid Static sessions. All primary control points will be set in pairs every 4 miles with intermediate control to be set from the primary control in between the 4 mile sections as needed. Control points will be a 5/8" rebar X 2' long, and will have a cap identifying it as a control point. The control point results will be processed utilizing OPUS, through the online NGS website. Control points will be set at roads near route crossings, and will be set in the road right of way, as to not encroach on land owners.

CENTERLINE SURVEY

- Surveyors shall capture centerline data every 200', or where there are P.I.'s, crop changes, significant changes in terrain, and anywhere that may be pertinent to construction of the proposed pipeline.



TRICO Surveying & Mapping, Inc.

441 West Gourley Pike, Bloomington, In 47404

Phone: 812-330-7030

Fax: 812-330-7035

Web: www.tricosurveying.com

- Also to be captured are above ground features, streams, water bodies and apparent property monuments within the 200' survey corridor.
- A feature and attribute code list will be utilized to identify GPS data captured. We can provide one with your approval, or the client can provide one if available.
- All data captured will be sent to the client in a CSV format, along with all field notes that are to be recorded during survey. Data and notes will be sent daily, via email or ftp.

MAPPING

- Property "sketches" will be completed as data from field survey becomes available. Sketches will be completed within 5 days of receiving data from field.
- Road and Railroad permit drawings are to begin January, 2014, and will be completed as data from road profiles is received. The field survey work for the permit drawings, (road profiles) will begin in January, 2014 also.

NOTE: Trico is available to provide any additional mapping services including but not limited to: Alignment sheets, E & S drawings, Open house maps, condemnation survey plats, etc.

Exhibit SPLP MG-10

SPLP
MG-10



ENERGY TRANSFER

Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

Hazardous Liquids Pipeline Shutdown and Startup

Code Reference :	Procedure No.: HLI.01	
49CFR: 195.402	Effective Date: 04/01/18	Page 1 of 12

1.0 Procedure Description

This Standard Operating Procedure (SOP) establishes requirements for starting up and shutting down any part of the pipeline in a manner designed to assure operation within the MOP limits prescribed by this SOP, plus the build-up allowed (110%) for operation of pressure-limiting and control devices.

2.0 Scope

The SOP includes procedures for startup and shutdown of liquid pipelines.

3.0 Applicability

This SOP applies to liquid pipeline facilities to assure operation within proper pressure ranges.

4.0 Frequency

As required: For the startup or shutdown of liquid pipeline facilities.

5.0 Governance

The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Operations Manager	Director of Operations

Hazardous Liquids Pipeline Shutdown and Startup

Code Reference :	Procedure No.: HLI.01	
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6.0

Terms and Definitions

For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

7.0

Hazardous Liquids Pipeline Shutdown and Startup

Working closely with Liquids Control, Operations Personnel use this SOP to verify that startup or shutdown of a liquid pipeline does not result in pressures above Maximum Operating Pressure (MOP) plus the build-up allowed (110%) for operation of pressure-limiting and control devices. This procedure contains the following sections:

- Shutdown and Startup Plan
- Selection of Flare or vent location if applicable
- Shutdown Procedures
- Requirements for Controlled Intentional Releases
- Startup Procedures



NOTE: Document each occurrence when a pipeline segment MOP is exceeded as a result of a startup or shutdown activity using *SOP HLA.13 Recognizing and Responding to Abnormal Operations*.

Shutdown and Startup Plan

For normal operating conditions, Operations Personnel develop a pipeline shutdown and startup plan prior to depressurizing or pressurizing a pipeline segment.



NOTE: If the intention is to depressurize the pipeline, prior to shutdown **CONSULT** with Pipeline Integrity Group to review the anomaly data to determine whether smart tool indications that are scheduled for future remediation will be in the shutdown section, and if indication should be investigated, remediated, and/or repaired during the shutdown.

Hazardous Liquids Pipeline Shutdown and Startup

Code Reference :	Procedure No.: HLI.01	
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WARNING: Prevent pressures in a pipeline segment from exceeding its MOP during startup or shutdown. Take into account the variations in elevation for the length of the pipeline. Take immediate action to correct the situation if it does occur. Refer to *SOP HLA.12 Safety-Related Condition Reporting* and *SOP HLA.13 Recognizing and Responding to Abnormal Operations* for potential abnormal operations reporting requirements.

Step	Activity
1	PREPARE site-specific shutdown or start up work-plan when applicable, VERIFY liquids are sent to flare, recirculated back into the system, or vented within appropriate limits.
2	VERIFY that the work-plan has detail and contents adequate for the particular pipeline segment and operating conditions.
3	BASE the work-plan on maintaining pressures at or below the segment MOP. REVIEW input and delivery points to verify all sources of liquids have been considered.
4	MAINTAIN pipelines above vapor pressure of the product to prevent vaporization, unless the intent is to evacuate the pipeline.
5	EVALUATE complexity. CONSIDER such things as the number of people involved, sequence of valve operations and what effect the operation may have on customers. INCLUDE visual aids, such as maps, drawings or sketches, in the work-plan when helpful.

Hazardous Liquids Pipeline Shutdown and Startup

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Step	Activity
6	REVIEW the work-plan with all personnel involved in the operation, including Liquids Control, prior to making any pressure changes and outages. VERIFY that each person involved knows their responsibility, who is in charge, and what to do if pressure limits are exceeded.
7	VERIFY valves to be used are in working condition.
8	REVIEW the work-plan with the Environmental Department as necessary to determine if federal or state reporting requirements apply or if there are environmental restrictions that may affect the operation.
9	If abnormal operations arises during implementation, TAKE corrective action. REFER to <i>SOP HLA.13 Recognizing and Responding to Abnormal Operations</i> .
10	VERIFY that Liquids Control is kept advised of progress or changes in schedule.

Use the table below to select a flare or vent location.

Selection of Flare or Vent Location



NOTE: Crude Oil Pipeline Operations will require drain lines to containment.

Step	Activity
1	When selecting flare / vent locations, consideration should be given to the safety of public and employees. CHOOSE a location suitable to minimize the

Hazardous Liquids Pipeline Shutdown and Startup

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	impact to the environment and the public. MONITOR for flammable or toxic vapors as appropriate.
2	TAKE steps to prevent accidental ignition, noting especially the location of overhead power lines.
3	CONSIDER access for special equipment to be used such as flares, diffusers, liquid separators, and absorption units.
4	CONSIDER the possibility that liquids may be entrained in the vapors.

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7.3 Shutdown Procedures

Once the work-plan has been prepared, Operations Personnel use the following guidelines to shutdown the pipeline segment.

Step	Activity
1	MAKE appropriate notifications.
2	SHUTDOWN pump stations or injections associated with the section to be shutdown according to local procedures.
3	ISOLATE section as appropriate, including tie-ins. UTILIZE Lockout Tagout Procedures as appropriate. Refer to <i>HLB.06 Hazardous Energy Control (Lockout Tagout)</i>

7.4 Requirements for Controlled Intentional Releases

Prior to flaring / venting of vapors, Operations Personnel should utilize the following guidelines:



NOTE: Crude is not considered a HVL according to PHMSA's definition.

Step	Activity
1	NOTIFY the following agencies, officials, and persons, if applicable, at least 24 hours in advance of the flare or venting.

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Step	Activity
	<ul style="list-style-type: none"> Emergency coordinators which are located within a 10 mile radius of the flaring or venting site. State police which are located within a 10 mile radius of the flaring or venting site. Local fire officials (city and county fire departments). Residents located within close proximity to the flaring or venting site (minimum of 300 ft.). Aerial Patrol Pilot The Federal Aviation Administration – see FAA contact list in Appendix B. <p>Liquids Control will NOTIFY other pipeline companies in the general area.</p>
2	PROVIDE information concerning the flaring or venting of vapors, such as location, time, product and duration in the notification.

7.5 Startup Procedures

Once the work that required the shutdown has been completed and the line is ready to be returned to service, follow the purge and pack procedures that were prepared during the planning of the job. Refer to *SOP HLB.03 Purging*.

- During the shutdown and startup, **MONITOR** pipeline pressure until steady state pressure and flow conditions are reached to assure operation within MOP limits.

Step	Activity
1	MAKE appropriate notifications. Before purging, once again make all the notifications required above in Section 7.4, Requirements of Liquid Releases

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2	PRIOR to purging and/or packing, CONSIDER disarming automated shutdown controls to PREVENT unintentional errant valve closures.
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NOTE: If the shutdown did not require evacuation of the liquids in the pipeline and the line was shut in with a positive pressure and that positive pressure was continuously maintained, purging will not be required prior to repacking the line.

Step	Activity
3	PURGE & PACK the line segment according to <i>HLB.03 Purging</i>
4	REMOVE lockout tagout, return all valves to their normal operating position per local procedures.
5	STARTUP pump stations or injections associated with the section to be started according to local procedures.
6	RE-ESTABLISH automated shutdown controls previously disarmed.
7	NOTIFY Liquids Control that the pipeline is back in normal operating configuration.

8.0

Documentation Requirements

Record data in electronic database or utilize the following form(s) as applicable:

A file for retaining records of pipeline startup and shutdown activities.

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If there is a work-plan, retain a copy of the work-plan for three (3) years.

Use a Company approved application for documenting the activities

9.0

References

HLA.12 Safety Related Condition Reporting

HLA.13 Recognizing and Responding to Abnormal Operations

HLB.03 Purging

HLB.06 Hazardous Energy Control (Lockout Tagout)

Appendix A: OQ Task Requirement

The table below identifies the Operator Qualification (OQ) task requirements.

Task Description	OQ Task
Operating Pipeline Valves	PLOQ007
Start-up / shutdown of pipeline / facilities to assure operation within MOP	PLOQ601

Appendix B: FAA Contacts

The table below identifies the Operator Qualification (OQ) task requirements.

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FAA Air Traffic Control Center - Sectors and Contact #'s



Hazardous Liquids Pipeline Shutdown and Startup

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	Air Traffic Control Center	Contact #
ZAB	Albuquerque	505-856-4500
ZAU	Chicago	630-906-8341
ZBW	Boston	603-879-6655
ZDC	Washington	703-771-3470
ZDV	Denver	303-651-4248
ZFW	Fort Worth	817-858-7504
ZHU	Houston	281-230-5560
ZID	Indianapolis	317-247-2242
ZJX	Jacksonville	904-549-1537
ZKC	Kansas City	913-254-8504
ZLA	Los Angeles	661-265-8205
ZLC	Salt Lake	801-320-2560
ZMA	Miami	305-716-1588
ZME	Memphis	901-368-8234
ZMP	Minneapolis	651-463-5580
ZNY	New York	631-468-1080
ZOA	Oakland	510-745-3331

**Hazardous Liquids
Pipeline Shutdown and
Startup**

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ZOB	Cleveland	440-774-0312
ZSE	Seattle	253-351-3520
ZTL	Atlanta	770-210-7622

Instructions/Guidelines

- Call the appropriate FAA/Air Traffic Control Center and ask that a Temporary Flight Restriction (TFR) be issued for a scheduled gas release. Recommend this to be a minimum of 1 mile radius and a minimum of 2000 feet above the ground if possible. Large gas releases may require larger TFR's.
- Provide GPS coordinates of the location in deg., min., and seconds (i.e. – N30 03 59, W095 32 51)
- Provide the date and estimated time frame for the TFR (i.e. – May 6 from 8:00 am – 3:00 pm local time). Recommend asking for enough time in case the gas release is delayed.

**Standard Operating Procedures***Applicable to Hazardous Liquids Pipelines and Related Facilities*

Code Reference :	Procedure No.: HLI.05	
49 CFR: 195.214, 195.228, 195.230, 195.234, 195.422	Effective Date: 04/01/18	Page 1 of 17

1.0 Purpose This Standard Operating Procedure (SOP) establishes the requirements for repairing pipelines when the strength of the pipe has been reduced by corrosion, mechanical damage, weld defects, material defects, or other injurious defects per *SOP HLI.06 Evaluating Pipeline Defects*.

2.0 Scope This SOP determines and describes the appropriate repair methods, based on pipeline defects, required to verify the continued integrity of the pipeline.

3.0 Applicability This SOP applies to regulated company pipelines requiring repair.

4.0 Frequency As required, including failures, leaks, pipeline damage, or wall loss without leaks are discovered.

5.0 Governance The following table describes the responsibility, accountability, and authority of the operations.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Operations Manager / Manager of Pipeline Integrity	Vice President of Pipeline Integrity

6.0 Terms and Definitions Terms associated with this SOP and their definitions follow in the table below. Refer to *SOP HLI.06 Evaluating Pipeline Defects* for additional terms and definitions associated with this SOP not covered in the table below. For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

Terms	Definitions
Alternative Repair	Any method approved by the Pipeline Integrity Group or QA/QC Group that is not covered under a specific category. This may include new methods not known at the time the SOP was written, other repair methods not normally used except under special circumstances, or any method not specifically stated as acceptable for a given type of defect.

Code Reference :	Procedure No.: HLI.05	
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Terms	Definitions
Composite Sleeve	A full encirclement repair consisting of composite layers such as fiber glass or carbon fiber that adhere with an epoxy.
File Repair	Removal of a defect, or of the detrimental aspects of a defect, through the use of a hand held file.
Force Screw Type Leak Clamp	An apparatus consisting of a band that encircles the pipe and a cone point on a screw. The screw is tightened forcing the cone into the pipe, sealing a small leak.
Grind Repair	Removal of a defect, or of the detrimental aspects of a defect, through the use of an abrasive disc attached to a power tool.
Pressure Containing Type "B" Sleeve	A full encirclement repair consisting of steel sections designed to fit over the carrier pipe. The sections are welded to each other and the ends are then fillet welded to the carrier pipe such that the sleeve is capable of containing any material or pressure that leaks from the pipe.
Pressure Reinforcing Type "A" Sleeve	A full encirclement repair consisting of steel sections designed to fit over the carrier pipe. The sections are welded to each other on either side. The ends are not fillet welded to the carrier pipe.
Pumpkin (Type C)	A full encirclement repair consisting of steel sections designed to fit over the carrier pipe and a raised feature such as a weld or coupling. The sections are welded to each other and the ends are then fillet welded to the carrier pipe such that the sleeve is capable of containing any material or pressure that leaks from the pipe. This is one type of sleeve covered in Specialty Steel Sleeves.
Weld Reinforcement Sleeve	A full encirclement repair consisting of steel sections designed to fit over the carrier pipe and a raised feature such as a weld.
Split Sleeve Bolt-On Clamp	A full encirclement repair consisting of two steel halves held together with a series of bolts.
Stress Concentrator	Any sharp feature or linear indication that can increase the amount of stress at a localized point.
Weld Pad	A steel encirclement sleeve added at pipe supports to prevent vibrations and movements from damaging the carrier pipe.

7.0 Pipeline Repair

This SOP contains the following sections:

- Defect to Repair Correlation
- Replacement of Pipe Section
- Grinding and Filing
- Split Sleeve Type Bolt on Clamp
- Force screw Type Leak Clamp
- Repairs Using Welded Encirclement Sleeves
- Welded Encirclement Sleeves: Specialty Steel Sleeves
- Composite Reinforcement Repairs

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WARNING: Operations Personnel shall take **IMMEDIATE** steps to protect the public from hazardous leaks or failures, and to repair any pipeline in which damage or imperfections are found that could affect the serviceability or safe operation of the pipeline.



CAUTION: If an immediate repair cannot be made, the segment of pipeline is to be removed from service, or the pressure reduced to a safe level based on the remaining strength of the segment until temporary or permanent repairs can be made.



NOTE:

- Follow all excavation and repair pressure reduction requirements per *SOP HLI.11 Pipeline Pressure Limit Criteria*.
- Conduct a pre-job safety meeting to discuss the work procedures prior to commencement of work.
- Refer to *Safety Procedure S-020 Asbestos Removal and Maintenance* before removing coating, if appropriate.
- Clean the pipe to bare metal in the area of repairs.
- Document the type, location, and size of all repairs in the Pipe Inspection Report or Maintenance Record.
- Clean and coat all bare surfaces prior to backfilling.
- Upon completion, Backfill per *SOP HLI.10 Excavation and Backfill* after the coating has cured.
- Submit the project documentation and as-built data to Engineering Records per *SOP HLB.11 Project Documentation and As-Built Process*

**7.1
Defect to
Repair
Correlation**

This SOP contains multiple repair types, each of which is applicable to a number of different defects. Each defect therefore can typically be repaired using one of several methods. The following table can be used to correlate the defects identified by *SOP HLI.06 Evaluating Pipeline Defects* to the correct repair.



WARNING:

- This procedure should only be used as a guideline in the field. If any abnormalities or questions arise, final repair type determination is the responsibility of the Pipeline Integrity Group.
- If multiple types of anomalies interact, confirm the repair methods with a Corrosion Specialist or a member of the Pipeline Integrity Group.
- Verify repairs made in the Company's pipeline systems are made in a safe manner and are made to prevent damage to persons or property.
- The Company may not use any pipe, valve, or fitting, for replacement in repairing pipeline facilities, unless it is designed and constructed as required by 49 CFR 195.

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NOTE:

- Notify Liquids Control regarding all proposed repair work and follow excavation pressure reduction requirements per *SOP HLI.11 Pipeline Pressure Limit Criteria*.
- Only those repair methods listed can be used unless an exception is made by the Pipeline Integrity Group. The repair methods are listed in the order generally preferred by the company such that the first repair listed should be the first type of repair considered. However, this order is not firm and repair methods further down on the list may be used based on other factors and preferences so long as a defect is repaired to an acceptable level.

**7.2
Replacement of
Pipe Section**

Operations Personnel or Company Approved Contractor follows this procedure, before a section of pipe is replaced. Refer to *SOP HLI.01 Hazardous Liquid Pipeline Shutdown and Startup* in conjunction with this SOP.

Step	Activity
1	Operations will DEVELOP and IMPLEMENT a project specific plan for the replacement of pipe.

**7.3
Grinding or
Filing**

Operations Personnel follows the procedures below to make repairs by grinding or hand filing.



WARNING:

- Do not exceed 10% nominal wall thickness removal for the purpose of performing a repair by grinding unless further approval is given by the Pipeline Integrity Group.



CAUTION:

- Prior to performing any grinding, advise Liquids Control of the proposed repair work.
- This section is not intended to be used for weld repair. Refer to the Company's Engineering Standards-Welding, and any other requirements as specified by Integrity Management.
- Do not grind as a means of repair for the following defects:
 - Acetylene weld defect
 - Single submerged arc weld (SSAW) defect
 - Lap weld defect
 - Pre-1970 electric resistance weld (ERW) defect
 - Electric flash weld (EFW) defect that is deeper than the cap

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NOTE:

- If there is a concern regarding the ability to accurately, measure the depth of a defect or the integrity of the pipe at the defect in consideration of a more stringent pressure reduction than outlined in *SOP HLI.11 Pipeline Pressure Limit Criteria* may be employed as directed by Pipeline Operations Specialist.
- Defect characteristics which may impair serviceability include but are not limited to:
 - Sharp edges
 - Stress concentrators
 - Surface breaking linear indications
 - Hard spots
 - Arc burns
 - Gouges

Step	Activity
1	ESTABLISH the actual wall thickness of the pipe in the area to be repaired prior to grinding by means of an ultrasonic procedure.
2	VERIFY the absence of laminations or internal corrosion pits with a compression wave ultrasonic procedure.
3	If in a weld cap, CONSIDER using shear wave ultrasonics to VERIFY the defect does not extend below the weld cap.
4	USE a power-driven coarse abrasive disk or a hand held file for grinding. Typical power equipment includes an angle grinder with a 40 to 80 grit flap or tiger style disc. A pencil-style grinder with ceramic tip may be allowed when access is limited.
5	Begin to REMOVE the defect by moving the grinder slowly across the impairing characteristic. Move back and forth in smooth even strokes to avoid digging into any localized area.
6	Periodically STOP and DETERMINE if the serviceability impairing characteristics have been removed or appear to be worsening. USE magnetic particle inspection (MPI) as necessary.
7	If repairing an arc burn or hard spot, REFER to that section at this time.
8	With an ultrasonic procedure, periodically CHECK the amount of metal removed during the process to ensure the limitation of a safe pressure has not been exceeded.
9	VERIFY that the serviceability impairing characteristics of the defect are completely removed.
10	CONTOUR the area around the defect to provide a smooth transition to meet the surrounding unaffected pipe surface.
11	ORIENT final scratch marks as nearly as possible in the circumferential direction.
12	EVALUATE the defect after grinding using a black-white, wet magnetic particle inspection (MPI) method to verify that no linear indications are present. If linear indications are discovered after reaching the maximum approved repair depth, CONSULT the Pipeline Integrity Group.

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Step	Activity
13	EVALUATE the area repaired by grinding per <i>SOP HLD.47 Evaluation of Remaining Strength of Pipe with Metal Loss</i> in order to establish a safe operating pressure. For defects in dents and welds, REFER to <i>TABLE-01</i> .
14	If the safe operating pressure of the grind repair does not meet the required MOP of the pipeline section, CONSIDER additional pressure reduction and repair.
15	CONSULT the Technical Operations Group to determine any further pressure reductions and repairs per <i>SOP HLI.11 Pipeline Pressure Limit Criteria</i> and this procedure.

7.3.1 Arc Burns & Hard Spots



In addition to the repair guidelines of this procedure, Operations Personnel or Company Approved Contractor employs an additional inspection as outlined below for the repair of arc burns or hard spots.

CAUTION:

- Follow all Steps, Notes, Cautions, and Warnings in the Grinding and Filing section as appropriate in addition to those presented here.
- Ammonium Persulfate, when applied to pipe, leaves a salt residue that can be detrimental to the adherence of pipe coating systems.

Step	Activity
1	EVALUATE arc burns and hard spots periodically during repair with a 20 percent Ammonium Persulfate and distilled water etch.
2	CONTINUE the repair until no darkening occurs after the application of the etch solution or until the maximum depth of repair limits are reached.
3	CLEAN pipe surfaces that have been contaminated with Ammonium Persulfate either by scrubbing with soap and water or by applying an acid wash such as Oakite 33 or Oxalic acid.

7.4 Split Sleeve Type Bolt-On Clamp



Operations Personnel or Company Approved Contractor follows the procedure below for using a bolt on, full encirclement, split sleeve.

NOTE: Bolt-On split sleeve may be utilized on onshore pipelines as a temporary repair only until it is feasible to make a permanent repair.

Step	Activity
1	SUPPORT the pipe with sandbags within four (4) feet of each end of the clamp installation location.

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2	PLACE the clamp around the pipe and tighten the bolts in accordance with the manufacturer's guidelines.
3	RESTRAIN the clamp against any movement or rotation until all bolts have been tightened.
4	MAINTAIN the support of the pipe with sandbags within 4 feet of each end of the clamp and RESTORE the pipeline to the original operating pressure once the repair has been completed.
5	For onshore applications, SCHEDULE for permanent repair.

7.5 Force Screw Type Leak Clamp

Operations Personnel or Company Approved Contractor follows the procedure below for using a force screw type leak clamp.



CAUTION: Do not use a mechanical leak clamp if the pipe section being repaired applies to any of the following locations unless it has been approved as temporary by the Pipeline Integrity Group :

- The repair is made within the right-of-way of a road.
- The pipe section is located in highly populated areas.
- The pipe is located in an HCA.
- The pipe section is located in a cultivated field with the potential for shallow cover.

Step	Activity
1	VERIFY the sealing surface of the clamp is not installed over an area of general wall loss
2	MINIMIZE the disturbance of the coating at the location of the leaking defect.
3	CLEAN the leak area thoroughly to determine the correct size and type of leak repair device and accessory to use on the leak.
4	USE a soapstone or paint stick, MARK the leak device and pipe with matching cross hair lines to VERIFY the leak device is centered over the leak.
5	FOLLOW manufacturer's recommended installation and testing procedures to insure the device is appropriately installed.

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7.6 Repairs Using Welded Encirclement Sleeves

Operations Personnel or Company Approved Contractor shall follow the procedure below when making repairs using welded encirclement Type A or B sleeves.



WARNING:

- Do not weld sleeve ends to the carrier pipe if any evidence of linear indications, laminations, reduced wall thickness, or other defects are discovered at the weld positions.
- Consult with the Pipeline Integrity Group if a linear indication may be covered.



CAUTION:

- Prior to installation of welded encirclement sleeves, Liquids Control should be advised of the proposed repair work and in-service welding.
- Prior to performing in-service welding, contact the QA/QC Group to perform the appropriate analysis in order to minimize the risk of burn-through and / or hydrogen cracking.
- Take care to minimize pipe movement and ensure proper support since the stiffness of the sleeves concentrate any stresses at the ends of the sleeve, especially between sleeves.



NOTE:

- Butt Welded Seam Design–Type B Sleeve is designed with the sides of each sleeve beveled so they can be butt welded to join the two halves together. A groove is made beneath the bevel so that a 1/16" thick steel backing strip can be placed beneath the joint prior to welding while still allowing the sleeve to fit flush against the pipe on either side of the joint. The ends of the sleeve must be fillet welded to the carrier pipe.
- Sleeves made by the company, a contractor, or manufactured sleeves purchased from a third party can be used for this section so long as the integrity is verified and the design is consistent with the applicable Engineering Standard.
- Alternative cleaning methods may be employed with approval of Technical Operations Group.
- Minimum sleeve length is 6 inches unless approved by Technical Operations Group.
- Multiple sleeves may be installed adjacent to one another with the approval of Pipeline Integrity Group and Technical Operations Group. The sleeves must all fit tightly around the pipe, and each sleeve must be supported with sand bags. Type A sleeves do not need to be welded together; however, the sleeves may be welded by either using a butt weld with a backing strip or by fillet welding an external bar around the outer circumference of the sleeves.

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- Do not install two sleeves, with the ends fillet welded, any closer than one pipe diameter from each other unless approved by the Pipeline Integrity Group or Technical Operations Group.
- Only allow 2 adjacent sleeves over a leaking defect, without approval of Pipeline Integrity Group and Technical Operations Group

Step	Activity
1	Prior to installation of welded encirclement sleeves, ADVISE Liquids Control of the proposed repair work and in-service welding.
2	PROVIDE proper support of sleeves and adjacent pipe using sandbags.
3	VERIFY that the encirclement sleeve is designed, tested, fabricated, and installed in accordance with Section ETWM-155 of the Company's Welding Procedures Manual, and any other requirements as specified by Integrity Management. OBTAIN mill test reports and company purchase order numbers for the sleeve material.
4	VERIFY that the sleeve is long enough to cover the defect and extends an additional 2 inches beyond each end of the defect, and the ends (including the HAZ) do not come within 2 inches of another anomaly or girth weld. EXTEND the sleeve as necessary. Refer to the diagram (Figure 1) at the end of this section for clarification.
5	For Type B sleeves, PERFORM magnetic particle inspection (MPI) and zero degree ultrasonic inspections for the full circumference, in a 4" wide strip centered at the proposed sleeve end locations. Refer to the diagram at the end of this section for clarification.
6	REPAIR the new anomaly with an alternate method per Table 1, if a sleeve repair is not sufficient.
7	If necessary TEST FIT the sleeve on the pipe if there are any concerns with proper alignment and fit up. VERIFY that the gaps between sleeve halves or sections are not situated over the defect area.
8	For pipe with a longitudinal seam with a raised weld cap that prevents tight fit-up, REFER to one of the methods listed in the following sub-sections.
9	FILL any deviations from pipe roundness (corrosion, dents, etc.) with a two-part, 100% solids epoxy filler material such as Armor Plate 360 or an approved equal. If a question regarding approved filler material arises, CONSULT with a Corrosion or Integrity Specialist.
10	CONTOUR the filler material to restore the original surface and roundness of the pipe, and to fill voids between the pipe and sleeve. ENSURE contact between the sleeve and defect area for good reinforcement.
11	FIT the sleeve over the pipe; VERIFY a tight fit up such that no unfilled voids are present. TIGHTEN the sleeve for welding using a jack and chains or other appropriate method.
12	VERIFY that any gap beneath the end of a sleeve to be fillet welded to the carrier pipe is no greater than 1/16-inch prior to welding. ADD a small amount of weld metal to the underside of the end of the sleeve prior to installing it on the pipe, if necessary, to obtain proper alignment.

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Step	Activity
13	GRIND and FIT the extra weld material to minimize the gap beneath the end of the sleeve.
14	WELD sleeves in accordance with the company Welding Manual and Procedures.
15	MAKE in-service welding consideration in order to minimize risk of burn through and hydrogen cracking. CONSULT the QA/QC Group.
16	Fully COMPLETE the fillet welding of one of the sleeve ends prior to commencing the welding of the second end.



NOTE:

- For sleeve sizes 14" or larger, two or more welders are required.
- Any one or a combination of adverse conditions can result in an in-service weld susceptible to burn through or hydrogen cracking.

Step	Activity
17	REMOVE by grinding any lugs or attachments applied for lifting.
18	INSPECT all welds in accordance with the company Welding Manual.
19	For Type A Sleeves where seal welding is not performed, APPLY a two-part, 100% solids epoxy filler material to the ends of the sleeve, lap bar sides, and other abrupt edges such as Armor Plate 360 or an approved equal. If a question regarding approved filler material arises, CONSULT with the Corrosion or Integrity Specialist.
20	For leaks ALLOW the Type B sleeve to pressure up and check for leaks after installation and prior to capping the nipple and bottle. SEAL the nipple and bottle with a weld cap after allowing the sleeve to pressure up to test for leakage.
21	VERIFY proper support of sleeves and adjacent pipe using sandbags prior to backfill.

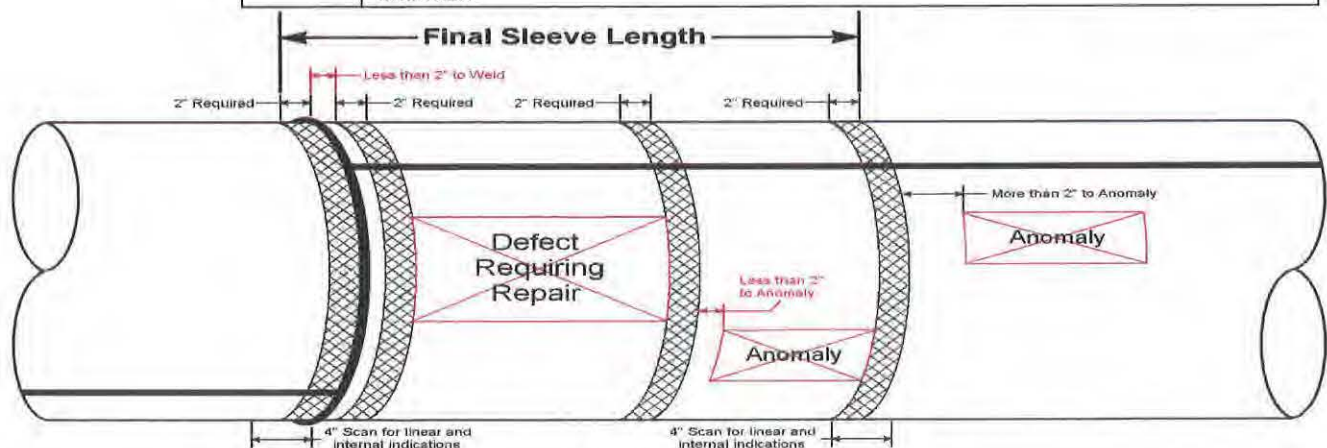


Figure 1

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**7.6.1
Installing
Type “A”
Sleeves Over
Pipe Seams:
Position the
Sleeve with the
Gap Over the
Seam**

Operations Personnel or Company Approved Contractor follows the procedure below when installing Type A sleeves over pipe seams by positioning the sleeve with the gap over the seam. Refer to *Step 17* in the table in *Section 7.6*.



CAUTION: This method can only be used when the defect is at least 3” away from the long seam.

Step	Activity
1	INSTALL a Type A sleeve with the gap between the two sleeve halves positioned along the longitudinal weld seam on the carrier pipe with the external bar spanning the gap. This positioning allows the sleeve to fit flush against the pipe on either side of the seam without having to grind the underside of the sleeve to fit over the weld.
2	INSTALL a three-part sleeve if necessary to ensure that the defect area is in contact with sleeve material. This ensures that the sleeve material, instead of the gap, covers a defect located 180° from the seam weld.

**7.6.2
Installing
Sleeves Over
Pipe Welds and
Seams:
Grinding the
Underside
of the Sleeve**

Operations Personnel or Company Approved Contractor follows the procedure below when installing sleeves over pipe girth welds and long seams by grinding into the sleeve.



NOTE: The QA/QC Group determines the acceptable depth to which a groove can be ground.

Step	Activity
1	GRIND a rounded groove in the inside surface of the sleeve to fit over a longitudinal seam, provided that sufficient sleeve wall thickness remains to meet the company sleeve design guidelines and no sharp corners are created. FOLLOW the acceptable methods described in the following diagram.

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Step	Activity
2	VERIFY a smooth groove with a U-shaped profile has been created, See Figure 2. V-shaped profiles or any other profile with corners in it are not acceptable.
3	USE a two-part, 100% solids epoxy to CONTOUR the weld to the adjacent pipe, and to VERIFY that no voids will exist between the weld and the sleeve.

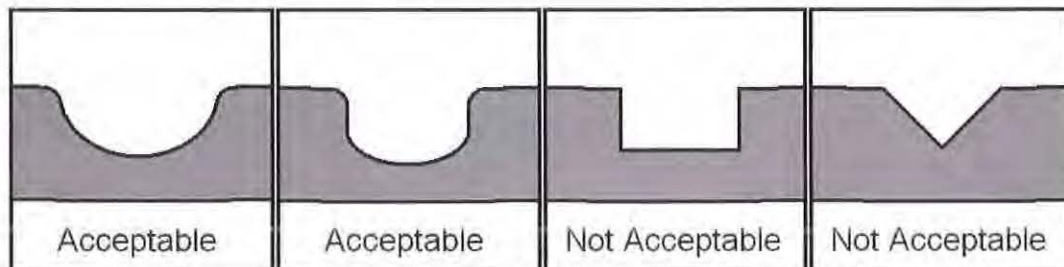


Figure 2: Acceptable Grooves

7.6.3 Installing Sleeves Over Pipe Welds and Seams: Grinding of the Cap

Operations Personnel or Company Approved Contractor follows the procedure below when installing sleeves over pipe girth welds, long seams or helical (spiral) seams by grinding the cap.



CAUTION:

- The Technical Operations Group must provide approval before removal of the weld cap for the purpose of fitting a sleeve.
- Do not grind the longitudinal seam weld on:
 - Pre 1970 or Low Frequency Electric resistance welded (ERW)
 - Single submerged arc welded (SSAW)
- Do not grind flush girth welds being spanned by a sleeve where the weld has not been X-rayed and the X-ray interpretation is acceptable per the latest edition of *API 1104* to verify its integrity. Never grind acetylene girth welds.



NOTE:

- Irregularities in the weld cap may be ground to a profile which is consistent with the remainder of the girth weld as long as the minimum weld cap height and smooth contour called for in the company welding procedures is maintained.
- When the integrity of the weld has been verified and the purpose of grinding is only for sleeve fit up, a more aggressive disc can be used. If preferred a solid ceramic "cutting" disc can be used.

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Step	Activity
1	VERIFY the integrity of the seam using black and white magnetic particle inspection (MPI) and ultrasonic inspection prior to grinding.
2	GRIND the seam such that it is flush for approximately 2" beyond the end of the sleeve. Then angle the grind to reach the original weld cap profile. CONTOUR the weld to remove any sharp edges.

7.6.4 Installing Sleeves Over Helical (Spiral) Seams: Custom Manufactured Sleeve

Operations Personnel or Company Approved Contractor follows the procedure below when installing sleeves over spiral seams welds by using a custom manufactured sleeve.



NOTE: This method can result in a several day delay between the assessment and the repair while a sleeve is manufactured and delivered.

Step	Activity
1	CONTACT the Pipeline Integrity Group with the sleeve length, seam orientation, and outside diameter to find an acceptable sleeve manufacturer, if possible.
2	VERIFY the manufactured sleeve provides a tight fit-up over the defect area.

7.7 Welded Encirclement Sleeves: Specialty Steel Sleeves

Operations Personnel or Company Approved Contractor follows the procedure below when making repairs using a Specialty Steel Repair Sleeve.



STOP: Except for defects within 6 inches of a coupling, bend, or other oddity that prevents the installation of standard sleeves this section (and all "pumpkin" style sleeves) should not be used.



CAUTION:

- This section is limited to manufactured steel repair sleeves that do not adhere to the company standards for sleeve designs.
- Composite repair sleeves such as those made by Armor Plate® or Clock Spring® are covered in a separate section

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NOTE:

- Consult with the Pipeline Integrity Group if any questions or concerns arise about the type of specialty sleeve being used.
- Examples of manufactured steel repair sleeves include, but are not limited to:
 - Pumpkins
 - Sleeves designed to fit over a coupling
 - Sleeves without a straight profile

Step	Activity
1	FOLLOW the steps, warnings, cautions, and notes to install a typical steel sleeve and any other manufacturer instructions.
2	If a coupling or other object is present VERIFY the sleeve has enough clearance to pass over the object and still fit tight at the ends.
3	REFER to any special instructions provided by the Director of Pipeline Integrity for the specific installation.

**7.8
Composite
Reinforcement
Repairs**

Operations Personnel follows the procedure below for performing Composite Reinforcement Repairs. Contact the Corrosion Specialists regarding Composite Sleeve repair option.



WARNING: Composite Repairs shall only be performed with approval from the Director of Pipeline Integrity and only approved manufacturers shall be utilized, which may include:

- Clock Spring Composite Sleeve by Clock Spring Company, L.P
- Armor Plate Pipe Wrap by Armor Plate, Inc.
- Aquawrap by Air Logistics Corporation
- PermaWrap by WrapMaster Inc.
- A+Wrap by Pipe Wrap, LLC



NOTE:

- All composite material repair sleeves are to be installed in accordance with the manufacturer's recommendation.
- All employees and or contractors which are directly participating in the installation of a composite material repair sleeve must be trained and certified by a composite material repair technique certified trainer.
- The composite repair must extend a minimum of two (2) inches beyond each end of the defective area.

Step	Activity
1	FILL all sharp geometry changes such as edges and lips with epoxy (as allowed by the manufacturer) to provide a smooth transition to the pipe and aid in coating.

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2	VERIFY all composite repairs are appropriately identified with magnets or bands for ILI detection.
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8.0 Record data in electronic database or utilize the following form(s) as applicable:

Documentation Requirements

Pipe Inspection Report or Maintenance Record
Project Book (Welding, NDE, Design, Inspectors notes, Etc.)
As-Built Drawings
1.05.D Pre-Job Safety Meeting;

9.0

References

HLB.11 Project Documentation and As-Built Process
HLD.47 Evaluation of Remaining Strength of Pipeline Metal Loss
HLI.06 Evaluating Pipeline Defects
HLI.10 Excavation and Backfill
HLI.11 Pipeline Pressure Limit Criteria
Safety Procedure S-020 Asbestos Removal and Maintenance
Coating Procedures Manual
Company Welding Procedures Manual

**Appendix A:
OQ Task
Requirements**

The table below identifies any Operator Qualification (OQ) task requirements for this SOP.

Task Description	OQ Task
Install mechanical clamps and sleeves -- bolted	PLOQ707
Apply Permanent field repair using composite materials - PermaWrap™ / WeldWrap™ (WrapMaster Products)	PLOQ706A
Apply Permanent field repair using composite materials - PipeWrap A+ Wrap™	PLOQ706B
Clockspring	PLOQ706C
Fabricate and fit-up repair sleeves	PLOQ708
Repair of steel pipe by grinding	PLOQ704
Visual Inspection of Welding and Welds	PLOQ203
Apply composite reinforcement products for repair of mechanically damaged or corroded pipe	PLOQ706

**Appendix B:
Company
approved
Permanent
Repair method**

Code Reference :	Procedure No.: HLI.05	
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DEFECT TYPE AND LOCATION		COMPANY APPROVED PERMANENT REPAIR METHODS (1) (8)					
		Repair By Grinding	Type A Sleeve (9) (11)	Type B Sleeve (10) (11)	Composite Reinforcement (12)	Mechanical Type B Sleeve	Mechanical Leak Clamp (12)
EXTERNAL METAL LOSS ≤ 80% W.T.	Pipe Seam	No	Yes (2)	Yes (2)	Yes (2)	Yes (3) (4)	No
	Girth Weld	No	Yes (2)	Yes (2)	Yes (2)	Yes (3) (4)	No
	Pipe Body	No	Yes (2)	Yes (2)	Yes (2)	Yes (3) (4)	No
	Pipe Bend	No	Yes (2)	Yes (2)	Yes (2)	Yes (3) (4)	No
EXTERNAL METAL LOSS > 80% W.T.	Pipe Seam	No	No	Yes (2)	No	Yes (3) (4)	No
	Girth Weld	No	No	Yes (2)	No	Yes (3) (4)	No
	Pipe Body	No	No	Yes (2)	No	Yes (3) (4)	No
	Pipe Bend	No	No	Yes (2)	No	Yes (3) (4)	No
INTERNAL METAL LOSS ≤ 80% W.T.	Pipe Seam	No	Yes (4)	Yes	Yes (4)	Yes (3) (4)	No
	Girth Weld	No	Yes (4)	Yes	Yes (4)	Yes (3) (4)	No
	Pipe Body	No	Yes (4)	Yes	Yes (4)	Yes (3) (4)	No
	Pipe Bend	No	Yes (4)	Yes	Yes (4)	Yes (3) (4)	No
INTERNAL METAL LOSS > 80% W.T.	Pipe Seam	No	No	Yes	No	Yes (3) (4)	No
	Girth Weld	No	No	Yes	No	Yes (3) (4)	No
	Pipe Body	No	No	Yes	No	Yes (3) (4)	No
	Pipe Bend	No	No	Yes	No	Yes (3) (4)	No
DENTS WITH STRESS CONCENTRATORS OR METAL LOSS	Pipe Seam	No	Yes (5) (2)	Yes (5)	Yes (5) (2)	Yes (3) (4) (5)	No
	Girth Weld	No	Yes (5) (2)	Yes (5)	Yes (5) (2)	Yes (3) (4) (5)	No
	Pipe Body	No	Yes (5) (2)	Yes (5)	Yes (5) (2)	Yes (3) (4) (5)	No
	Pipe Bend	No	Yes (5) (2)	Yes (5)	Yes (5) (2)	Yes (3) (4) (5)	No
PLAIN DENTS	Pipe Seam	No	Yes (2)	Yes (2)	Yes (2)	Yes (3) (4)	No
	Girth Weld	No	Yes (2)	Yes (2)	Yes (2)	Yes (3) (4)	No
	Pipe Body	No	Yes (2)	Yes (2)	Yes (2)	Yes (3) (4)	No
	Pipe Bend	No	Yes (2)	Yes (2)	Yes (2)	Yes (3) (4)	No
(GOUGES) MECHANICAL DAMAGE	Pipe Seam	Yes (13)	Yes (6) (2)	Yes (6)	Yes (6) (2)	Yes (3) (4) (6)	No
	Girth Weld	Yes (13)	Yes (6) (2)	Yes (6)	Yes (6) (2)	Yes (3) (4) (6)	No
	Pipe Body	Yes (13)	Yes (6) (2)	Yes (6)	Yes (6) (2)	Yes (3) (4) (6)	No
	Pipe Bend	Yes (13)	Yes (6) (2)	Yes (6)	Yes (6) (2)	Yes (3) (4) (6)	No
SURFACE BREAKING LINEAR INDICATIONS	Pipe Seam	Yes (13)	Yes (7) (2)	Yes	Yes (7) (2)	Yes (3) (4)	No
	Girth Weld	Yes (13)	Yes (7) (2)	Yes	Yes (7) (2)	Yes (3) (4)	No
	Pipe Body	Yes (13)	Yes (7) (2)	Yes	Yes (7) (2)	Yes (3) (4)	No
	Pipe Bend	Yes (13)	Yes (7) (2)	Yes	Yes (7) (2)	Yes (3) (4)	No
LEAKS	Pipe Seam	No	No	Yes	No	Yes (3) (4)	No
	Girth Weld	No	No	Yes	No	Yes (3) (4)	No
	Pipe Body	No	No	Yes	No	Yes (3) (4)	Yes (4) (14)
	Pipe Bend	No	No	Yes	No	Yes (3) (4)	Yes (4) (14)
WELD FLAWS	Pipe Seam	No	No	Yes	No	Yes (3) (4)	No
	Girth Weld	No	No	Yes	No	Yes (3) (4)	No
WRINKLES (1)	All	No	No	No	Yes	No	No
ARC BURN/HARD SPOT	Pipe Body	Yes (13)	Yes (5)	Yes	Yes (5)	Yes (3) (4)	No
OBSOLETE MATERIALS (1)	All	No	No	No	No	No	No
LAMINATION	Pipe Body	No	Yes	Yes	Yes	Yes (3) (4)	No
	Pipe Bend	No	Yes	Yes	Yes	Yes (3) (4)	No

Table-01 Company Approved Permanent Repair Method

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**Notes for
Table-01**

The following notes apply to the *Table 1*:

1. Pipe replacement should be performed whenever practical, other repairs may acceptable with approval from the Pipeline Integrity Group.
2. A hardenable, incompressible filler shall be used to fill the annular space between the anomaly and the sleeve.
3. Shall only be utilized offshore or within navigable waters.
4. May be utilized on onshore pipelines as a temporary repair until it is feasible to make a permanent repair.
5. Stress concentrators will be removed by grinding prior to installing the sleeve. If no grinding is performed or the stress concentrators are not completely removed, then a Type B sleeve shall be used.
6. The mechanical damage will be removed by grinding to a smooth contour prior to installing the sleeve. If the remaining thickness is less than 20% W.T. after removal, then a Type B sleeve shall be used. If no grinding is performed or the stress concentrators are not completely removed, then a Type B sleeve shall be used.
7. The SCC shall be removed by grinding. If the remaining thickness is less than 20% W.T. after removal, then a Type B sleeve shall be used.
8. Other repair methods may be used provided they are based on sound engineering practices and reviewed and approved by Pipeline Integrity prior to their use.
9. Type A repair sleeves are designed not to be pressure containing and shall only be used on non-leaking defects. The ends of the sleeve shall be sealed to prevent migration of water between the sleeve and the carrier pipe.
10. Type B repair sleeves are designed to contain pressure and/or carry substantial longitudinal stress imposed on the pipeline by lateral loads. The circumferential ends of the sleeve are fillet-welded to the carrier pipe.
11. The design of all Type A and Type B sleeves shall be reviewed by Engineering.
12. Only with approval from the Pipeline Integrity Group and only approved manufacturers shall be utilized.
13. With prior approval from the Pipeline Integrity Group, Grinding is permitted to a depth of 10% of the required wall thickness with no limit on length or; Grinding is permitted to a depth greater than 10% up to a maximum of 40% of the required wall thickness with metal removal confined to a length given by the equation in paragraph 851.42 of ASME B31.8-2003.
14. For isolated through wall pits only

**Standard Operating Procedures***Applicable to Hazardous Liquids Pipelines and Related Facilities*

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1.0 Procedure Description This Standard Operating Procedure (SOP) describes the steps required to consistently characterize and evaluate defects in a pipeline.

2.0 Scope This SOP determines the characteristics of pipeline defects required to verify integrity and necessity for repair or replacement.

3.0 Applicability This SOP applies to the characterization of any defect affecting the integrity of pipeline facilities.

4.0 Frequency As required: Upon discovery of pipeline defects.

5.0 Governance The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Pipeline Integrity Personnel or Corrosion Specialist	Vice President of Pipeline Integrity

6.0 Terms and Definitions Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

Terms	Definitions
Arc burn	A hard spot or gouge caused by the arc of a welding tool or any unknown source.
Constrained Dent	A dent that is not free to rebound or reround, because the indenter is not removed (a rock dent is an example of a constrained dent).
Crack	A fracture type discontinuity in the pipe wall with sharp tips.
Dent	Permanent deformation of circular cross section produces a decrease in diameter and is concave inward.

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Terms	Definitions
Dent involving a weld	Any dent that involves either a longitudinal or girth weld.
Dent with metal loss	A dent with metal loss that is associated with; scratches, gouges, grooves, or corrosion.
Gouges and other metal loss	Scratches, gouges, mill pits, grinding marks
HAZ	Heat affected zone
Lamination	An internal metal separation that creates layers in the pipe wall which are generally parallel to the longitudinal axis of the pipe surface
Longitudinal seam weld anomaly	Any anomaly that is caused by, constrained to, or specific to, the longitudinal weld. Anomalies vary based on weld type but may result from manufacturing or be time dependent such as: Hook cracks, Inclusions, Lack of fill, Lack of fusion, Porosity, Selective seam weld corrosion, Toe crack, Undercut, or others.
Other defects	Any defect that doesn't meet the characteristics of the above referenced defects but may impact the serviceability of the pipeline
Ovality	A flattening of the pipe in which the circular cross section becomes elliptical (ovular); and where the length is typically significantly greater than the ovality percent. This is caused by outside forces and may be due to land movement or heavy loading across the line.
Plain Dent	A depression that produces a disturbance in the curvature of the pipe wall without reducing wall thickness that does not interact with any other anomalies such as corrosion, gouges, hard spots, or linear indications.
Stress Corrosion Crack (SCC)	A crack or colony of cracks in the pipe wall that are classified as being environmentally assisted. SCCs are generally, but not always, associated with piping that meets the criteria identified in ASME B31.8 S
Surface breaking linear indication	A linear accumulation of magnetic powder on the surface of the pipe body found using magnetic particle inspection in accordance with <i>SOP HLD.45 Wet Magnetic Particle Inspection</i> .
Weld defect	Weld defects are characterized as, but not limited to, the following: Porosity, wormholes, slag, inclusions, cavities, cracking, lack of fusion, or undercut.
Wrinkle	A circumferential pipe deformation found on the inside bend radius of a pipe caused during the construction process to obtain pipeline alignment.

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7.0

Evaluating Pipeline Defects

This section describes these procedures for evaluating pipeline defects:

- Evaluation
- Corrosion, general metal loss, and wall thickness deviations
- Gouges and other metal loss
- Plain Dents
- Dents with metal loss
- Dents involving welds
- Inclusions
- Laminations
- Surface breaking linear indications
- Stress corrosion cracks
- Longitudinal seam weld defects
- Wrinkles
- Internal metal loss
- Obsolete materials or installations, and other defects
- Arc burns
- Ovality

7.1

Evaluation

Perform the following process in order to evaluate defects in pipelines.

Step	Task
1	CHARACTERIZE defects in the pipeline in order to determine the extent to which the serviceability of the pipeline has been impaired.
2	ESTABLISH inspection pressure reduction per <i>SOP HLI.11 Pipeline Pressure Limit Criteria</i> . CONFIRM pressure reductions required for all pipeline segments.
3	If there is a question regarding the characterization of a defect, CONSULT with the Pipeline Integrity Group
4	EVALUATE defects based upon one or a combination of the methods described in this SOP.
5	CONFIRM all evaluations of pipeline corrosion, damage, or other defects.



NOTE: Establish a safe excavation per *SOP HLI.10 Excavation and Backfill*.

7.2

Corrosion, General Metal Loss, and Wall Thickness Deviations

Operations Personnel or Company Approved Contractor / Pipeline Integrity Group follows the steps below to evaluate corrosion, general metal loss, and wall thickness deviations.

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Step	Activity
1	CHARACTERIZE a defect with the single characteristic of a measurable reduction in wall thickness as “corrosion or general metal loss.”
2	EVALUATE external corrosion and general metal loss defects in the pipe wall, girth welds, and longitudinal seams in accordance with <i>SOP HLD.47 Evaluation of Remaining Strength of Pipe with Metal Loss</i> .
3	CONFIRM defect characterization and evaluation with Corrosion Specialist.
4	REPAIR external corrosion and general metal loss if required per <i>SOP HLI.05 Pipeline Repair</i> .



NOTE: For pre-1970 Electric Resistance Welded (ERW) pipe confirm that the corrosion is not in the seam, use Ammonium Persulfate to identify the seam if necessary. Pre-1970 ERW and Electric Flash Welded (EFW) pipe with corrosion damage interacting with the seam or HAZ and penetrating deeper than the pipe wall cannot be assessed using remaining strength calculations and must be repaired.

7.3 Gouges and Other Metal Loss

Operations Personnel or Company Approved Contractor / Pipeline Integrity Group follows the steps below to evaluate gouges and other metal loss.

Step	Activity
1	INSPECT and EVALUATE metal loss defects in the pipe (i.e., scratches, gouges, mill pits, grinding marks, etc.) to determine the extent of damage.
2	If the extent of the damage is limited to a general reduction in wall thickness, CHARACTERIZE the defect as “corrosion or general metal loss,” and EVALUATE the defect per <i>SOP HLD.47 Evaluation of Remaining Strength of Pipe with Metal Loss</i> .
3	If any of the following characteristics exist that may impair the serviceability of the pipe, CHARACTERIZE the defect as a “gouge or other metal loss defect”: <ul style="list-style-type: none"> • Sharp defect edges • Stress concentrators • Hard spots • Cracking • Plastically deformed material
4	CONSIDER using Ammonium Persulfate to INSPECT for a hard spot.
5	USE magnetic particle inspection (MPI) to inspect for linear indications according to <i>SOP HLD.45 Wet Magnetic Particle Inspection</i> . Dye penetrant inspection (DPI) or other NDE Methods may be permitted as directed by Corrosion Specialist or Pipeline Integrity Group.

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Step	Activity
6	CONFIRM defect characterization and evaluation with company Corrosion Specialist.
7	REPAIR defect per <i>SOP HLI.05 Pipeline Repair</i> .



NOTE: If mechanical damage involving a dent or gouge is suspected, take a pressure reduction according to *SOP HLI.11 Pipeline Pressure Limit Criteria*.

7.4 Plain Dents

Operations Personnel or Company Approved Contractor follows the steps below to evaluate plain dents.

Step	Activity
1	CHARACTERIZE a depression that produces a disturbance in the curvature of the pipe wall without reducing the pipe wall thickness as a “dent with no metal loss.”
2	MEASURE the depth of a dent from the lowest point of the depression to a straight line representing the original contour of the pipe.



CAUTION: Do not use MFL data to determine the depth of a dent.

Step	Activity
3	INSPECT for hard spots using Ammonia Persulfate or other acid etching method.
4	INSPECT and EVALUATE all excavated dents with magnetic particle inspection (MPI) for the presence of linear indications. Dye penetrant inspection (DPI) or other NDE Methods may be permitted as directed by Corrosion Specialist or Pipeline Integrity Group. If linear indications are evident or if there is a concern that the dent has been prestrained or has “re-rounded,” REPAIR the section of pipe containing the dent per <i>SOP HLI.05 Pipeline Repair</i> .
5	For all dents in pipe containing a dent that measures more than ¼ inch deep in pipe less than or equal to 12 inches diameter, or which measures more than 2% of the nominal pipe diameter in pipe over 12 inches diameter, REPAIR pipe per <i>SOP HLI.05 Pipeline Repair</i> .
6	DETERMINE if the dent was constrained prior to excavation. REPAIR all constrained dents per <i>SOP HLI.05 Pipeline Repair</i> regardless of depth.
7	DOCUMENT characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

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NOTE: If mechanical damage involving a dent or gauge is suspected, take a pressure reduction according to *SOP HLI.11 Pipeline Pressure Limit Criteria*.

7.5 Dents with Metal Loss



Operations Personnel or Company Approved Contractor follows the steps below to evaluate dents with metal loss.

NOTE: Dents containing metal loss include those that are scratched, gouged, grooved, or corroded.

Step	Activity
1	MEASURE the depth of a dent from the lowest point of the depression to a straight line representing the original contour of the pipe.
2	EVALUATE metal loss in accordance with <i>SOP HLD.47 Evaluation of Remaining Strength of Pipe with Metal Loss</i>
3	CHARACTERIZE a depression that produces a disturbance in the curvature of the pipe wall and has reduction the pipe wall thickness as a “dent with metal loss.”
4	INSPECT for hard spots using Ammonia Persulfate or other acid etching method.
5	INSPECT and EVALUATE all excavated dents with magnetic particle inspection (MPI) for the presence of linear indications. Dye penetrant inspection (DPI) or other NDE Methods may be permitted as directed by Corrosion Specialist or Pipeline Integrity Group.
6	DOCUMENT characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.
7	REPAIR defect per <i>SOP HLI.05 Pipeline Repair</i> .

7.6 Dents Involving Welds

Operations Personnel or Company Approved Contractor follows the steps below to evaluate dents involving welds.

Step	Activity
1	MEASURE the depth of a dent from the lowest point of the depression to a straight line representing the original contour of the pipe.
2	INSPECT for hard spots using Ammonia Persulfate or other acid etching method.
3	INSPECT and EVALUATE all excavated dents with magnetic particle inspection (MPI) for the presence of linear indications. Dye penetrant inspection (DPI) or other NDE Methods may be permitted as directed by Corrosion Specialist or Pipeline Integrity Group.
4	REPAIR any pipe with a dent involving a longitudinal seam or girth weld.

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Step	Activity
	per <i>SOP HLI.05 Pipeline Repair</i> .
5	Each weld that is repaired must have the defect removed down to sound metal and the segment to be repaired must be preheated if conditions exist which would adversely affect the quality of the weld repair. After repair, the segment of the weld that was repaired must be inspected to ensure its acceptability.
6	DOCUMENT characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

7.6.1 Dents with Linear Indications

Operations Personnel or Company Approved Contractor follow the steps below to evaluate dents that have been further characterized as dents with linear indications.

Step	Activity
1	INSPECT and EVALUATE all excavated dents with magnetic particle inspection (MPI) for the presence of linear indications. Dye penetrant inspection (DPI) or other NDE Methods may be permitted as directed by Corrosion Specialist or Pipeline Integrity Group.
2	CHARACTERIZE a depression that produces a disturbance in the curvature of the pipe wall and that has a linear indication (as found with Magnetic Particle Inspection) as a “dent with linear indication.”
3	EVALUATE and CONFIRM if the linear indication can be removed by grinding in accordance with <i>SOP HLI.05 Pipeline Repair</i> . If removed, TREAT the remaining dent as a dent with metal loss.
4	REPAIR , per <i>SOP HLI.05 Pipeline Repair</i> , any pipe with dents containing a linear indication (that cannot be removed by grinding).
5	DOCUMENT characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

7.7 Inclusions

Operations Personnel or Company Approved Contractor follows the steps below to determine and evaluate inclusions.



WARNING: An inclusion does not normally affect the integrity of the material. However, do not perform welding on an area of material with known inclusion defects.

Step	Activity
1	CHARACTERIZE a metallic or non-metallic solid material trapped within the wall of the pipe or weld metal as an inclusion
2	EVALUATE inclusions thoroughly using ultrasonic inspection or other methods.

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Step	Activity
3	COORDINATE the determination of the evaluation method with the QA/QC Group.
4	DOCUMENT characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

7.8 Laminations

Operations Personnel or Company Approved Contractor / Pipeline Integrity Department follows the steps below to determine, evaluate and repair laminations.

Step	Activity
1	CHARACTERIZE an internal metal separation creating layers generally parallel to the pipe surface as a lamination.
2	EVALUATE material adjacent to a lamination to verify that no additional defects exist. MEASURE the dimensions of the lamination using <i>SOP HLI.34 Use of Ultrasonic Thickness Equipment for Measurement of Wall Thickness</i> .
3	CHARACTERIZE a lamination that is greater than 12 square inches in total area as potentially impairing the serviceability of the pipeline. CONTACT the Pipeline Integrity Group if this criteria is met.
4	REPAIR laminations that may impair the serviceability of the pipeline per <i>SOP HLI.05 Pipeline Repair</i> .
5	DOCUMENT characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.



CAUTION: Welding and flame cutting should not be performed on areas of material with known laminations.

7.9 Surface Breaking Linear Indications

Operations Personnel or Company Approved Contractor follows the steps below to determine, evaluate, and repair linear indications.

Step	Activity
1	CHARACTERIZE a fracture type discontinuity with sharp tips as cracking linear indication.
2	MEASURE and EVALUATE the length of cracks with wet magnetic particle inspection (MPI) or dye penetrant inspection (DPI) as directed by Corrosion Specialist or Pipeline Integrity Group.
3	REPAIR cracks that threaten the serviceability of the pipeline per <i>SOP HLI.05 Pipeline Repair</i> .
4	DOCUMENT characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

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NOTE: A crack in an existing girth weld can be repaired provided the length of the crack is less than 8% of the weld length.

**7.10
Stress
Corrosion
Cracks (SCC)**

Operations Personnel or Company Approved Contractor / Pipeline Integrity Group follows the steps below to determine, evaluate, and repair stress corrosion cracks.

Step	Activity
1	IDENTIFY a group of linear indications as suspected Stress Corrosion Cracking (SCC).
2	CONTACT Pipeline Integrity Group when evidence of Stress Corrosion Cracking (SCC) is discovered.
3	EVALUATE stress corrosion cracks with a wet magnetic particle inspection (MPI) or dye penetrant inspection (DPI) as directed by Corrosion Specialist or Pipeline Integrity Group.
4	REPAIR stress corrosion cracks per <i>SOP HLI.05 Pipeline Repair</i> .
5	DOCUMENT characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

**7.11
Longitudinal
Seam Weld
Defects**

Operations Personnel or Company Approved Contractor / Pipeline Integrity Group follows the steps below to characterize and evaluate longitudinal seam weld defects.

Step	Activity
1	CHARACTERIZE and evaluate weld defects with appropriate visual and Non-Destructive Testing (NDT) inspection. REFER to Appendix C for seam type clarification. For girth weld indications REFER to the welding manual.
2	EVALUATE long seam indication in accordance with API5L.
3	CONTACT the Pipeline Integrity Group for acceptance criteria and repair methods for weld defects found in specific types of longitudinal welds.
4	REPAIR in accordance with <i>SOP HLI.05 Pipeline Repair</i> .
5	DOCUMENT characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

**7.12
Wrinkles**

Operations Personnel or Company Approved Contractor / Pipeline Integrity Group follows the steps below to characterize and evaluate wrinkles.

Step	Activity
1	CHARACTERIZE an irregular waiver in the pipe with a ripple height (d) to

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Step	Activity
	pipe diameter (D) ratio ≤ 0.01 when measured with a 6" long straight edge oriented longitudinally, as a wrinkle.
2	NOTIFY the Pipeline Integrity Group
3	REPAIR defect in accordance with <i>SOP HLI.05 Pipeline Repair</i> .
4	DOCUMENT characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

**7.13
Internal Metal
Loss**

Operations Personnel or Company Approved Contractor / Pipeline Integrity Department characterizes the location where internal metal loss is discovered or an anomaly is indicated by inline inspection tool.

Step	Activity
1	EVALUATE the defect in accordance with <i>SOP HLD.47 Evaluation of Remaining Strength of Pipe with Metal Loss</i> as directed by Pipeline Integrity Department.
2	REPAIR defect in accordance with <i>SOP HLI.05 Pipeline Repair</i> .
3	DOCUMENT characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

**7.14
Obsolete
Materials or
Installations &
Other Defects**

Operations Personnel or Company Approved Contractor follows the steps below to evaluate obsolete materials or installations, or other defects that do not fall under a standard category.



NOTE:

- Examples may include miter welds greater than 3 degrees, branch tees with weld pads, patches, and orange peel.
- An existing facility that was constructed using materials or methods that are no longer considered acceptable practice may need to be replaced.

Step	Activity
1	CONTACT the Pipeline Integrity Group or QA/QC Group
2	DEVELOP repair plan in accordance with <i>SOP HLI.05 Pipeline Repair</i> .
3	DOCUMENT characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

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7.15

Arc Burns

Operations Personnel or Company Approved Contractor / Pipeline Integrity Group follows the steps below to evaluate arc burns.

Step	Activity
1	CHARACTERIZE a hard spot or a hard spot and gouge caused by the arc of a welding tool or any unknown source as an “arc burn.”
2	INSPECT and EVALUATE the area visually for metal damage and signs of significant metallurgical changes at the location of the arc burn.
3	CONTACT Corrosion Specialist or Pipeline Integrity Group for an Ammonium Persulfate etch procedure and criterion for arc burn assessment if needed. If necessary, USE a 20% Ammonium Persulfate etch to assess the metallurgical effects of an arc burn.
4	As directed by Corrosion Specialist or Pipeline Integrity Group, EVALUATE an arc burn with magnetic particle (MP) in order to inspect for cracking. USE wet magnetic particle inspection (MPI) to verify the presence of potential cracking due to hardness. Dye penetrant inspection (DPI) or other NDE Methods may be permitted as directed by Corrosion Specialist or Pipeline Integrity Group.
5	If visual and magnetic particle inspection determines the arc burn to be non-injurious, CONSULT with the Pipeline Integrity Group to determine if the defect can be removed by grinding or filing.
6	If an arc burn has caused apparent damage that could be detrimental to the integrity of the pipe, REPAIR the arc burn per <i>SOP HLI.05 Pipeline Repair</i> .



NOTE: Arc burn damage that may be detrimental to the integrity of the pipe includes but is not limited to:

- Cracking
- Metal loss
- Hardness levels
- Stress concentrators

7.16

Ovality

Operations Personnel or Company Approved Contractor / Pipeline Integrity Group follows the steps below to evaluate ovalities.

Step	Activity
1	CHARACTERIZE ovality as any flattening of the pipe that occurs on opposite sides of the circumference in a relatively uniform manner over a long distance. (I.e. The pipe is flattened at 12:00 and 6:00, and expanded at 3:00 and 9:00, for an entire joint.)
2	CONTACT the Pipeline Integrity Group to determine if it needs to be repaired in accordance with <i>SOP HLI.05 Pipeline Repair</i> .
3	DOCUMENT characterizations and evaluations in the Pipe Inspection Report

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	or Maintenance Record.
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**8.0
Documentation
Requirements**

Record data in electronic database or utilize the following forms as applicable:

Pipe Inspection Report or Maintenance Record; retain on location for the life of the facility.

**9.0
References**

HLD.47 Evaluation of Remaining Strength of Pipe with Metal Loss
HLD.45 Wet Magnetic Particle Inspection
HLI.05 Pipeline Repair
HLI.10 Excavation and Backfill
HLI.11 Pipeline Pressure Limit Criteria
HLI.34 Use of Ultrasonic Thickness Equipment for Measurement of Wall Thickness

**Appendix A:
OQ Task
Requirements**

The table below identifies the Operator Qualification (OQ) task requirements for this SOP.

Task Description	OQ Task
Measure and evaluate pipeline defects.	PLOQ418A
Demonstrate proper use of Pipe Thickness Gauge (Ultrasonic)	PLOQ008
Visual Inspection of Welding and Welds	PLOQ203
Utilize Wet Mag Particle Inspection to identify cracks	PLOQ205
Visual Inspection for Internal Corrosion	PLOQ401
Visual Inspection for Atmospheric Corrosion	PLOQ414
Demonstrate the use of a pit gauge	PLOQ421

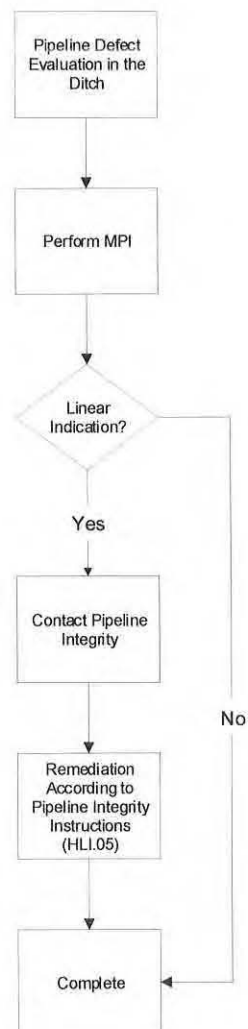
Standard Operating Procedures
Applicable to Hazardous Liquids Pipelines and Related Facilities

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Appendix B: The figure below identifies the process for evaluating linear indications in the Ditch.

Flow Chart for Linear Indications in the Ditch

Field SOP (HLI.06)
Evaluation in the ditch



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Appendix C: This appendix should be used to identify longitudinal welds in the field and determine anomalies specific to each type of weld.
Longitudinal Seam Identification

Double Submerged Arc Welding (DSAW) – formed through the deposition of a weld metal on both the outside and inside surface. Single Submerged Arc Welding (SSAW), where the pipe is only welded from the outside surface, is almost never used for longitudinal seams. Typical anomalies include (but are not limited to) lack of fusion, toe cracks, HAZ cracks, porosity, inclusions, and lack of fill.



Figure 1. Actual DSAW Long Seam

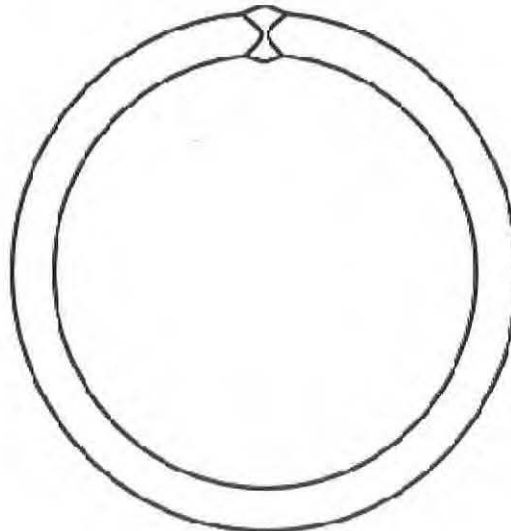
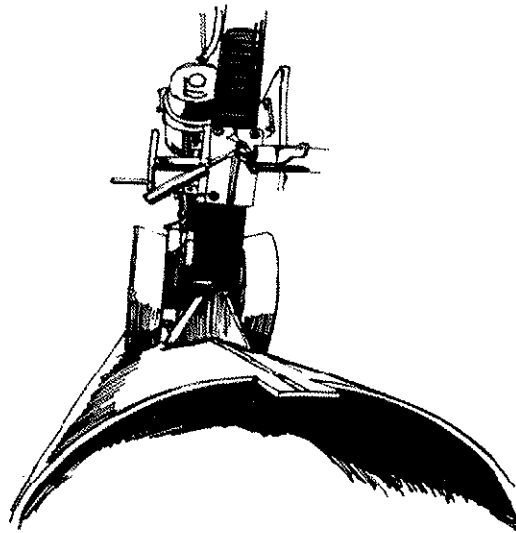
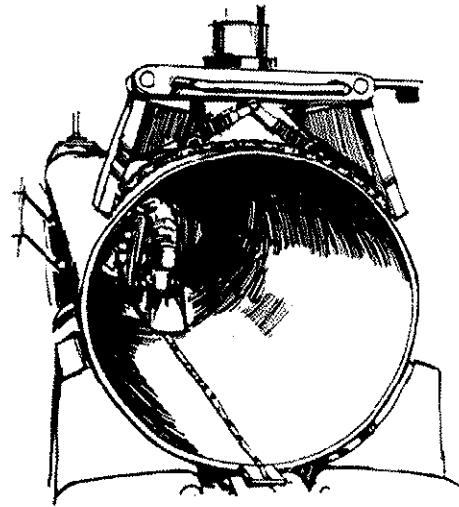


Figure 2. DSAW Profile

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Outside Welding



Inside Welding

Figure 3. Manufacturing Process for Lap Weld
(Image from History of Line Pipe Manufacturing in North America)

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Electric Resistance Welding (ERW) – formed by passing a current through the pipe effectively melting the two sides together without the use of any additional weld material. Any cap or excess metal resulting from the process is trimmed flush with the pipe making identification difficult in the field. Typical anomalies include (but are not limited to) lack of fusion, HAZ cracks, and contact marks.



Figure 4. Actual ERW Long Seams

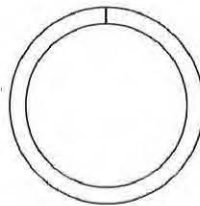


Figure 5. ERW Profile

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Electric Flash Welding (EFW) – formed similarly to ERW by passing a current through the pipe effectively melting the two sides together without the use of any additional weld material. This was only produced by the A.O. Smith Company and is characterized by a cap that is trimmed squarely. Typical anomalies include (but are not limited to) lack of fusion, HAZ cracks, and selective seam corrosion.



Figure 4. Actual EFW Long Seams

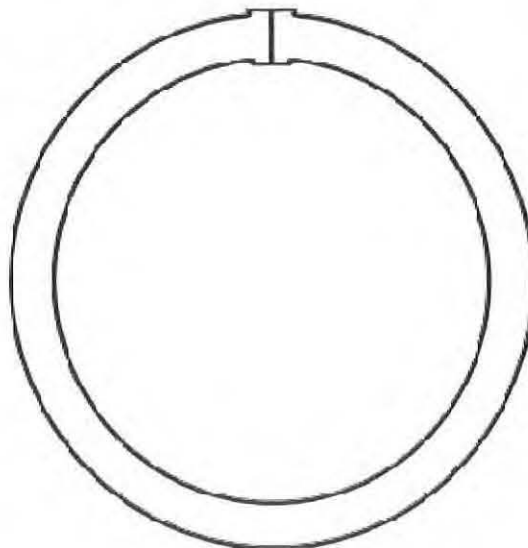


Figure 5. EFW Profile

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Lap Welding – formed by trimming the edges of the plate at an angle and then overlaying them, this provides for a larger surface area to be welded. No additional weld material is used and the weld is formed by heating the entire plate and forcing it between rollers that press it together. Typical anomalies include (but are not limited to) lack of fusion.



Figure 6. Manufacturing Process for Lap Weld

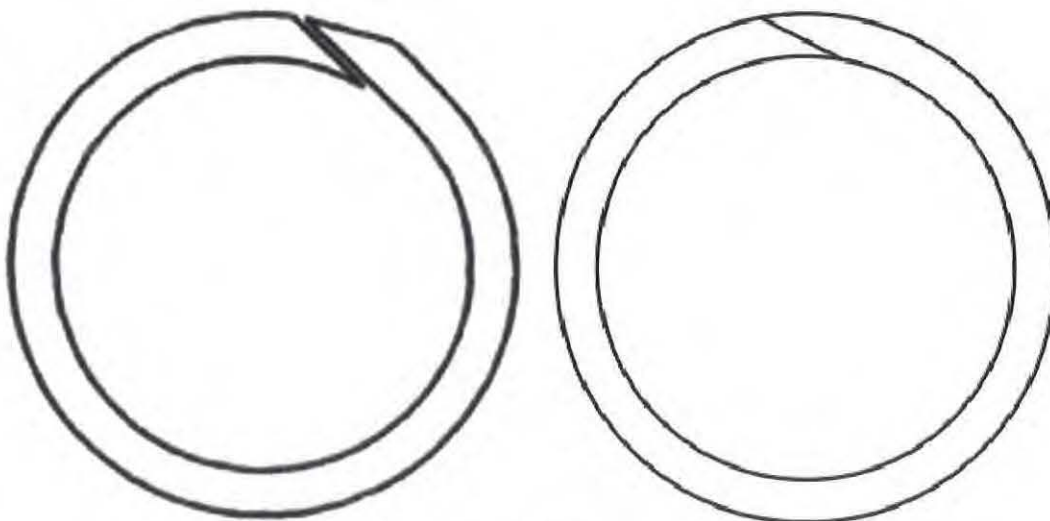


Figure 7. Lap Weld Profile Before and After Forming

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Hammer Welding – formed by heating and overlaying the ends of the plate and then beating them down to the wall thickness of the pipe. This provided for a larger surface area to be welded. No additional weld material is used. Typical anomalies include (but are not limited to) lack of fusion.

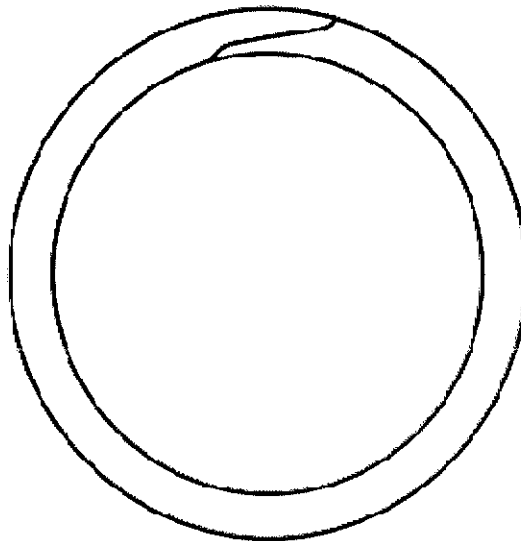


Figure 8. Hammer Weld Profile

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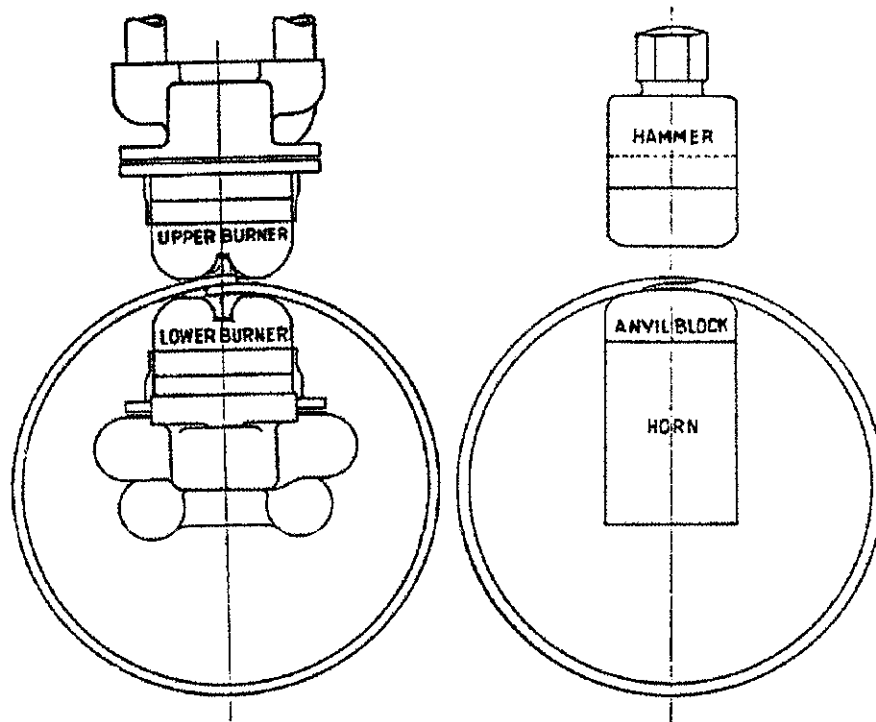


Figure 9. Manufacturing Process for Hammer Weld
(Image from History of Line Pipe Manufacturing in North America)

***Abandonment/
Deactivation of Pipeline
Facilities******Standard Operating Procedures****Applicable to Hazardous Liquids Pipelines and Related Facilities*

Code Reference :	Procedure No.: HLI.07	
49 CFR: 195.59, 195.402	Effective Date: 04/01/18	Page 1 of 7

**1.0
Procedure
Description**

This Standard Operating Procedure (SOP) establishes the requirements for inactivating, abandoning, and removing regulated pipelines or pipeline systems from service.

**2.0
Scope**

The SOP includes procedures for changing the status of regulated liquid pipelines or pipeline systems that are inactivated, abandoned, or removed.

**3.0
Applicability**

This SOP applies to all regulated pipeline facilities where a change in status is required.

**4.0
Frequency**

As required: To Change Pipeline or Pipeline System Status

**5.0
Governance**

The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Operations Manager	Director of Operations

**6.0
Terms and
Definitions**

Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

Terms	Definitions
Active Service Pipelines	Pipelines that operate at system pressure and are actively used to transport liquids.
Inactive / Out-of-Service Pipelines	Pipelines under inert pressure but isolated from all sources of liquids and not presently being used to transport liquid. These pipelines and the right-of-way are fully maintained as active service pipeline. Any exceptions to full maintenance shall be documented in an MOC such that when a pipeline is reactivated or brought back into service, the work required to bring the system into compliance can be determined.

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49 CFR: 195.59, 195.402	Effective Date: 04/01/18	Page 2 of 7

Terms	Definitions
Spare	Pipelines or pipeline systems that was installed as a spare pipeline and never placed into operation and is isolated from an active system. Typically, this refers to a spare crossing of a river or highway. Some levels of maintenance may be performed; however, a thorough review must be performed prior to activating this pipeline.
Abandoned Pipelines (Abandoned in place)	Pipelines that are physically disconnected from the pipeline system, purged with an inert material, and sealed at the ends. These pipelines are not pressurized. All maintenance activities have been discontinued.
Removed	This status applies to pipelines which are physically removed from the pipeline right-of-way.
Pipeline (or Pipeline System)	All parts of a pipeline, subject to the pipeline safety laws, through which a gas or hazardous liquid is transported. This includes but is not limited to: (1) line pipe, (2) valves and other appurtenances connected to line pipe, (3) pumping units, (4) compressor units, (5) fabricated assemblies associated with pumping units, (6) metering, delivery, and regulator stations and fabricated assemblies therein, and (7) breakout tanks.

7.0

Abandonment / Inactivation of Pipeline Facilities

The following processes and procedures are described in this section:

- Developing Procedures to Change Pipeline or Pipeline System Status
- Inactivating Pipelines or Pipeline Systems
- Abandoning Pipelines or Pipeline Systems
- Permanent Removal of Pipelines or Pipeline Systems



CAUTION:

- Approval must be obtained from Commercial prior to abandoning any pipeline or pipeline system.
- Contact Right-of-way Department prior to any inactivation or abandonment.

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**7.1
Developing
Procedures to
Change
Pipeline Status**

Use the process below to develop procedures to change pipeline status.

Step	Task
1	SPECIFY the pipelines and associated facilities to be inactivated, abandoned, or removed.



NOTE: State of Louisiana Office of Conservation Pipeline Division – Title 43 Natural Resources, requires an application for abandonment be submitted to the commissioner for permission and approval at least 30 days, but no more than six (6) months prior to proposed date of abandonment. Forms PL-1(A) for abandonment of service and PL-1(B) for abandonment of facility may be obtained from the Office of Conservation. Applications for abandonment received before the end of the preceding month are reviewed in a hearing schedule for the third Thursday of the following month.

Step	Task
2	PERFORM the work in accordance with a plan developed by the Operations Manager or designee.
3	VERIFY that the abandonment or removal is carried out in accordance with the plan.
4	DISTRIBUTE the required documentation.

**7.2
Inactivating
Pipelines**

Operations Personnel perform the following procedure for inactivating regulated liquid pipelines.

Step	Activity
1	PRIOR to inactivating a pipeline or pipeline system, NOTIFY PHMSA of the intent to inactivate and DETAIL the maintenance activities that will no longer be applied until the pipeline is reactivated per PHMSA ADB 2016-0075.
2	SHUTDOWN the pipeline section in accordance with <i>SOP HLI.01 Pipeline Shutdown and Startup</i> .
3	DISPLACE product from pipeline or pipeline system in accordance with <i>SOP HLB.03 Purging</i>
4	CLOSE and LOCK the applicable valves, properly blind or physically DISCONNECT the pipeline to isolate it from all sources of hazardous liquids
5	PRESSURIZE the pipeline with inert material.

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Step	Activity
6	DOCUMENT using the applicable form(s) for <i>Abandonment & Deactivation</i> or the Legacy SXL IMPACT MOC.
7	<p>PERFORM the following maintenance requirements after the pipeline is inactivated:</p> <ul style="list-style-type: none"> • DOCUMENT routine maintenance activities using the applicable form(s). • MAINTAIN cathodic protection on inactivated pipelines by bonding it to a cathodically protected facility and/or installing supplemental cathodic protection. • CONTINUE all other normal maintenance, including but not limited to: right-of-way mowing, patrolling, valves maintenance, One Call, Damage Prevention and Public Awareness processes. OPP is not required until the pipeline system is reactivated. • IDENTIFY and DOCUMENT maintenance activities that will no longer be applied until the pipeline is reactivated such as In-line inspections. • VERIFY pipeline pressure periodically as applicable. • REPORT any significant changes to Area Management



NOTE: Pipeline Integrity Department and Regulatory Compliance must be notified prior to **Reactivating** a pipeline that has been inactivated in accordance with the procedures above. A Restart Plan will be required.

7.3 Abandoning Pipelines

Operations Personnel perform the following steps to abandon a regulated liquid pipeline.

Step	Activity
1	SHUTDOWN the pipeline section in accordance with <i>SOP HLI.01 Pipeline Shutdown and Startup</i> .
2	<p>PURGE the abandoned pipeline with water or nitrogen using a displacement pig as directed by the Operations Manager. <i>See SOP HL B.03 Purging.</i></p> <p>ESTABLISH the purge medium by considering the following factors:</p> <ul style="list-style-type: none"> • Water prevents future floatation of abandoned pipelines in areas subject to inundation. • Abandoned pipeline segments with large elevation differences will have a high static head in low areas which could be potentially dangerous. • Purging with nitrogen allows a pipeline to be purged at the time of disconnection without waiting for a final environmental release, whereas purging with water must be performed after the release.

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Step	Activity
3	DISCONNECT and ISOLATE the pipeline by physically separating it from all sources, such as pipelines, crossover piping, branch connections, or measuring stations.
4	DRAIN and SEAL any taps, branch connections, or other sources leading to the isolated facility with a plug, cap, blind, or a permanent type closure or fitting.
5	SEAL the ends of the abandoned pipeline and any openings
6	•
7	
8	Each pipe abandoned in place must be disconnected from all sources of liquids and purged of hydrocarbons.
9	REMOVE vaults to below ground level and FILL these vaults along abandoned pipelines with a suitable, compacted material.
10	DOCUMENT the abandonment using the applicable form(s) for <i>Abandonment & Deactivation</i> . REPORT the abandonment to the Regulatory Compliance Department and GIS Department.



NOTE: For abandoned Offshore Lines and onshore lines that pass over, under or through a commercially navigable waterway a statement that details the following needs to accompany the applicable form(s):

- Line Identification
- Date of Abandonment
- Diameter
- Method of Abandonment
- Statement that Abandonment was completed in accordance with applicable laws to the best of the Company's knowledge

Step	Activity
9	COMPLETE the applicable form(s) to remove the abandoned pipeline from the liquid Plant accounting classification.
10	DISCONTINUE right-of-way maintenance, cathodic protection, patrolling, and other forms of maintenance. REMOVE pipeline markers.
11	DISCONTINUE all maintenance activities.

7.4 Permanent Removal of Pipelines

Upon receiving authorization from Director of Operations, Operations Personnel perform the following steps to permanently remove a pipeline.

Step	Activity
1	COMPLETE Steps 1 – 9 in Section 7.3 Abandoning Pipelines

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Step	Activity
2	REMOVE the pipeline in accordance with the removal plan.
3	REMOVE all aboveground signs and markers.
4	DOCUMENT using the applicable form(s) for <i>Pipeline Deactivation Report</i> once the pipeline has been removed
5	COMPLETE the applicable form(s) to permanently remove the pipeline. INCLUDE the following information: <ul style="list-style-type: none"> • Reason for removal • Pipe description: diameter, wall thickness, and grade • Pipe length • Location • Dates • Purging method and media • Methods of isolating liquid sources



NOTE: This work order is the final documentation for a permanent removal.

Step	Activity
6	DISCONTINUE maintenance associated with the right-of-way.

7.6 PHMSA required Reporting to the National Pipeline Mapping System (NPMS)

GIS Management submits NPMS required attributes and information from the Special Reporting to the NPMS for abandoned offshore pipelines and onshore pipelines that cross over, under and through commercially navigable waterways.

GIS Management obtains the required information from the applicable form(s) and Special Reporting detailed in this SOP. This Special Report is submitted annually to the NPMS in addition to other required supporting information.

Refer to SOP HLA.16 (Annual Report – PHMSA) for reporting requirements.

8.0 Documentation Requirements

Record data in electronic database or utilize the following form(s) as applicable:

- I.07.A Abandonment & Deactivation

For onshore abandonment I.07.A must be provided to GIS Department for annual update to NPMS.

- EAM Unscheduled Work Order or appropriate Maintenance Record

The following table describes the documentation and reporting requirements for Offshore and Onshore Navigable Waterways.

Code Reference :	Procedure No.:HLI.07	
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Activity	Reporting
<p>Submit Abandonment Report for abandoned offshore lines and onshore lines that pass over, under or through a commercially navigable waterway.</p> <p>Submit a statement that details the following accompanying the Retirement Completion Report:</p> <ul style="list-style-type: none"> • Line Identification • Date of Abandonment • Diameter • Method of Abandonment • Statement that Abandonment was completed in accordance with applicable laws to the best of the Company's knowledge 	GIS Special Reporting information
NPMS for abandoned offshore pipelines and onshore pipelines that cross over, under and through commercially navigable waterways.	Submit NPMS required attributes and information from the Special Reporting. NPMS submission must be filed upon abandonment of facility.

**9.0
References**

HLI.01 Pipeline Shutdown and Startup
HLB.03 Purging
HLA.16 Annual Report – PHMSA

**Appendix A:
OQ Task
Requirements**

The table below identifies the Operator Qualification (OQ) task requirements.

Task Description	OQ Task
Operate Valves	PLOQ007
Commission and Maintain Pneumatic Actuator	PLOQ351
Commission and Maintain Electric Actuator	PLOQ361
Commission and Maintain Hydraulic	PLOQ371
Commission and Maintain Plug Valve	PLOQ716A
Commission and Maintain Ball Valve	PLOQ716B
Commission and Maintain Gate Valve	PLOQ716C
Commission and Maintain Globe Valve	PLOQ716D
Purging with air or inert gas	PLOQ614
Purge a Pipeline	PLOQ812



Lowering or Raising In-Service Pipelines

Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

Code Reference :	Procedure No.: HLI.08	
49 CFR 195.424, API 1117	Effective Date: 04/01/18	Page 1 of 25

1.0

Procedure Description

This Standard Operating Procedure (SOP) describes how to lower or raise, a liquids pipeline due to soil erosion, road crossings, cultivation, shorted casings, subsidence, or other reasons. This SOP also establishes guidelines to prevent over-stressing operating pipelines when lifting.

2.0

Scope

This procedure satisfies the requirement for lowering and raising in-service pipelines in a safe manner.

3.0

Applicability

This SOP is utilized during pipeline lowering or raising operations to minimize stresses and protect pipe and coating from damage.

4.0

Frequency

As required for lowering and/or raising in-service pipelines.

5.0

Governance

The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Operations Manager	Area Director

6.0

Terms and Definitions

Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

Terms	Definitions
Strain Gauge	Instrument used to monitor stress induced by pipeline movement.

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**7.0
Lowering or
Raising
In-Service
Pipelines**

The following procedures are described in this section:

- Evaluating the Potential for Lowering a Pipeline
- Developing a Lowering Plan and Profile
- Excavation of the Pipeline
- Inspecting the Exposed Pipeline
- Final Preparations for Lowering the Pipeline
- Performing the Lowering Operation
- Lifting Pressurized Pipelines Using Air Bags

**7.1
Evaluating the
Potential for
Lowering a
Pipeline**

Operations Personnel use the following procedure to evaluate the potential for lowering a pipeline.



CAUTION:

- A. No movement of any line pipe may be performed unless the pressure in the line is reduced to not more than 50% of the MOP.
- B. No operator may move any pipeline containing highly volatile liquids where materials in the line section involved are joined by welding unless:
 1. Movement when the pipeline does not contain highly volatile liquids is impractical
 2. The procedures of the operator under 195.402 contain precautions to protect the public against the hazard in moving pipelines containing highly volatile liquids, including the use of warnings, where necessary, to evacuate the area close to the pipeline; and
 3. The pressure in that line section is reduced to the lower of the following:
(Note: If this requirement cannot be achieved the line shall be removed from service)
 - i. 50% or less of the MOP; or
 - ii. The lowest practical level that will maintain the highly volatile liquid in a state with continuous flow but not less than 50 psig above the vapor pressure of the commodity
- C. No operator may move any pipeline containing highly volatile liquids where materials in the line section involved are not joined by welding unless:
 1. The operator complies with the paragraph B 1 & 2 above.
 2. The line section is isolated to prevent the flow of highly volatile liquid

Step	Activity
1	ANALYZE various considerations carefully to determine whether this type of modification is appropriate.
2	UNDERSTAND the special considerations for coupled pipelines, including allowable length of line where overburden may be removed and sleeving unreinforced couplings U/S and D/S of the work location.
3	If the stress levels are expected to exceed the allowable stresses, CUT and

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Step	Activity
	LOWER the pipeline, or REPLACE the pipe section in accordance with <i>SOP HLI.01 Pipeline Shutdown and Startup</i> .



NOTE: By cutting the pipe, the elongation stress and possibly some of the thermal stress is removed; however, the bending and other remaining stresses should still be analyzed.

Step	Activity
4	CONSULT Pipeline Integrity, Liquid Technical Operations, or Engineering Department to PERFORM a structural evaluation of the section to be lowered as outlined Section 7.2 below or other literature on lowering pipelines such as API 1117.
5	If the pipeline is located in hilly terrain, CONDUCT a survey of the existing profile.



NOTE: In flat areas, a USGS quadrangle map is sufficient with field verification.

Step	Activity
6	LOCATE skids, pre-tested repair pipe, river weights, and other materials. VERIFY that these are available for the lowering project.
7	CONSULT Pipeline Integrity, Liquid Technical Operations, or Engineering to determine a safe operating pressure for the lowering or raising or horizontal adjustment of the pipeline.

7.2 Developing a Lowering Plan and Profile

The Operations Personnel uses the following procedure to develop a lowering plan and profile.

Step	Activity
1	DEVELOP a final “Lowering Profile” and “Lowering Plan” after the proposed lowering is evaluated and a decision is made to lower the pipeline while in service.
2	DETERMINE the strain levels in the “Lowering Plan” for lowering associated with mining subsidence or for other lowering projects where strain gauges are installed.
3	REVIEW anomaly data for any anomalies that would be adversely affected if not repaired and/or removed.
4	OBTAIN written approval of these plans prior to any lowering related activities from an Engineer from Pipeline Integrity, Engineering, or Liquid Technical Operations.

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7.3 Excavation of the Pipeline

Operations Personnel use the following procedure to excavate the pipeline for the purpose of lowering or raising in-service pipelines.

Step	Activity
1	EXCAVATE the full length of pipe to be lowered, plus a minimum of 25 feet on either end in accordance with <i>SOP HLI.10 Excavation and Backfill</i> with the ditch sloped properly for personnel working in the ditch.
2	CONSIDER the support of heavy equipment working on the ditch bank.

CAUTION: Do not lower an in-service coupled pipelines without a detailed work plan considering pressure reduction and reinforcing mechanical couplings

Step	Activity
3	EXCAVATE the trench to at least the ditch depth required for the “Lowering Profile.”
4	PERFORM additional excavation beyond the “Lowering Profile” to allow for the following: <ul style="list-style-type: none"> • Placement of sandbags per “Supporting the Final Lowered Profile” below to obtain the final profile elevation • A pad dirt allowance in rocky areas • Room for the soil from beneath the pipeline to be cleared out after the cribbing supports are installed
5	PLAN the initial excavation to permit the line to be lowered with no further digging.

7.3.1 Cribbing

Operations Personnel use the following procedure to perform cribbing while excavating the pipeline.

Step	Activity
1	SUPPORT the pipeline firmly as it is excavated by cribbing in such a way that the pipeline stays at its original elevation.
2	PLACE tires, carpet, sandbags, or other padding between the pipe and cribbing to prevent coating damage.
3	SPACE the cribbing supports at maximum intervals of 25 feet unless otherwise specified in the “Lowering Plan.”
4	INSTALL the supports as far as practical from, and never directly beneath any girth welds since bending stresses can be much higher at the support points than at mid-span and girth welds have additional residual stresses and variable material properties.
5	MONITOR the cribbing daily and REPLACE or REPAIR as necessary.
6	SUPPORT the pipeline so that settlement or thermal expansion and

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Step	Activity
	contraction will not force the pipeline off of the cribbing.
7	When pipe operating temperatures are known to be changing or the pipeline is taken out of service for lowering, CHECK the cribbing to verify that it remains stable or is adjusted accordingly.



CAUTION: Personnel working in the ditch should be especially alert to possible side movement of the pipe due to thermal expansion or contraction.

Step	Activity
8	MAINTAIN the cribbing to prevent the pipe from shifting during the lowering operation.



WARNING: If the pipe were to slip off of one of the cribbing supports, the entire section could jump the supports and fall into the ditch.

7.3.2 Drainage Ditches

Operations Personnel use the following procedure to create drainage ditches.

Step	Activity
1	PROVIDE adequate drainage so that the pipeline ditch will not fill with water causing the pipe to float.
2	If this is not possible, OPERATE pumps which have adequate flow capacity to keep the pipeline from floating.

7.3.3 Initial Elevation Profile

Operations Personnel use the following procedure to create an initial elevation profile when excavating the pipeline.

Step	Activity
1	TAKE an initial elevation profile of the top of the pipe at maximum intervals of 25 feet after the excavation is complete.
2	IDENTIFY the midpoint of the section to be lowered.
3	VERIFY the accuracy of the original "Lowering Profile."

7.4 Inspecting the Exposed Pipeline

Operations Personnel use the following procedure to inspect the exposed pipeline.

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Step	Activity
1	INSPECT the pipeline visually for coating damage, gouges, corrosion, dents, arc burns, and wrinkles per <i>SOP HLD.35 Buried Pipe Inspection and Evaluations</i> .
2	CONSIDER the possibility of any anomalies causing complications, stress concentrations, or buckling in the lowered pipeline.
3	REPORT pipe defects to the Pipeline Integrity Department for consideration in the lowering plan.
4	If anomalies are found which are not acceptable by company standards, REPAIR them per <i>SOP HLI.06 Evaluating Pipeline Defects</i> before the line is lowered, and CONSIDER the need to continue with this procedure.
5	DOCUMENT pipe inspection on Pipe Inspection Report or Maintenance Record.

7.4.1 Evaluation of Circumferential Defects

Operations Personnel uses the following procedure to evaluate circumferential defects.

Step	Activity
1	EVALUATE the circumferential extent of corrosion or other defects in addition to the conventional evaluation of longitudinal defects.



NOTE: This is required because the lowering section will be subjected to axial bending stresses.

Step	Activity
2	If a defect is found that could reduce the bending strength of the pipe, EVALUATE the defect in developing the lowering plan.
3	If necessary, MOVE the lowering bend location to position the defect in an area of straight pipe.



NOTE: The bending, which occurs during the lowering operation, must still be considered.

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7.4.2 Operations Personnel use the following procedure for inspecting and repairing welds.
Inspecting and Repairing Welds

Step	Activity
1	Visually INSPECT all circumferential welds in the lowering section. Acetylene welded lines require particular attention to ensure lowering stresses to do not affect integrity of the weld. Acetylene welds shall be reinforced prior to initiating lowering activities.
2	VERIFY that they are 100% NDE inspected by radiography or other approved NDE methodology such as MPT and/or LPT, unless weld inspection records are available or as noted under “Welds Which Do Not Require NDE” below.
3	USE the applicable form(s) for <i>NDE Inspection Report of Field Girth Welds</i> .
4	REMOVE the pipe coating (except FBE coating) from the weld area prior to inspection.
5	INSPECT the welds visually for cracks, arc burns, or external undercutting that may be detrimental to the integrity of the weld or pipe.
6	PERFORM the radiographic inspection, INTERPRET the radiographs per API 1104, and DETERMINE if any welds do not meet the current code limitations.
7	BE AWARE that the bending of the pipe, which results from the lowering operations, is more likely to affect certain types of weld defects.
8	If any welds are interpreted as having cracks, BLOW DOWN the section and REPLACE the pipe containing the cracked weld.



NOTE Do not perform radiographic inspection for welds that are not located in the area of the final lowering bends if the longitudinal stresses from bending and axial tension during the lowering operations are calculated to be less than the Poisson effect of the hoop stress under normal operating conditions. This applies where approved by Pipeline Integrity.

Step	Activity
9	CONSIDER the need to continue with this procedure.
10	HANDLE welds that fail to meet the code limitations regarding “Inadequate Penetration,” “Inadequate Penetration Due to High-Low,” or “Incomplete Fusion” (in the bead or cap) as follows: <ul style="list-style-type: none"> • REPAIR defects in the top or bottom quadrant of the pipe except as allowed for in company lowering guidelines. • EVALUATE defects in the side quadrants of the weld that are in the neutral axis of the lowering bends per “Analysis of All Other Weld Defects” immediately below.
11	PERFORM an analysis of the remaining defects.

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NOTE: This analysis establishes whether the discontinuities are excessive to the extent that they could be adversely affected by the movement of the pipe during the lowering or subsidence.

Step	Activity
12	DETERMINE the action required for each weld.
13	DOCUMENT the justification for the action planned for each weld.
14	If the length of a defect or the accumulation of defects is only a moderate amount in excess of the API 1104 limitation, EVALUATE the defect per the alternate criteria in the Appendix to API 1104.
15	CONSULT Pipeline Integrity Department regarding defects accepted based upon the alternate criteria.
16	If the size of defect or length of accumulation is significant, and/or the overall appearance of the weld is questionable, REPAIR or CUT OUT the weld unless sufficient justification can be made to leave the weld as is.
17	PAY special attention to the evaluation of welds in areas where the highest stresses are anticipated (e.g., the edge of mining panels, areas where bends will be induced, areas where deflections will be the greatest, bends in existing pipe, etc.).
18	If the pipeline must be removed from service to make a repair, CONSIDER cutting the pipe and performing the lowering at the same time to eliminate the elongation stress component.
19	CONSIDER the final stress produced by bending, temperature differences, and other factors if permanent lowering bends are not installed as part of the lowering plan.

7.5 Final Preparations for Lowering the Pipeline

Operations Personnel use the following procedure to make final preparations for lowering a pipeline.

Step	Activity
1	TAKE the following final preparations prior to commencing the lowering operation.
2	ADVISE Pipeline Integrity or Liquid Tech Ops Department of any circumstances, which should be considered in establishing the need for an additional pressure reduction during the lowering operation.



NOTE:

- It may be necessary to reduce the operating pressure when excavating a section of pipe with known defects. Refer to *SOP HLI.05 Pipeline Repair*.
- A reduced operating pressure may also be required during the lowering operation based upon the calculations performed in developing the lowering plan.

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Step	Activity
3	ADVISE Liquid Control to reduce the pipeline operating pressure at the location to the pressure approved by Management.
4	CONSIDER evacuating the area near the pipeline when necessary unless conditions from the analysis in the Lowering Plan indicate that there is no need for concern.
5	If feasible MAN the mainline valves immediately upstream and downstream of the excavation while the lowering operations are in progress.
6	POST an observer for the purpose of maintaining communication with people manning valves and with Liquid Control

7.6 Performing the Lowering Operation

Operations Personnel use the following procedure to perform the lowering operation.

Step	Activity
1	ADHERE to the following guidelines and the site specific “Lowering Plan” strictly.



CAUTION: Adherence to the following is critical to the safety of the pipeline lowering since a considerable amount of the allowable axial and bending stresses can be consumed by the handling of the pipe during the lowering operation.

Step	Activity
2	HOLD a pre-job safety meeting to discuss the sequence of events for the lowering operation.
3	COMPLETE the applicable form(s) for <i>Pre-job Safety Meeting</i> .
4	VERIFY that the pipeline lowering is supervised by a person knowledgeable of the procedures and methods necessary to successfully perform the work, and that the personnel performing the work are properly trained and are familiar with the requirements.
5	ALIGN the lifting equipment directly above/below the pipe to minimize any lateral movement.
6	LIFT the pipe the minimum amount necessary to remove skids. DO this slowly and to no more than a few inches.
7	REMOVE the first layer of skids from the first cribbing support and REBUILD the support if necessary. REFER to “Using Shims” below.
8	LOWER the pipe slowly back down to the shortened cribbing support.



NOTE: The lowered distance will be approximately one skid thickness.

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Step	Activity
9	REPEAT the above four steps at the second cribbing support.
10	CONTINUE from one end of the lowering section to the other until the first row of skids has been removed from each crib support for the entire lowering length.
11	REPEAT the above sequence one layer at a time until the pipeline meets the final elevation profile.
12	MINIMIZE any bouncing or other movement of the pipe.
13	ALLOW any pipe movement to stop between each lifting and lowering step during the lowering operation.



CAUTION:

- Handle the pipe carefully to maintain control of the lowering activities and to verify that the pipe is not dropped or left unsupported.
- Do not lower the pipeline to an elevation below that established in the "Lowering Profile."

Step	Activity
14	USE shims or other support methods at crib supports where the final required elevation falls between two successive layers of skids.
15	PERFORM the lowering operation by one of the following methods, or as approved by Pipeline Integrity or Liquid Tech Ops Department: <ul style="list-style-type: none"> • USE conventional pipeline equipment. • USE pressurized air bags to support and lower the pipe. REFER to Section 7.8, Lifting Pressurized Pipelines Using Air Bags, and Appendix B. • PLACE beams across the ditch and LOWER the pipe using a winch. VERIFY the beams are adequately designed to carry the weight of the pipe.
16	If a valve or other heavy component is included in the lowering section, SUPPORT it directly.



CAUTION: Do not lift the pipe on both sides of the ditch.

Step	Activity
17	MAINTAIN adequate support beneath the pipe as it is lifted to remove skids and as it is lowered back down to the shortened crib support during each successive pass to remove another layer of skids.



NOTE: A pipeline larger than 4 inches in diameter will probably not sag down far enough under its own weight to rest on the next skid using the cribbing spacing under the "Spacing of Cribbing" subsection above until the skids have been removed from several consecutive supports.

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Step	Activity
18	REFER to Appendix C for the initial unsupported span length required to lower the pipe down to the elevation required by the “Lowering Profile” or down to the shortened cribbing support (whichever comes first).



NOTE: As the lowering progresses, the required span length is reduced. Support requirements are illustrated in Appendix D.

Step	Activity
19	VERIFY that equipment supporting the pipe during the lowering operation is not spaced more than 50 feet apart.
20	REFER to the company lowering guidelines for the stresses induced by the above span lengths.
21	If a span fails to reach one of the cribbing supports after the specified span length is achieved, SUPPORT the pipe and CONTACT Pipeline Integrity Department.



NOTE: This may be a result of wall thickness variations or higher than anticipated axial stresses being present in the pipe prior to the start of the lowering operation.

Step	Activity
22	REDUCE the operating pressure temporarily, or REDUCE the axial stress from other sources to offset the lowering stresses until the work can be completed, if necessary.



CAUTION: Do not place the lifting and support points for lowering the pipe beneath or near the pipeline girth welds. This is the same as for cribbing placements as described above.

Step	Activity
23	LOWER the pipeline under its own weight.



CAUTION: If the pipeline does not readily lower to the intended elevation, do not force it.

Step	Activity
24	NOTIFY Pipeline Integrity Department to analyze the original and current profiles to determine the required action.



CAUTION: Do not change the configuration of any original pipe bends except as indicated in the lowering plan. This applies during the lowering process and in the final placement of the pipe.

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Step	Activity
25	REMOVE the remaining skids.
26	DETERMINE the final lowered elevation and CHECK it against the "Lowering Profile."
27	MAKE adjustments as necessary to match the lowering profile.



CAUTION: Do not allow final strain levels to exceed the maximum allowable value provided by Pipeline Integrity or Liquid Tech Ops Department where strain gauges have been installed.

Step	Activity
28	REPORT excessive strain values to Pipeline Integrity Department, who will analyze the profile and provide instructions to correct the problem.
29	DOCUMENT the evaluations under <i>Section 7.1</i> , Evaluating the Potential for Lowering a Pipeline; <i>Section 7.4.2</i> , Inspecting and Repairing Welds; and <i>Section 7.6</i> , Performing the Lowering Operation; as well as the initial profile, profile calculations supporting the final profile, the final profile, and the final stress levels per <i>Section 7.2</i> , Developing a Lowering Plan and Profile.
30	DOCUMENT all work, and KEEP the records in the project file and RETAIN for the life of the facility. SUBMIT project file to Engineering Records Group per requirements of <i>SOP HLB.11 Project Documentation and As-built Process</i>
31	BACKFILL the pipeline per <i>SOP HLI.10 Excavation and Backfill</i> .

7.8 Lifting Pressurized Pipelines Using Air Bags

Operations Personnel use the following procedure to lift or move pressurized pipelines using air bags. This method helps prevent over-stressing operating pipelines.



NOTE:

- Pipe of any size, other than at casings, can be lifted by this method. However, for the tables in Appendix B to apply, it must be unrestrained for approximately 80 feet in length, and the lifting should take place within 15 feet of the midpoint.
- For pipeline diameters less than 20" or greater than 36", create a work plan to determine appropriate number of bags, bag size and maximum bag pressure.
- For use of airbag other than this, a specific study must be made. Contact Pipeline Integrity Department to determine the applicability of the raising criteria if a bend is present.

Step	Activity
1	EQUIP air bags with 125-150 psig gauges that are accurate to the nearest one

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	pound.
2	VERIFY that there is a solid base under the air bag to determine the actual lifting force.
3	ESTABLISH a fixed reference point for measuring the deflection of the pipe.



NOTE: Do not use pipe casing as a reference since it may move along with the pipe.

Step	Activity
4	If there are different wall thicknesses of pipe inside the casing and in the excavated area, USE the values in the tables in Appendix B for the lighter wall pipe to determine the allowable lifting force and deflection.
5	POSITION air bag(s) under the pipe as close together as possible so the center of the lifting area is approximately 6 feet from the end of the casing.
6	PROVIDE a smooth, flat surface for the air bag(s) to rest on, such as ¾ inch or 1 inch plywood.
7	PLACE a piece of heavy canvas or rock shield between the pipe and the air bag to help protect the bag from any sharp protrusions in the coating.
8	CONNECT the air source to the bags and slowly INFLATE while watching the pipe deflection and bag pressure.



CAUTION: Do not exceed the elevation change specified by the pipeline raising plan developed by Pipeline Integrity Department.

Step	Activity
9	MONITOR the shorted casing to the pipe potential and when the shorted condition is eliminated and there is clearance enough between the bottom of the pipe and the casing, STOP pressuring the air bag(s).
10	INSTALL insulating material between the pipe and casings.
11	RELEASE pressure and CHECK that the shorted condition does not recur.
12	If an adequate pipe deflection is not obtained with the force listed in the tables in Appendix B for existing conditions, or the conditions do not match model conditions outlined in the Note following Step 13 below, CONTACT Pipeline Integrity Department.



NOTE: Pipeline Integrity Department calculates a safe lifting force and maximum deflection from the existing conditions.

Step	Activity
13	REFER to the following for a discussion of this method and a description of model conditions.

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NOTE:

- A typical shorted casing repair was used as a model for making the pipe stress calculations. This model consists of 40 feet of straight pipe excavated from the end of the casing, 40 feet of free pipe inside the casing and the air bag lifting the pipe at a point approximately 6 feet from the end of the casing. The maximum stress level used in the calculations was 75% of Specified Minimum Yield Strength (SMYS).
- For Appendix B, the bag pressure to be used was determined by dividing the force on the pipe by the area of the “foot print” on the bag for each diameter of pipe 20” through 36”. In all cases, the primary air bag used was the larger size bag of 30” x 30” nominal size. Those situations where the tables in Appendix B indicate a second or third bag is to be used, the bag sizes are footnoted as to size, either the 24” x 24” or 30” x 30” nominal size. Where more than one air bag is required, the bag pressure in the table in Appendix B is for each bag. The additional bags should be placed under the pipe as close to the first bag as possible. It is important to keep the lifting point approximately 6 feet from the end of the casing. The table values for bag pressure and pipe deflection at the end of the casing are maximum values. If a casing short can be cleared using lower values, use only the bag pressure or deflection necessary to accomplish the task. For pipeline diameters less than 20” or greater than 36”, create a work plan to determine appropriate number of bags, bag size and maximum bag pressure.
- Possible existing conditions that have not been considered in the stress calculations are:
 - Corrosion (internal or external)
 - Acetylene welds
 - Condition of un-x-rayed welds
 - Unreinforced couplings
 - Stresses (resulting from tie-ins, settlement, bends, construction damage, lamination, etc.)
 - If it is determined that any of these conditions exist, consult Pipeline Integrity Department.
- In the event an adequate pipe deflection cannot be obtained with the force listed for the conditions, contact Pipeline Integrity Department. Be prepared to give the details of the situation, i.e. length of excavation, pipe size, wall thickness, grade, heavy and light wall lengths in the excavated area, existing line pressure, area of contact between bag and pipe, deflection obtained at the listed pressure, obstructions in casing, or any other condition that could affect the situation. From this information, a recalculation can be made that will better fit the conditions and possibly result in the attainment of the required deflection.

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- 8.0 Documentation Requirements**
- Record data in electronic database or utilize the following forms as applicable:
- Pipe Lowering Profile
 - Pipe Lowering Plan
 - I.05.A NDT Report of Field Girth Welds (or Equivalent Contractor Form)
 - I.05.B NDT Report of Field Girth Welds – Overflow (or Equivalent Contractor Form)
 - I.05.D Pre-Job Safety Meeting Form
 - Pipe Inspection Database

- 9.0 References**
- HLI.01 Pipeline Shutdown and Startup
HLI.05 Pipeline Repair
HLI.06 Evaluating Pipeline Defects
HLI.10 Excavation and Backfill
HLI.26 Mining, Subsidence, and Soil Slippage
HLB.11 Project Documentation and As-built Process

Appendix A: OQ Task Requirements

The table below identifies the Operator Qualification (OQ) task requirements.

Task Description	OQ Task
Visual Inspection of Buried Pipe and Components When Exposed	PLOQ401
Measure and Evaluate Pipeline Defects	PLOQ418A
Backfilling – Pipe and Coating Protection	PLOQ404
Damage Prevention During Excavation/Encroachment Activities	PLOQ607
Visual Inspection of Welding and Welds	PLOQ203

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Appendix B: The tables below define the maximum allowable bag pressures, pipe deflections and
Air Bag Tables force on pipe for each diameter 20" through 36", wall thickness, SMYS and line pressures.

**20 INCH PIPE
LARGE BAG - 303 SQ. IN.**

Pipe Diameter (Inches)	Wall Thickness (Inches)	SMYS	Line Pressure (psig)	Maximum Allowable		
				Bag Pressure (psig)	Pipe Deflection (Inches)	Force on Pipe (Lbs.)
20	0.281	4200	200	59.5	3.05	18020
20	0.281	4200	400	44.7	2.30	13554
20	0.281	4200	600	30.0	1.54	9089
20	0.281	4200	400	51.4	2.64	15566
20	0.281	4200	600	36.6	1.88	11101
20	0.281	4200	800	21.9	1.12	6636
20	0.281	4400	400	54.5	2.80	16507
20	0.281	4400	600	39.7	2.04	12042
20	0.281	4400	800	25.0	1.28	7577
20	0.312	2500	200	38.2	1.78	11573
20	0.312	2500	400	23.5	1.09	7129
20	0.312	26900	200	41.5	1.93	12561
20	0.312	26900	400	26.8	1.25	8117
20	0.312	26900	600	12.1	0.56	3672
20	0.312	28200	200	43.7	2.03	13237
20	0.312	28200	400	29.0	1.35	8793
20	0.312	28200	600	14.4	0.67	4348
20	0.5	24000	200	65.7	1.96	19911
20	0.5	24000	400	51.5	1.54	15591
20	0.5	24000	600	37.2	1.11	11270

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**AIR BAG TABLES
22 INCH PIPE
LARGE BAG - 374 SQ. IN.**

Pipe Diameter (Inches)	Wall Thickness (Inches)	SMYS	Line Pressure (psig)	Maximum Allowable		
				Bag Pressure (psig)	Pipe Deflection (Inches)	Force on Pipe (Lbs.)
22	0.281	43600	400	48.7	2.31	18201
22	0.281	43600	600	32.7	1.55	12235
22	0.281	43600	800	16.8	0.80	6269
22	0.281	46700	400	53.4	2.53	19973
22	0.281	46700	600	37.5	1.78	14007
22	0.281	46700	800	21.5	1.02	8040
22	0.312	31300	200	52.5	2.25	19619
22	0.312	31300	400	36.6	1.57	13678
22	0.312	31300	600	20.7	0.89	7737
22	0.312	32200	200	54.0	2.32	20188
22	0.312	32200	400	38.1	1.63	14247
22	0.312	32200	600	22.2	0.95	8306
22	0.312	40000	200	67.2	2.88	25117
22	0.312	40000	400	51.3	2.20	19176
22	0.312	40000	600	35.4	1.52	13235
22	0.312	40800	200	68.5	2.94	25623
22	0.312	40800	400	52.6	2.26	19682
22	0.312	40800	600	36.7	1.58	13740
22	0.312	52000	200	87.4	3.75	32700
22	0.312	52000	400	71.5	3.07	26759
22	0.312	52000	600	55.7	2.39	20818
22	0.375	32200	200	67.6	2.43	25285
22	0.375	32200	400	51.9	1.87	19395
22	0.375	32200	600	36.1	1.30	13505
22	0.375	42000	200	87.3	3.15	32664
22	0.375	42000	400	71.6	2.58	26774
22	0.375	42000	600	55.8	2.01	20884

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Pipe Diameter (Inches)	Wall Thickness (Inches)	SMYS	Line Pressure (psig)	Maximum Allowable		
				Bag Pressure (psig)	Pipe Deflection (Inches)	Force on Pipe (Lbs.)
22	0.375	46000	400	79.6	2.87	29786
22	0.375	46000	600	63.9	2.30	23896
22	0.375	46000	800	48.1	1.73	18006
22	0.375	52000	200	60.7	3.87	40194
22	0.375	52000	400	51.8	3.30	34304
22	0.375	52000	600	42.9	2.74	28414
22	0.375	60000	200	69.8	4.45	46218
22	0.375	60000	400	60.9	3.88	40328
22	0.375	60000	600	52.0	3.32	34438
22	0.5	42000	200	67.7	3.29	44845
22	0.5	42000	400	59.0	2.87	39055
22	0.5	42000	600	50.2	2.44	33265
22*	0.5	46000	400	65.0	3.16	43003
22*	0.5	46000	600	56.2	2.73	37213
22*	0.5	46000	800	47.5	2.31	31423

* Use two (2) air bags, one (1) 30" x 30" and one (1) 24" x 24" (662 sq. in.)

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**AIR BAG TABLES
24 INCH PIPE
LARGE BAG - 428 SQ. IN.**

Pipe Diameter (Inches)	Wall Thickness (Inches)	SMYS	Line Pressure (psig)	Maximum Allowable		
				Bag Pressure (psig)	Pipe Deflection (Inches)	Force on Pipe (Lbs.)
24	0.281	45000	400	48.7	2.03	20860
24	0.281	45000	600	30.6	1.27	13089
24	0.281	45200	400	49.1	2.05	20996
24	0.281	45200	600	30.9	1.29	13225
24	0.281	47400	400	52.6	2.19	22497
24	0.281	47400	600	34.4	1.43	14727
24	0.281	47400	800	16.3	0.68	6956
24	0.281	60000	400	72.7	3.03	31095
24	0.281	60000	600	54.5	2.27	23324
24	0.281	60000	800	36.3	1.52	15554
24	0.312	43700	400	55.6	2.10	23814
24	0.312	43700	600	37.6	1.42	16073
24	0.312	43700	800	19.5	0.73	8333
24	0.375	43700	400	73.7	2.33	31539
24	0.375	43700	600	55.7	1.76	23859
24	0.375	43700	800	37.8	1.19	16179
24*	0.5	46000	400	65.7	2.77	49256
24*	0.5	46000	600	55.6	2.35	41696
24*	0.5	46000	800	45.5	1.92	34136
24*	0.5	52000	400	75.1	3.17	56344
24*	0.5	52000	600	65.0	2.75	48784
24*	0.5	52000	800	55.0	2.32	41224

* Use two (2) air bags, one (1) 30" x 30" and one (1) 24" x 24" (750 sq. in.)

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AIR BAG TABLES

26 INCH PIPE

1 LARGE BAG & 1 SMALL BAG - 737 SQ. IN.

Pipe Diameter (Inches)	Wall Thickness (Inches)	SMYS	Line Pressure (psig)	Maximum Allowable		
				Bag Pressure (psig)	Pipe Deflection (Inches)	Force on Pipe (Lbs.)
26	0.271	60000	500	37.5	2.19	27629
26	0.271	60000	700	24.0	1.40	17711
26	0.271	60000	900	10.6	0.62	7792
26	0.281	57830	500	37.8	2.13	27846
26	0.281	57830	700	24.3	1.37	17939
26	0.281	57830	900	10.9	0.61	8033
26	0.312	52000	400	45.2	2.30	33303
26	0.312	52000	500	38.5	1.96	28367
26	0.312	52000	600	31.8	1.62	23432
26	0.312	52000	700	25.1	1.28	18496
26	0.312	52000	800	18.4	0.94	13560
26	0.312	52000	900	11.7	0.60	8625
26	0.375	52000	500	52.7	2.25	38834
26	0.375	52000	700	39.4	1.68	29034
26	0.375	52000	900	26.1	1.11	19235
26	0.375	60000	400	70.8	3.02	52214
26	0.375	60000	600	57.5	2.46	42414
26	0.375	60000	800	44.3	1.89	32615
26	0.375	65000	500	71.4	3.05	52614
26	0.375	65000	700	58.1	2.48	42815
26	0.375	65000	900	44.8	1.91	33015
26	0.5	40000	500	57.6	1.87	42469
26	0.5	40000	700	44.5	1.45	32811
26	0.5	40000	900	31.4	1.02	23152
26	0.5	42000	400	68.0	2.21	50084
26	0.5	42000	600	54.9	1.78	40426
26	0.5	42000	800	41.7	1.36	30768

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Pipe Diameter (Inches)	Wall Thickness (Inches)	SMYS	Line Pressure (psig)	Maximum Allowable		
				Bag Pressure (psig)	Pipe Deflection (Inches)	Force on Pipe (Lbs.)
26	0.5	45000	500	67.1	2.18	49434
26	0.5	45000	700	54.0	1.75	39776
26	0.5	45000	900	40.9	1.33	30118
26	0.5	47000	400	77.4	2.51	57050
26	0.5	47000	600	64.3	2.09	47391
26	0.5	47000	800	51.2	1.66	37733
26	0.5	52000	500	80.3	2.61	59186
26	0.5	52000	700	67.2	2.18	49527
26	0.5	52000	900	54.1	1.76	39869

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AIR BAG TABLES

30 INCH PIPE

1 LARGE BAG & 1 SMALL BAG - 768 SQ. IN.

Pipe Diameter (Inches)	Wall Thickness (Inches)	SMYS	Line Pressure (psig)	Maximum Allowable		
				Bag Pressure (psig)	Pipe Deflection (Inches)	Force on Pipe (Lbs.)
30	0.312	52000	500	41.2	1.41	31624
30	0.312	52000	700	21.3	0.73	16386
30	0.312	60000	500	53.6	1.84	41132
30	0.312	60000	700	33.7	1.16	25894
30	0.312	60000	900	13.9	0.48	10657
30	0.325	42000	500	28.7	0.95	22077
30	0.325	52000	500	44.8	1.48	34441
30	0.325	52000	700	25.0	0.83	19224
30	0.344	60000	500	64.0	2.00	49117
30	0.344	60000	700	44.2	1.38	33929
30	0.344	60000	900	24.4	0.76	18740
30	0.361	52000	500	55.1	1.65	42350
30	0.361	52000	700	35.4	1.06	27187
30	0.361	52000	900	15.7	0.47	12025
30	0.375	52000	500	59.2	1.70	45452
30	0.375	52000	700	39.5	1.14	30311
30	0.375	52000	900	19.8	0.57	15170
30	0.406	52000	500	68.0	1.81	52197
30	0.406	52000	700	48.3	1.29	37103
30	0.406	52000	900	28.7	0.76	22009
30	0.406	60000	500	83.9	2.24	64454
30	0.406	60000	700	64.3	1.71	49360
30	0.406	60000	900	44.6	1.19	34265
30	0.5	42000	500	69.9	1.53	53721
30	0.5	42000	700	50.5	1.10	38769
30	0.5	42000	900	31.0	0.68	23817

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Pipe Diameter (Inches)	Wall Thickness (Inches)	SMYS	Line Pressure (psig)	Maximum Allowable		
				Bag Pressure (psig)	Pipe Deflection (Inches)	Force on Pipe (Lbs.)
30	0.5	47000	500	82.1	1.79	63066
30	0.5	47000	700	62.6	1.37	48114
30	0.5	47000	900	43.2	0.94	33162
30	0.5	52000	500	94.3	2.06	72412
30	0.5	52000	700	74.8	1.63	57459
30	0.5	52000	900	55.3	1.21	42507

AIR BAG TABLES

30 INCH PIPE

2 LARGE BAGS - 884 SQ. IN.

Pipe Diameter (Inches)	Wall Thickness (Inches)	SMYS	Line Pressure (psig)	Maximum Allowable		
				Bag Pressure (psig)	Pipe Deflection (Inches)	Force on Pipe (Lbs.)
30.125	0.375	60000	500	64.7	2.11	57091
30.125	0.375	60000	700	47.3	1.54	41757
30.125	0.375	60000	900	29.9	0.98	26424
30.175	0.375	60000	500	64.8	2.11	57204
30.175	0.375	60000	700	47.3	1.54	41793
30.175	0.375	60000	900	29.9	0.97	26382
30.313	0.469	60000	500	91.8	2.37	81062
30.313	0.469	60000	700	74.3	1.92	65581
30.313	0.469	60000	900	56.7	1.47	50100
30.375	0.5	46000	500	70.4	1.70	62129
30.375	0.5	46000	700	52.8	1.28	46599
30.375	0.5	46000	900	35.2	0.85	31070
30.375	0.5	60000	500	100.8	2.44	88970
30.375	0.5	60000	700	83.2	2.01	73441
30.375	0.5	60000	900	65.6	1.59	57911

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AIR BAG TABLES

36 INCH PIPE

2 LARGE BAGS - 968 SQ. IN.

Pipe Diameter (Inches)	Wall Thickness (Inches)	SMYS	Line Pressure (psig)	Maximum Allowable		
				Bag Pressure (psig)	Pipe Deflection (Inches)	Force on Pipe (Lbs.)
36	0.375	60000	500	71.3	1.49	69008
36	0.375	60000	700	44.1	0.92	42680
36	0.375	60000	900	16.9	0.35	16351
36	0.5	60000	500	116.6	1.84	112871
36	0.5	60000	700	89.7	1.42	86816
36	0.5	60000	900	62.8	0.99	60762
36.25*	0.5	60000	500	78.4	1.82	113908
36.25*	0.5	60000	700	90.2	1.40	87298
36.25*	0.5	60000	900	62.7	0.97	60698
36.25*	0.562	65000	500	104.8	2.15	152209
36.25*	0.562	65000	700	86.3	1.77	125458
36.25*	0.562	65000	900	102.0	1.40	98707

* Use three (3) air bags - 30" x 30" (1453 sq. in.)

Appendix C: The table defines the maximum span length of unloaded pipelines prior to lowering the pipe down to the elevation required by the Lowering Profile or down to the shortened cribbing support, whichever comes first.

Pipe Diameter	Maximum Span Length
4"	50'
6"	60'
8"	70'
10"	78'
12"	85'
14"	92'
16"	99'
18"	105'
20"	112'
24"	125'
26"	132'

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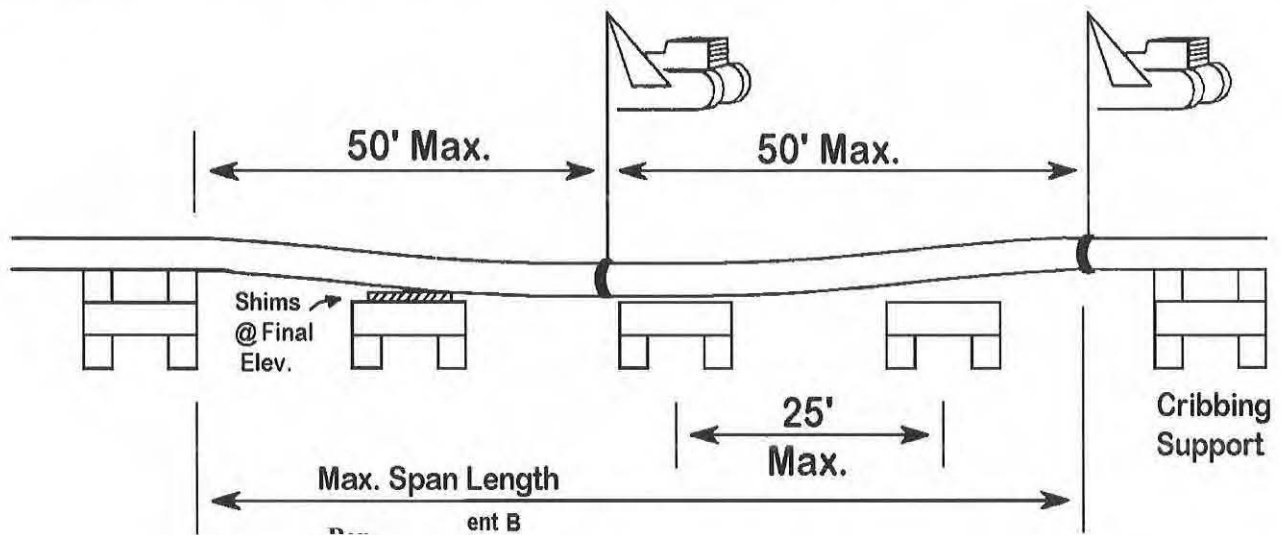
30"	145'
36"	160'



NOTE: These lengths vary slightly with pipe wall thickness and are not applicable for pipe with weight coating, liquids, or other heavy components.

**Appendix D:
Figure 1**

The figure below defines the maximum span length for cribbing at the final lowering profile elevation.



**Excavation and Backfill****Standard Operating Procedures***Applicable to Hazardous Liquids Pipelines and Related Facilities*

Code Reference :	Procedure No.: HLI.10	
49 CFR 195.402, 195.248, 195.252	Effective Date: 04/01/18	Page 1 of 16

1.0 Procedure Description This Standard Operating Procedure (SOP) describes how to provide adequate support and protection of company pipeline facilities during excavation and backfilling activities.

2.0 Scope This SOP establishes requirements to be followed prior to, during and post any excavation and backfilling activities on or around company pipeline facilities. This SOP also protects company personnel who are required to work in or around excavations and trenches by establishing excavation procedures to help prevent the hazards of cave-in or asphyxiation in trenches, under embankments, and in holes.

3.0 Applicability This SOP applies to any excavation and backfilling activities on or around company pipeline facilities performed by Company employees or authorized contractors.

4.0 Frequency As required: All excavations and backfilling on or around company pipeline facilities.

5.0 Governance The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Operations Manager	Director of Operations

6.0 Terms and Definitions Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

Terms	Definitions
Bell-Hole	An excavation where the width is typically greater than the depth and access routes are cut along the sides of the excavation to form an approximate bell shape.
Competent Person	One who is qualified, capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.
Trench	A long, narrow excavation where the width of the excavation

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	is less than the depth.
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7.0

Excavation and Backfill

The following procedures are described in this section:

- Prior to Excavation
- Requirements for New Pipeline Installation
- Excavation of Existing Company Pipeline Facilities
- Safety Precautions
 - Hazardous Atmospheres
- Using Explosives
- Excavation of Company Pipelines by a Contractor
- Sloping and Shoring
 - Sloping Requirements
 - Shoring Requirements
- Inspecting Excavations
- Backfilling
 - Erosion Control

7.1

Prior to Excavation

Operation Personnel perform the following procedures prior to excavation.

Commented [A1]: The phrase "Operation Personnel" is all encompassing including leadership. No need to uniquely call out the Ops Manager for section 7.1

Step	Activity
1	DESIGNATE and VERIFY a qualified competent person will be on site to supervise all excavation work performed by company personnel.
2	REVIEW the terms of the easement for the tract(s) of land where the excavation is to be conducted.
3	LOCATE and MARK company pipeline facilities per <i>SOP HLB.04 Pipe Location and Marking</i> . VERIFY the proposed excavation limits are marked to assist local One-Call responders in identifying the limits of excavation activities.



NOTE: Indicate the depth of cover of company pipeline facilities on each marking when the excavation limits will be 75 ft. or greater.



CAUTION: When excavating existing company pipeline facilities for maintenance, where shallow cover is discovered, **DEVELOP** an excavation and backfill plan prior to excavation to confirm the safety and integrity of the company pipeline facility. Methods include but are not limited to:

- Additional soil combined with grading and contouring to re-establish adequate cover.
- Installation of erosion control and mechanical protection (e.g., revetment mats, concrete slabs, and rip-rap).
- Pipeline lowering
- Installation of box sag bends

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- Installation of warning tape to alert future excavators

4	CONTACT the local One-Call system and REQUEST a notification be sent out for the proposed excavation. NOTIFY all utilities not participating in the One-Call system in the area of the proposed excavation.
5	If necessary, REQUIRE utilities to move any overhead hazards. If below-ground utilities present a hazard, DISCUSS work with the utility representative.
6	ENCOURAGE affected utility owners to have a representative at the site during excavation and backfilling operations.
7	CONSIDER traffic and/or any material, structures, or equipment which could be present near the edge of the excavation.
8	DEPLOY barricading, signal guards, stop logs, or other warning systems needed when mobile equipment is used around the excavation.
9	DEPLOY proper barricading, plating and other warnings on excavations left open after working hours or left unattended.



NOTE: Secure all necessary permits and observe barricading/signage rules of the local governing authorities when excavations cross or affect roads.

10	CONSULT with Pipeline Integrity Department to review the anomaly data to determine whether smart tool indications will be exposed during the excavation.
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11	CONFIRM if any additional pressure reductions are required prior to starting excavation activities. Refer to <i>SOP HLI.11 Pipeline Pressure Limit Criteria</i>
12	NOTIFY Liquids Control.

7.2 Requirements for New Pipeline Installation

Operation Personnel perform the following procedure when excavating for new company pipeline facility installation.

Step	Activity
1	DETERMINE the dimensions of the ditch for new company pipeline facility installations based on the size of the pipeline.
2	REFER to the following table for: <ul style="list-style-type: none"> • The minimum width at the bottom of the ditch • Minimum cover as measured from the top of the pipe to the average level of the ground on both sides of the ditch.

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Nominal Pipe Size (Inches)	Minimum Ditch Width (Inches)		
4	22		
6	26		
8	26		
10	26		
12	30		
14	32		
16	36		
18	38		
20	40		
22	42		
24	44		
26	46		
30	50		
36	52		
42 & Larger	56		

Location	For Normal Excavation (inches)	For Rock Excavation (Inches)
Industrial, Commercial, and residential areas	36	30
Crossing of inland bodies of water with a width of at least 100 feet from high water mark to high water mark	48	18
Drainage ditches at public roads and railroads	36	36
Deepwater port safety zones	48	24
Any other area	30	18



NOTE:

- These depths of cover are applicable for new installations in soil.
- Rock excavation is any excavation that requires blasting or removal by equivalent means.

**7.3
Excavation of
Existing
Company
Pipeline
Facilities**

Operation Personnel performs the following procedure to excavate existing company pipeline facilities.

Step	Activity
1	CLASSIFY the soil in each section of the excavation. DETERMINE

Excavation and Backfill

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appropriate sloping, shoring, or shielding per Section 7.7 below.



CAUTION: When conditions change, reclassify soil and modify sloping, shoring, or shielding requirements as necessary before entry.

2	VERIFY excavation equipment (e.g., backhoe, track hoe) has the side cutters detached with a plate welded over the teeth or the bucket teeth removed unless otherwise permitted by Operations Management.
3	POSITION a spotter to watch for unmarked lines, probe company facilities when required, and to stop the excavation equipment (e.g., backhoe, track hoe) operator if a foreign object is observed.
4	EXCAVATE on both sides parallel to the marked location of the company pipeline facility to minimize the danger of contact.



CAUTION: A minimum of 24" of separation between company pipeline facilities and any mechanized excavating equipment will be maintained unless otherwise permitted by Operations Management. At no time shall the separation be less than 12".

5	CONTINUE the excavation adjacent to the company pipeline facility with a hand shovel until the side wall of the company pipeline facility is exposed.
6	PUSH the dirt directly above the company pipeline facility into the adjacent ditch with hand shovels.
7	PLACE the excavated material at least two (2) feet from the edge of the excavation. SEPARATE the topsoil and fill material for later use in the backfill operation.
8	<p>When excavation is to take place within the specified tolerance zone of company pipeline facilities, an excavator must exercise such reasonable care as may be necessary for the protection of any underground pipeline in or near the excavation area (Sections A. through C. shall be exercised in Texas).</p> <p>A. "Tolerance zone" is defined as half the width of the underground pipeline plus a minimum of eighteen inches (18") on either side of the outside edge of the underground pipeline on a horizontal plane. The tolerance zone shall not be less than twenty-four inches (24") on either side of the pipe.</p> <p>B. Unless approved by the underground utility operator, excavation within the "Tolerance Zone" shall only be performed by non-mechanical means. Certain climate or geographical conditions may require a specific method of excavation such as hand digging, soft digging, vacuum excavation, or pneumatic hand tools. Other mechanical or technical methods developed may be used with the approval of the underground pipeline operator.</p> <p>C. Hand digging and non-invasive methods are not required for pavement removal.</p>

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NOTE: When excavation activity occurs on company pipeline facilities and is complete by Operations Personnel, or Company Contractors, sections A. through C. above are not required, but should be considered.

9	IF it becomes necessary to operate excavation equipment over company pipeline facilities, VERIFY there is adequate stable cover and DETERMINE per <i>SOP HLI.27 Abnormal Loading External Loads Hwy RR</i> if external loading from excavation equipment is within acceptable limits.
10	COMPLETE a Pipe Inspection Report upon exposing company pipeline facilities designed for below grade service. Refer to <i>SOP HLD.35 Buried Pipe Inspection and Evaluations</i> .

7.4 Safety Precautions

Operation Personnel follow the safety procedures below when working in a trench, ditch, or hole.



CAUTION: Reference *Safety Procedure S-130 Excavation and Trenching* for additional requirements.

Step	Activity
1	VERIFY all personnel who are exposed to public vehicular traffic during excavation activities are provided and wear suitable warning vests or garments.
2	EXCAVATE the area in a careful and controlled manner.
3	PLACE excavated material at least two (2) feet from the edge of the ditch to avoid impeding the use of ramps, ladders, or steps. ADHERE to OSHA Subpart P guidelines for the placement of the soil.



WARNING: Prohibit any entrance into the excavation until approval of all sloping, shoring, shielding, and means of egress has been granted by the designated excavation competent person.

4	PROVIDE ramps, ladders, or steps on both sides of the company pipeline facility to provide escape routes for personnel in the event of an emergency.
5	VERIFY the area of exit from ramps, ladders, or steps is not obstructed.
6	VERIFY ladders are in good condition, extend from the floor of the excavation to three (3) feet above the top of the excavation, and are secured at the top.
7	For excavations of greater than four (4) feet in depth: <ul style="list-style-type: none"> PROVIDE means of egress/exit so no more than 25 feet of lateral travel is necessary from any point in the ditch. VERIFY the slope of exit runways does not exceed a one (1) feet rise over a three (3) feet run, or PROVIDE cut in steps. REFER to <i>Section 7.8</i> below for sloping and shoring requirements.

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4	PROVIDE ramps, ladders, or steps on both sides of the company pipeline facility to provide escape routes for personnel in the event of an emergency.
	<ul style="list-style-type: none"> PROVIDE walkways with standard guardrails when employees are required to cross over excavations where the walkways are four feet or more above the lower levels.
8	INSPECT the work area daily before work, during each shift, and under any circumstance making the work area unsafe.
9	COMPLETE a hot work permit/hazardous operations plan when performing welding, cutting, heating, or other maintenance activities where liquid or vapors might be present in the trench.
10	TEST excavations for any possible accumulation of dangerous fumes or oxygen deficient atmospheres. DIRECT employees to report any signs of fume accumulation or oxygen depletion.



NOTE:

- Hazardous liquids or vapors are not generally expected in the excavation of company liquid pipeline facilities. However, when hazardous liquids or vapors are expected or known to be present adequate precautions shall be taken to protect personnel.
- Direct reading instruments will be utilized to determine whether hazardous, vapors or inadequate oxygen levels exist prior to personnel entering excavation, or a confined space. Personnel will not enter excavation where hazardous vapors, or insufficient oxygen levels are found without appropriate personal protective equipment and training.
- Training in the use of hazardous vapor detection devices will be in accordance with manufacturer's recommended procedures.

11	MONITOR water control and removal equipment. DIRECT employees to report accumulations of water or other material that might weaken the excavation or make escape difficult. DISCONTINUE work if water in the trench impedes safe egress.
12	DIRECT employees to watch for evidence of cracks, slumping, slides, caving in soil, and signs of stress or failure in shoring or shielding.
13	STORE any materials at least two (2) feet from the edge of the excavation.
14	IF a welder or other worker is required to lie down in a trench over 3½ feet deep, WIDEN and SLOPE OUT the trench at the elevation the worker is present.
15	VERIFY bell-holes are large enough in all dimensions for safe and easy working conditions.

**7.4.1
Hazardous
Atmospheres**

Operation Personnel are responsible for the following procedures when individuals work in the trench and there is an unsafe accumulation of vapor or gas.

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WARNING: No personnel will be allowed to enter any excavation, regardless of depth, until the area is made safe from the presence of a hazardous atmosphere.

Step	Activity
1	TAKE adequate precautions to prevent employee exposure to hazardous atmospheres and atmospheres containing less than 19.5% oxygen. PROVIDE respiratory protection or ventilation, if appropriate.
2	IF hazardous vapors are being vented in trench excavations out of a company pipeline facility during maintenance functions, INSTRUCT employees working in close proximity to venting vapors to position themselves in such a way to not be inhaling fumes. USE approved monitors to verify air quality.



CAUTION: Hazardous vapors accumulate in low lying areas and do not dissipate quickly and have a tendency to accumulate in the trench.

Step	Activity
3	MONITOR trenches and bell-holes where vapors are venting for any unsafe accumulation of vapors using portable gas detection.
4	If distillate or some other condition causes an unsafe accumulation of vapor in the trench or bell-hole, PROVIDE the appropriate emergency rescue equipment, including a breathing apparatus and a rescue harness and line.



NOTE: Excavations may be considered confined spaces and require permit entry. Refer to *Safety Procedure S-370 Work Permits*.

7.5 Using Explosives

Operation Personnel perform the following procedure where explosives are used to assist in excavations near existing company pipeline facilities.



WARNING: Reference *SOP HLL.23 Protection of Pipeline Facilities From Blasting Operations* for the requirements of a blasting plan, the evaluation of the plan, and any actions to be taken.



CAUTION: When the use of explosives is necessary and approved for assisting in excavations, the utmost care must be taken to not endanger life or adjacent property and maintain the safety and integrity of company pipeline facilities. In addition, all use of explosives must be witnessed by a company representative

Step	Activity
1	SECURE all necessary permits required for the transportation, storage, and use of explosives.
2	FOLLOW all laws, rules, and regulations governing the storing, handling,

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	and use of such explosives.
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CAUTION: Do not permit blasting within or near stream channels without prior consultation with federal or state conservation authorities to determine what protective measures to take to minimize damage to fish and other aquatic life.

Step	Activity
3	PROVIDE a blasting plan the Pipeline Integrity Department, who will evaluate and approve the plan prior to blasting.
4	NOTIFY building owners prior to blasting and PERFORM a pre-blast survey, including photos.
5	If buildings or other structures are located within 200 ft. of company pipeline facilities, USE seismic equipment and MONITOR each of these locations during blasting.



NOTE: Seismographic monitoring criteria, such as peak particle velocity, give a very poor correlation with the stress imposed on pipelines from blasting. Where the company's guidelines for blasting near pipelines are used to evaluate blasting plans, seismographic equipment is not necessary and is not used for monitoring the pipeline.

Step	Activity
6	USE mats and/or backfill over the blast area and TAKE all other possible precautions to prevent damage to livestock and other property and to avoid inconvenience to the property owner or tenant during blasting operation.
7	HAUL any rock scattered outside the right-of-way by blasting operations to the right-of-way.

7.6 Excavation of Company Pipeline Facilities by a Contractor

In addition to the requirements set forth in this SOP, Operation Personnel or a qualified Company Inspector follow the procedures below and are responsible for overseeing the excavation of company pipeline facilities when performed by a contractor or other parties.

Step	Activity
1	VERIFY a Operation Personnel or Company Inspector is on site at all times while the contractor is excavating within company right-of-way to watch for unmarked lines, probe company facilities when required, and to stop the excavation equipment (e.g., backhoe, track hoe) operator if a foreign object is observed.

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WARNING: Operation Personnel or Company Inspector has full authority to stop the work if he/she determines the work is being performed unsafely, if a foreign object is spotted, or if the guidelines set forth in this procedure are not properly followed.

2	VERIFY excavation equipment (e.g., backhoe, track hoe) is maintained, serviced, and in good working order allowing it to be operated safely and having the ability to maintain depth and offset specifications.
3	VERIFY the excavation equipment (e.g., backhoe, track hoe) is operated by a skilled and experienced operator.
4	COMPLETE work permits as necessary considering scope of work.

**7.7
Sloping and
Shoring**

All Sloping and Shoring should be done when directed by and in accordance with the current *Safety Procedure S-130 Excavation and Trenching*.

Step	Task
1	CONSULT Operations Manager or Project Manager of proposed excavations which may require sloping and shoring.
2	INSPECT all sloping, shoring, or shielding as required.

**7.7.1
Sloping
Requirements**

Operation Personnel equipment operator uses the following procedure when required by the current *Safety Procedure S-130 Excavation and Trenching*.

Step	Activity
1	DETERMINE the angle of repose for the walls of the excavation per <i>Safety Procedure S-130 Excavation and Trenching</i> based on the type of soil, water conditions, and previous soil disturbances.
2	SLOPE the ditch by stair-stepping/benching or cutting back the ditch walls to an appropriate angle of repose.
3	FLATTEN the angle of repose when the excavation has water conditions, silty material, loose boulders, and areas where erosion, deep frost action, or slide planes appear.

**7.7.2
Shoring
Requirements**

Operation Personnel qualified as an OSHA competent person uses the following procedure when the appropriate angle of repose cannot be achieved and required by the current *Safety Procedure S-130 Excavation and Trenching*.

Step	Activity
1	SHORE the trench for additional protection using timbers and trench jacks, sheet piling, or manufactured hydraulic shoring systems. INSTALL shoring from the top down.
2	REMOVE shoring from the bottom up after work has been completed on

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	excavations.
3	TAKE precautions in the release of shoring jacks and braces. In unstable soil, USE ropes to remove jacks and braces.

7.8 Inspecting Excavations

Operation Personnel Competent Person uses the following procedure to inspect an excavation.

Step	Activity
1	INSPECT the shoring system, soil conditions, and construction methods daily to detect unsafe conditions.
2	NOTE the condition of the soil and shoring materials.
3	IDENTIFY existing and potential hazards in the surrounding working conditions. TAKE prompt corrective action to eliminate hazards.
4	INSPECT excavations after rain storms or other hazard-increasing occurrences.
5	COMPLETE the applicable form(s) for <i>Safety Procedure S-130A Excavation Report</i>
6	PROVIDE additional protection against slides or cave-ins, if necessary.
7	ADHERE to local highway department requirements while on a highway right-of-way.

7.9 Backfilling

Operation Personnel or a qualified Company Inspector follow the procedures below when backfilling company pipeline facilities or are responsible for overseeing backfilling operations of company pipeline facilities when performed by a contractor or other parties.



NOTE: The backfilling operation is critical for providing support around and beneath company pipeline facilities.

Step	Activity
1	REPAIR probe marks and damaged coating in accordance with <i>Engineering Standard HL6.0306 Coating of Field Joints, Valves, Tie-Ins, Girth Welds and Short Sections of Pipe Using Two Part Epoxy or HL6.0306 Wax Coating for Buried or Submerged Fittings, Valves, Tie-Ins, & Repairs to Linepipe Coating.</i>
2	FOLLOW the coating manufacturer's recommended cure time prior to backfilling.
3	VERIFY the company pipeline facility rests on the bottom of the ditch/trench.
4	PREPARE a dirt cushion of at least six (6) inches prior to laying company pipeline facility in solid or loose rock. CONSIDER using approved rock shield.
5	REMOVE bottom trench supports first. RELEASE trench jacks slowly.

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Step	Activity
6	PLACE additional pad dirt around the company pipeline facility to a minimum elevation of six (6) inches above the top of the pipeline.



NOTE: Rock, two (2) inches in diameter and larger, or like materials shall not be backfilled directly onto company pipeline facilities. Where such materials are encountered, sufficient earth or sand shall be used to backfill around and over company pipeline facilities to form a protective padding or cushion as specified in step 6 above.

Large rock or boulders shall not be backfilled into the ditch and shall be disposed of properly.



CAUTION: Exercise care when backfilling to assure rocks of significant size (rocks large enough to penetrate the padding and damage the coating and/or the pipeline) are not backfilled immediately on top of the padding.

Step	Activity
7	IF backfilling in cultivated lands, REPLACE the original depth of surface soil.
8	VERIFY no foreign or refuse material is included in the backfill. DO NOT USE contaminated fill. These materials include, but are not limited to: <ul style="list-style-type: none"> • Skids • Welding rods • Pipe rings • Trash • Tree and shrubbery limbs REMOVE all such materials from the job site.



CAUTION:

- Do not stand in excavation when mechanical back filling is underway.
- In unstable soil, clear all employees from trench and use ropes to remove the trench jacks.

Step	Activity
9	RESTORE any fences, culverts, or markers.
10	SPREAD soil which has been excavated during construction and not used evenly onto the cleared areas or REMOVE it from the site.
11	GRADE the topsoil to conform to the adjacent terrain. MAKE an allowance, such as a crown over the ditch, for the natural settlement of the soil.
12	IF excavating existing company pipeline facilities, RETURN the grade to its original condition.
13	COMPLETE the applicable form(s) for inadequate cover or ENTER data in electronic database for all company pipeline facilities excavated with less than 24 inches of cover. Refer to <i>SOP HLL.24 Management of Depth of Cover and Evaluation</i> .
14	REMOVE excess construction material and other debris from the right-of-

Code Reference :	Procedure No.: HLI.10	
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Step	Activity
	way.
15	REMOVE rock brought to the surface by excavation and remaining after backfilling from the property unless approved by management.
16	SEED and FERTILIZE the right-of-way or otherwise return it to approximately the original condition.
17	VERIFY the replacement of earth adjacent to water crossings is at slopes equal to or less than the normal angle of repose for the soil type involved.
18	ACCOMPLISH sandbagging, seeding, or other methods of soil stabilization without undue delay.
19	FOLLOW any special and reasonable considerations requested by the landowner and approved by the company Right-of-Way Representative and Operations Management regarding the clearing and restorations activities.
20	VERIFY that the depth of cover is in accordance with the permit or easement requirements, the latest revision of the company drawing standards and the requirements of applicable jurisdictional government agencies.

**7.9.1
Erosion
Control**

During the backfill operation, Operations Personnel follow this procedure to prevent subsurface soil movement and subsequent erosion in hilly or mountainous terrain.

Step	Activity										
1	CONSTRUCT an interceptor dike with compacted earth or earth filled burlap bags extending completely across company right-of-way at a minimum height and width of 18" x 36".										
2	POSITION each dike to divert water downhill at a 2% slope toward a well vegetated area, if possible.										
3	INSTALL permanent interceptor dikes after the final grading and prior to reseedling. As a general rule, interceptor dikes are not used in cultivated lands (except as a field boundary) or in residential or landscaped areas.										
4	SPACE interceptor dikes as follows: <table border="1"> <tr> <th>Right-of-Way Slope</th><th>Interceptor Dike Spacing</th></tr> <tr> <td>< 5%</td><td>No structure</td></tr> <tr> <td>5 to 15%</td><td>150 ft.</td></tr> <tr> <td>15 to 30%</td><td>100 ft.</td></tr> <tr> <td>30%</td><td>50 ft.</td></tr> </table>	Right-of-Way Slope	Interceptor Dike Spacing	< 5%	No structure	5 to 15%	150 ft.	15 to 30%	100 ft.	30%	50 ft.
Right-of-Way Slope	Interceptor Dike Spacing										
< 5%	No structure										
5 to 15%	150 ft.										
15 to 30%	100 ft.										
30%	50 ft.										
5	INSTALL trench plugs after the company pipeline facility has been laid in the ditch and prior to backfilling.										

NOTE: Trench plugs are composed of earth filled sacks packed tightly around company pipeline facilities.

Step	Activity				
6	SPACE trench plugs as follows: <table border="1"> <tr> <th>Right-of-Way Slope</th><th>Trench Plug Spacing</th></tr> <tr> <td>< 5%</td><td>No plugs required</td></tr> </table>	Right-of-Way Slope	Trench Plug Spacing	< 5%	No plugs required
Right-of-Way Slope	Trench Plug Spacing				
< 5%	No plugs required				



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5 to 15%	300 ft. (150 ft.)
15 to 30%	200 ft. (100 ft.)
30%	50 ft.



NOTE: Values in parentheses indicate required spacing on slopes with highly erodible soils.

Step	Activity
7	DETERMINE whether trench plugs or interceptor dikes are appropriate for company pipeline facility replacements and installations less than 50 feet in length.

8.0 Documentation Requirements

Record data in the electronic database or utilize the following form(s) as applicable:

- S-130A Excavation Report
- I.10.C Pipeline Inadequate Cover Notification
- I.10.D Rights-of-Way and Other Property Damage Reports
- Shallow Cover Database
- Pipe Inspection Database

The following table describes the documentation reporting requirements of this SOP.

Activity	Reporting
Acknowledge the requirements as outlined in the SOP have been completed. Record exceptions, if any, in the comments section.	EAM Unplanned Pipeline Work Order or appropriate maintenance record; retain for the life of the facility.

9.0 References

- E.S. HL6.0306 Wax Coating for Buried or Submerged Fittings, Valves, Tie-Ins, & Repairs to Linepipe Coating
- E.S. HL6.0306 Coating of Field Joints, Valves, Tie-Ins, Girth Welds and Short Sections of Pipe Using Two Part Epoxy
- HLA.01 Glossary and Acronyms
- HLB.04 Pipe Location and Marking
- HLD.35 Buried Pipe Inspection and Evaluations
- HLI.11 Pipeline Pressure Limit Criteria
- HLI.23 Protection of Pipelines Facilities from Blasting Operations
- HLI.24 Management of Depth of Cover and Evaluation
- HLI.27 Abnormal Loading of External Loads / Highway and Railroad Crossings
- Safety Procedure S-370 Work Permits

Code Reference :	Procedure No.: HLI.10	
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- Safety Procedure S-130 Excavation & Trenching
-

Appendix A: The table below identifies the Operator Qualification (OQ) task requirements.
OQ Task Requirements

Task Description	OQ Task
Backfilling Pipe and Coating Protection	PI.OQ404
Underground Pipeline – locate and temporarily mark	PLOQ605
Damage Prevention During Excavation/Encroachment Activities	PLOQ607



ENERGY TRANSFER

Pipeline Facilities Identification

Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

Code Reference :	Procedure No.: HLL12	
49CFR 195.434, 195.410, 195.438	Effective Date: 04/01/18	Page 1 of 6

1.0 Purpose This Standard Operating Procedure (SOP) describes the various methods used to identify company pipelines and related facilities, as well as the activities involved with the placement and maintenance of the different types of identification markers.

2.0 Scope This procedure describes the requirements for the type and placement of signs along the pipeline ROW as well as fenced or otherwise enclosed boundaries of company facilities to aid in their identification and alert the general public of potential hazards.

3.0 Applicability This SOP applies to all regulated pipelines and facilities.

4.0 Frequency As required: Install and maintain signs and markers.

5.0 Governance The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Operations Manager	Director of Operations

6.0 Terms and Definitions For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

7.0 Pipeline Facilities Identification The following procedures are described in this section:

- Placement of Pipeline Markers
- Aerial Markers
- Road and Blacktop Stencils and Decals
- Temporary Markers
- Painted Fence Posts
- Facility Signs
- Maintenance

Code Reference :	Procedure No.: HLI.12	
49CFR 195.434, 195.410, 195.438	Effective Date: 04/01/18	Page 2 of 6

7.1 Placement of Pipeline Markers

Operations Personnel follows the steps below for the placement of pipeline markers at the following locations:

- Stream crossings
- Both sides of public road crossings
- Other utility's right-of-way
- Both sides of railroad crossings
- Aboveground pipelines in areas accessible to the public
- Any other location where it is necessary to identify the pipeline location

Step	Activity
1	PROVIDE pipeline identification and warning information on casing vents or pipeline markers.
2	Markers MUST include the following written legibly on a background of sharply contrasting color: <ul style="list-style-type: none"> • OPERATING COMPANY NAME, • The words "WARNING", "CAUTION" or "DANGER", followed by the type of PRODUCT TRANSPORTED, (ei "HAZARDOUS LIQUIDS") "PIPELINE", all of which (except for markers in heavily developed urban areas) must be in letters 1" high by 1/4" stroke • The appropriate 24-hour, toll free or emergency phone number, including area code.
3	CONSIDER placing markers at LINE-OF-SIGHT intervals where practical
4	REFER to alignment sheets for installation details.

7.2 Aerial Markers

Operations Personnel follows the steps below for installing aerial markers where applicable.



NOTE: Aerial markers may include mileposts, valve numbers, and other pipeline information visible by aerial patrol.

Step	Activity
1	INSTALL aerial patrol markers at frequent intervals and at all industrial sites only where necessary to assist the aerial patrol pilot in identifying locations along the pipeline ROW.
2	VERIFY that aerial patrol markers are maintained in good condition and are clearly visible from the air.
3	VERIFY that all aerial markers have clear bold letters and/or numbers.
4	REFER to appropriate company standard drawings for aerial markers.



NOTE: In lieu of aerial markers, GPS waypoints may be established at frequent intervals to enable the aerial patrol operator and Operations Personnel to locate the pipeline and associated facilities along the ROW. A master list of waypoints should be maintained for quick reference.

Code Reference :	Procedure No.: HLI.12	
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7.3
Road and
Parking-lot
Stencils and
Decals

Operations Personnel follows the steps below to use stencils and decals to mark pipeline locations.

Step	Activity
1	USE decals, stencils or other appropriate markers to MARK the location of the pipeline where it is impractical to install a marker on company facilities, such as areas where the pipeline is located longitudinally within a road, and where the pipeline is located within parking areas.
2	VERIFY that the decals identify the company name, the appropriate signage (i.e. "Hazardous Liquid" or "Petroleum Pipeline") that identifies the pipeline the 24 hour telephone number, and the orientation of the pipeline.

7.4
Waterway
Warning Signs

Operations Personnel installs warning signs for waterway crossings.

Step	Activity
1	POST waterway warning signs at navigable inland waterway crossings where anchor damage to the pipeline is possible.
2	VERIFY that the decals identify the company name, the appropriate signage (ei "Hazardous Liquid" or "Petroleum Pipeline") that identifies the pipeline the 24 hour telephone number, and the orientation of the pipeline.



NOTE: Consider boat traffic, flood zones, and high water areas when placing pipeline markers and water crossing signs.

7.5
Temporary
Markers

Operations Personnel follows the steps below for installing temporary markers.

Step	Activity
1	INSTALL temporary markers where necessary to aid in preventing damage caused by short-term construction activities. Refer to <i>SOP HLI.28 ROW Encroachments</i> and <i>SOP HLI.30 Third Party Damage</i> .



NOTE: Temporary markers include stakes, flags, marker posts, signs, painted markings on paved surfaces.

Code Reference :	Procedure No.: HLI.12	
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7.6
Painted Fence
Posts

Operations Personnel follows the steps below for painting fence posts if directed by the area Operations Management.

Step	Activity
1	PAINT the fence posts located within the pipeline ROW with high visibility paint, after NOTIFYING the landowner.
2	If the pipeline easement does not have a defined width, EXTEND the painted fence posts 25 feet out from the centerline of the outermost pipeline.
3	PAINT the fence posts unless forbidden by the landowner.
4	If the landowner forbids the painting, NOTIFY the ROW Representative.
5	DOCUMENT in <i>ROW Tract Files</i> that the landowner has forbidden the painting of fence posts.

7.7
Facility Signs

Operations Personnel places the following signs at the appropriate locations for the listed company facilities.

7.7.1
Pump Stations
and Breakout
Tanks

Smoking or an Open Flame is prohibited where there is a potential or presence of flammable vapors or liquids. Follow the steps below for the placement of signs at pump stations, breakout tank and DOT regulated sphere facilities, junctions and delivery facilities where there is a potential for the presences of flammable vapors or liquid.

Step	Activity
1	PLACE "No Trespassing" "Authorized Personnel Only" signs at or near each walk-in or drive-in gate.
2	CONSIDER placing "No Trespassing" "Authorized Personnel Only" signs at 100-foot intervals along the fence where appropriate.
3	PLACE line markers where liquid pipelines enter and exit the facility.
4	PLACE "Smoking in Designated Areas Only" signs at or near each walk-in or drive-in gate.
5	PLACE "Smoking in Designated Areas Only" signs between any smoking and non-smoking areas on the property. Add "No Open Flames" signs where smoking is prohibited.
6	PLACE signs including the company name, facility name and appropriate emergency telephone numbers at the main entrance to the facility or the entrance facing the public and around the facility fence.

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49CFR 195.434, 195.410, 195.438	Effective Date: 04/01/18	Page 5 of 6

7.7.2
Measuring
Stations

Follow the steps below for the placement of signs at measuring stations.

Step	Activity
1	PLACE "No Trespassing" signs at or near each walk-in or drive-in gate, "Authorized Personnel Only".
2	PLACE company and facility name, and appropriate emergency telephone numbers at the main entrance to the facility or the entrance facing the public roadway.
3	PLACE line markers where liquid pipelines enter and exit the facility.
4	PLACE "No Smoking or Open Flames Signs" at or near each walk-in or drive-in gate.

7.7.3
Main/Lateral
Line Valve
Settings

Follow the steps below for the placement of signs at main/lateral line valve settings.

Step	Activity
1	PLACE "No Trespassing" signs at or near each walk-in or drive-in gate.
2	PLACE "No Smoking Signs" at or near each walk-in or drive-in gate.
3	PLACE sign on the facility fence including the name of the operator and the 24 hour emergency call number
4	PLACE line markers where liquid pipelines enter and exit the enclosed boundary.



NOTE:

- On facilities south of the Colorado River (in Texas) and at other locations where English may not be the predominant language, signs must be printed in English and the locally predominant language, or two signs must be used, one in English and the other in the locally predominant language.
- For small meter stations, especially in the gathering area, where there may be only a tap valve and Electronic Gas Measurement (EGM) (where the producer owns the meter run), or where there is a skid-mounted metering facility that may be on others' property, there may not be sufficient surface area or fence to install signs as on larger facilities.

Step	Activity
5	INSTALL an approved pipeline warning sign on the meter house door and/or at the tap valve in areas where the cases in the previous note are present.
6	For main/lateral line valve settings or measurement facilities where there is only a pipe-fence and no woven fence, PLACE signs inside the area as long as they are clearly visible at the property boundary and do not interfere with operations and maintenance activities.

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NOTE: It is not the intent to install fencing in order to post signs.

7.8 Maintenance

Operations Personnel follows the steps below for maintenance.

Step	Activity
1	REPAIR or REPLACE damaged or missing markers in a timely manner.

8.0 Documentation Requirements

There are no documentation requirements for this SOP.

9.0 References

HLI.28 ROW Encroachments
HLI.30 Third Party Damage

Appendix A: OQ Task Requirements

The table below identifies the Operator Qualification (OQ) task requirements.

Task Description	OQ Task
Install and Maintain Pipeline Markers	PLOQ703

***Pigging and Pig Trap
Operation******Standard Operating Procedures****Applicable to Hazardous Liquid Pipelines and Related Facilities*

Code Reference: 49 CFR 195.426	Procedure No.: HLL13
	Effective Date: 04/01/18
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**1.0
Procedure
Description**

This Standard Operating Procedure (SOP) establishes minimum requirements to ensure that launchers and receivers are operated in a manner which ensures the safety of personnel involved.

**2.0
Scope**

The following procedures for running pigs demonstrate general practices only. Operating Personnel should thoroughly familiarize themselves with the site-specific requirements of individual launching and receiving facilities prior to operation.

Pigs are run in pipelines for the following primary purposes:

- To minimize internal corrosion
- To clean for maintenance requirements
- To maintain high flow efficiency
- To fill and dewater for hydrostatic testing
- To internally inspect the pipe

**3.0
Applicability**

This procedure applies to company pipeline facilities when pigging is required to cleaning, inspecting, or maintenance on the pipeline(s).

**4.0
Frequency**

As required: Launching and receiving pigs.

**5.0
Governance**

The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Operations Manager	Director of Operations

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**6.0
Terms and
Definitions**

Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

Terms	Definitions
Foam Pig	Internal pipeline cleaning tool, conical or cylindrical in shape, made of open cell polyurethane foam, with a thin polyurethane covering.
Pig	Tool used to internally clean or inspect the pipe.
Pigging	Refers to line cleaning, scraping operations & in-line inspection
Scraper Pig	Internal pipeline cleaning tool, usually conical in shape, made of a hard polyurethane plastic and lined with steel bristles (brushes)
Sphere Pig	Internal pipeline cleaning tool, round, made of hard polyurethane plastic, filled with glycol to retain size and shape.
Pig Launching	Process for inserting cleaning tools into liquid stream.
Pig Trap	Pipeline facility where line cleaners and internal inspection tools are inserted or removed from the liquid stream. These include both the launcher and receiver.
Relief Device	Small relief device connected to the launcher and receiver as a safety feature to ensure the receiver barrel is blown down before opening the closure.

**7.0
Pigging and Pig
Trap Operation**

This SOP contains the following sections:

- Preparation
- Safety
- Pig Insertion and Removal
- Pig Launching
- Pig Receiving
- Operating and Maintaining Pig Traps
- Sample Liquids or Solids from Pig Runs

**7.1
Preparation**

Use the following steps prior to pigging operation.

Step	Activity
1	COORDINATE pig runs with Liquids Control
2	VERIFY a site-specific launching and receiving procedure exists and is approved for the facility and is available.



NOTE: The same procedure may be used for multiple locations with the same configurations

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Step	Activity
3	Each scraper trap or launcher must be PROVIDED with a drain valve and a vent valve. Each trap equipped with a drain valve, a vent valve and an ASME approved closure fully complies with DOT requirements.
4	VERIFY that a pressure-indicating gauge is installed on the barrel of each launcher and receiver to indicate the internal pressure.
5	VERIFY both the launcher/receiver pig traps has adequate space to safely insert/launch and receive/remove pig and is designed to allow for proper pressure reduction per site-specific procedure.
6	VERIFY operation of both pig trap valves and door before loading and launching pig.
7	If there is a pig signal installed, DETERMINE whether pig signal (Pig Sig) is functioning and set at the receiver pig trap before launching.



NOTE: Mount and set portable electronic Pig Sig before launching if available.

Step	Activity
8	VERIFY pig has connections or means to safely remove from pig trap before loading.
9	DETERMINE the condition of tools before each run: <ul style="list-style-type: none"> • CHECK wire brush cleaners for proper brush attachment and adjustment as well as for wear. If fitted with magnets check for proper attachment. • CHECK squeegees and spheres for wear or cracking.
10	CONDUCT a pipeline(s) review to check for possible obstructions, heavy wall fittings, double drop out drips, HDPE liner, or any other configuration that may lodge or damage a pig.
11	CONSIDER the presence of scraper bars in larger tees when preparing the pigging procedure.
12	RETRACT or REMOVE all coupons, orifice plates, electrical resistance probes, insertion meters, or other possible obstructions prior to launching a pig.
13	VERIFY all valves on the line to be pigged are in the fully open position prior to launching pig.
14	DISARM any Line Breaks, Low Pressure Switches, etc. that could trigger a valve to close as the results of pressure waves associated with the pigging operation.

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7.2 Safety

The Operations Personnel use the following safety procedures for pigging and pig trap operations.



WARNING:

- Do not stand in front of the launcher or receiver door in the projected path of the pig while opening.
- Wear fire retardant clothing and appropriate PPE during pigging operations.
- If there is a history of iron sulfide presence, consider having a supply of water or other fire or heat suppressing material is available when opening the barrel.
- Have containment or a catch pan available for any liquids or solids, wet the material after removal, if applicable.



NOTE: All trap closures must have a relief device to ensure that no pressure remains in the launching/receiving trap as the trap closure door is opened.

Step	Activity
1	VERIFY that Personnel not directly involved with the operation of the pig traps are kept clear of the area.
2	ELIMINATE sources of ignition.
3	KEEP fire extinguishers readily available on site.
4	TREAT a lodged pig similar to a solid line freeze.



CAUTION: Do not back-blow lodged pigs through an open launcher or blow forward through an open trap.

Step	Activity
5	HOLD pressure build-up to a minimum during launching procedures.
6	RECEIVE the pig under control without bringing in the pig too fast and damaging the pig trap door or pig.
7	IF receiving multiple pigs in the pig trap, before opening the door, take caution and release possible trapped pressure between pigs.



NOTE: Do not exceed the Maximum Operating Pressure (MOP) of the facilities.

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7.3 Pig Insertion and Removal

The Operations Personnel follow these steps to insert or remove pigs.

Step	Activity
1	FOLLOW the site-specific procedure prior to opening the barrel.
2	VERIFY that the pig trap is isolated.
3	REMOVE all internal pressure (blow down).
4	Field personnel DRAIN the trap of fluid by slowly opening the trap drain valve. Typically, a pressure gauge is installed on the trap to VERIFY that the trap is being drained. When all fluid is drained and no pressure registers on the gauge, field personnel PERFORM the following: <ul style="list-style-type: none"> • OPEN an air bleeder valve to VERIFY that no fluid remains in the trap. • OPEN and CHECK the pressure relief device on the closure to ENSURE that no pressure is remaining on the trap • UNBOLT or UNSCREW the trap closure door.
5	VERIFY <i>SOP HLB.06 Hazardous Energy Control and Safety Procedure S-230 Lockout Tagout</i> are followed before opening the closure.
6	OPEN the pig trap for insertion or removal of the pig.
7	PERFORM internal corrosion inspection of barrels when opened and DOCUMENT in corrosion database.

7.4 Pig Launching

The Operations Personnel follow these steps to launch pigs.

Step	Activity
1	LOAD the pig into a launching trap making sure to seal the pig against the nominal pipe of the barrel.
2	FOLLOW the site-specific procedure and OPERATE valves to launch the pig into the piping system.
3	RETURN all valves to the normal operating position per the procedure.

7.5 Pig Receiving

The Operations Personnel use the following steps to perform pig-receiving operations.

Step	Activity
1	FOLLOW the site-specific procedure to operate valves and bring the pig into the barrel.
2	ISOLATE the trap after the pig is in the trap and blow it down.
3	VERIFY the trap is depressurized and that <i>SOP HLB.06 Hazardous Energy</i>

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Step	Activity
	Control and Safety Procedure S-230 Lockout Tagout are followed before opening the closure
4	REMOVE the pig.
5	RETURN the trap to normal service per the site specific procedure.

7.6 Operating and Maintaining Pig Traps

The Operations Personnel perform the following procedures each time the pig trap is opened to assure that the closures consistently operate and seal.

Step	Activity
1	USE a screw-type wrench for opening and closing screw-type doors.



CAUTION: Do not use a hammer for opening and closing screw-type doors. This may damage the door.

Step	Activity
2	SERVICE O-rings as follows: <ul style="list-style-type: none"> • AVOID removing the O-ring if it is not damaged. It may be difficult to reinstall. • INSPECT O-ring and replace if signs of wear or other damage are observed. • WIPE and CLEAN the O-ring, O-ring groove, hub, and cap sealing face when removed. • GREASE the surfaces with a lightweight lubricant.
3	For pig traps equipped with a pressure alert mechanism: <ul style="list-style-type: none"> • INSPECT the pressure alert mechanism for proper operation. • CLEAN debris from the mechanism thoroughly.



WARNING: The engagement of a manually-operated Motor Operated Valve (MOV) handwheel on its shaft during power gas operation can yield a safety danger.

Step	Activity
4	If a motor operated valve requires manual operation with a handwheel, follow these steps: <ul style="list-style-type: none"> • CLOSE, LOCKOUT/TAGOUT the power gas supply that connects to the operator. • BLEED off the pressure on the supply lines prior to installing the handwheel on the handwheel shaft.

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WARNING: Remove the handwheel from the shaft prior to reopening the power gas supply lines.

7.7 Sample Liquids or Solids from Pig Runs

The Operations Personnel use the following steps to obtain sample of solids from pig runs. Refer to *SOP HLD.38 Analysis of Gas, Solids, and Liquid Samples*.

Step	Activity
1	OBTAIN solid samples from residue found in receiver after a pig has been received.



NOTE: It is not necessary to obtain these samples after every pig run. Obtain guidance from the Corrosion Specialist.

Step	Activity
2	NOTE if the quantity or appearance of this residue has changed from previous pig runs.
3	STORE data in the Corrosion database.
4	COLLECT the sample in a sterilized collection container and IDENTIFY the container's contents with location and date.



NOTE: A minimum of four (4) ounces is normally required.

Step	Activity
5	ANALYZE the water separately from hydrocarbons and solids, if water is present.

8.0 Documentation Requirements

Record data in electronic database or utilize the following form(s) as applicable:

- I.13.A Field Pig Run Record
- Corrosion database

9.0 References

HLD.38 Analysis of Solids Samples
HLB.06 Hazardous Energy Control
Safety Procedure S-230 Lockout Tagout

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Appendix A: The table below identifies Operator Qualification (OQ) task requirements.
OQ Task
Requirements

Task Description	OQ Task
Operating Pipeline Valves	PLOQ007
Start-up / shutdown of pipeline / facilities to assure operation within MOP	PLOQ601
MOP – Monitoring and Protecting	PLOQ602
Collect Sample for Internal Corrosion Monitoring	PLOQ718
Purge a Pipeline (for Liquids P/L's Only)	PLOQ812
Operate Pressure Relieving Devices for Launching and Receiving Facilities (for Liquids P/L's Only)	PLOQ814
Product Batch and Pig Tracking (for Liquids P/L's Only)	PLOQ816



Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

Code Reference :	Procedure No.: HLI.19	
49 CFR: 195.303, 195.307	Effective Date: 04/01/18	Page 1 of 3

1.0 Purpose

This Standard Operating Procedure (SOP) outlines the minimum test requirements for piping installations, repairs, substantiates the Maximum Operating Pressure (MOP) or verifies the integrity of steel pipelines.

2.0 Scope

This SOP describes the requirements of operations to ensure that all facilities have been pressure tested prior to being placed in to service.

3.0 Applicability

This SOP applies to all new pipelines, facilities, additions to, replacement, or conversions to service portions of existing and relocated facilities



NOTE: This SOP does not apply to pressure testing for stress corrosion cracking.

4.0 Frequency

As required: Conduct pressure testing.

5.0 Governance

The following table describes the responsibility, accountability, and authority for this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Operations Manager	Director of Operations

6.0 Terms and Definitions

For general terms and definitions, refer to *SOP HLA.01 Glossary and Acronyms*.

7.0 Pressure Testing

All Pressure testing should be done in accordance with the Engineering Standards HL4.0104 Pressure Test Design and HL4.0105 Pressure Testing.

The General Requirements as stated in 49 CFR 195.302 are:

- Except as otherwise provided in this section and in 195.305(b), no operator may

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operate a pipeline unless it has been pressure tested under this subpart without leakage. In addition, no operator may return to service a segment of pipeline that has been replaced, relocated, or otherwise changed until it has been pressure tested under this subpart without leakage.

- b) Except for pipelines converted under 195.5, the following pipelines may be operated without pressure testing under this subpart:
 - 1. Any hazardous liquid pipeline whose maximum operating pressure is established under 195.406(a)(5) that is—
 - i) An interstate pipeline constructed before January 8, 1971;
 - ii) An interstate offshore gathering line constructed before August 1, 1977;
 - iii) An intrastate pipeline constructed before October 21, 1985; or
 - iv) A low-stress pipeline constructed before August 11, 1994 that transports HVL.
 - 2. Any carbon dioxide pipeline constructed before July 12, 1991, that—
 - i) Has its maximum operating pressure established under 195.406(a)(5); or
 - ii) Is located in a rural area as part of a production field distribution system.
 - 3. Any low-stress pipeline constructed before August 11, 1994 that does not transport HVL.
 - 4. Those portions of older hazardous liquid and carbon dioxide pipelines for which an operator has elected the risk-based alternative under 195.303 and which are not required to be tested based on the risk-based criteria.
- c) Except for pipelines that transport HVL onshore, low-stress pipelines, and pipelines covered under 195.303, the following compliance deadlines apply to pipelines under paragraphs (b)(1) and (b)(2)(i) of this section that have not been pressure tested under this subpart:
 - 1. Before December 7, 1998, for each pipeline each operator shall—
 - i) Plan and schedule testing according to this paragraph; or
 - ii) Establish the pipeline's maximum operating pressure under 195.406(a) (5).
 - 2. For pipelines scheduled for testing, each operator shall—
 - i) Before December 7, 2000, pressure test—
 - A. Each pipeline identified by name, symbol, or otherwise that existing records show contains more than 50 percent by mileage (length) of electric resistance welded pipe manufactured before 1970; and
 - B. At least 50 percent of the mileage (length) of all other pipelines; and
 - ii) Before December 7, 2003, pressure test the remainder of the pipeline mileage (length).

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The Components required to tested in accordance with 49 CFR 195.305 are:

- a) Each pressure test under 195.302 must test all pipe and attached fittings, including components, unless otherwise permitted by paragraph (b) of this section.
- b) A component, other than pipe, that is the only item being replaced or added to the pipeline system need not be hydrostatically tested under paragraph (a) of this section if the manufacturer certifies that either—
 1. The component was hydrostatically tested at the factory; or
 2. The component was manufactured under a quality control system that ensures each component is at least equal in strength to a prototype that was hydrostatically tested at the factory.

**8.0
Documentation
Requirements**

Record data in electronic database or utilize the following form(s) as applicable:
The required records are stated in the referenced Engineering Standards Pressure Test Documentation:

- TestOp Certification Report
- B.10.A MAOP/MOP Establishment
- B.10.B Pressure Test Letter/MOP Verification
- Certification of calibration for deadweights, pressure chart recorders, and temperature chart recorders

**9.0
References**

Engineering Standard HL4.0104 Pressure Test Design
Engineering Standard HL44.0105 Pressure Testing

**Appendix A:
OQ Task
Requirements**

The table below identifies the Operator Qualification (OQ) task requirements.

Task Description	OQ Task
Pressure test to substantiate MAOP / MOP / Integrity	PLOQ501
Conduct Pressure Test on Pipe that is to be Operated at a Pressure <100 psig	PLOQ502



ENERGY TRANSFER

Inspection of Rights-of-Way & Crossings Under Navigable Waters

Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

Code Reference :	Procedure No.: HLI.21	
49 CFR: 195.412	Effective Date: 04/01/18	Page 1 of 6

1.0 Purpose

This Standard Operating Procedure (SOP) establishes the requirements inspection of rights-of-way (ROW) and crossings under navigable waters. Methods of inspection include walking, driving, flying or other appropriate means of traversing the right-of-way.

2.0 Scope

This SOP describes the criteria for conducting and documenting pipeline inspections to verify the safety of the pipeline.

3.0 Applicability

This SOP applies to all regulated hazardous liquid facilities that are operated by the company.

4.0 Frequency

At intervals not exceeding 3 weeks, but at least 26 times each calendar year: Inspect the surface conditions on or adjacent to each pipeline right-of-way, including off-shore rights-of-way.

At intervals not exceeding 5 years: Inspect each crossing under a navigable waterway to determine the condition of the crossing, except for offshore pipelines.

5.0 Governance

The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
Patrol Observations & Reporting	Contractor / Operator Performing Patrol / Inspection	Operations Manager	Director of Operations

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6.0 Terms and Definitions

Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

Terms	Definitions
Navigable Waterway	As defined in Subpart 2.10-5 of 33 CFR where it states that "...navigable waters of the United States shall be construed to mean those waters of the United States, including the territorial seas adjacent thereto, the general character of which is navigable, and which, either by themselves or by uniting with other waters, form a continuous waterway on which boats or vessels may navigate or travel between two or more States, or to or from foreign nations...."

7.0 Inspection of Rights-of-Way & Crossings under Navigable Waters

Operations Personnel develop an inspection program to observe surface conditions on and adjacent to the facilities and/or pipeline right-of-way for indications of leaks, construction activity, and other factors affecting safety and operations.

Methods of inspection include walking, driving, flying, or other appropriate means of traversing the right-of-way.

The following procedures are described in this section:

- Aerial surveillance
- Observations during Inspection
- Inspection methods for crossings under navigable waterways
- Notification of encroachment problems
- Reporting and Investigating Patrol Observations
- Crossings Under Navigable Waterways Inspection Summary

7.1 Aerial Surveillance

Operations Personnel schedule aerial inspections.

In the event of a cancellation, the pilot documents the cancellation of a scheduled aerial inspection due to weather conditions, mechanical readiness of the aircraft or other conditions and notifies Operations Personnel. Consideration of alternative methods of inspection should be initiated to insure compliance with frequency requirements in Section 3.0.

Step	Activity
1	VERIFY personnel performing the inspections have adequate training and experience.
2	CONSIDER accompanying the pilot on the aerial inspections periodically.
3	EVALUATE construction activity to determine if more frequent flights are warranted.

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**7.2
Observations
during
Inspections**

The operator performing an inspection keeps a log of the inspection, observing and documenting the following items:

- General conditions of the right-of-way.
- Indications of sink holes, sunken trenches, or exposed pipelines.
- Water erosion, bank erosion, soil slippage, or landslide areas.
- Indications of leakage such as blowing liquids / vapors, displaced backfill, discolored or wilted vegetation, oil sheen on water crossing areas or rights-of-way, bubbles in water puddles or water crossing areas, and/or ice formations over the pipeline.
- Fires on or adjacent to the right-of-way.
- The condition of pipeline markers. If they are found not to meet the requirements of SOP HLI.12 *Pipeline Facilities Identification*, correct that condition at this time.
- Damage to existing company facilities such as valves, pump stations and junctions, delivery facilities, loop terminals, or communications facilities.
- Construction or logging activity on, in the vicinity of, or progressing toward the pipeline right-of-way (including evidence of possible construction such as the presence of excavation equipment or evidence of disturbed earth that crosses the ROW.)
- Land leveling or grading activities.
- Excavation near the pipelines, including routine activities occurring within industrial properties.
- Installation of houses, mobile homes, businesses, churches, schools or other structures.
- Installation of parks, recreation areas, play grounds or other places of assembly on or adjacent to the right-of-way.
- Construction of irrigation or drainage canals, ponds, or swimming pools.
- Installation of irrigation piping systems, sprinkler systems, sewers, utilities, or other underground facilities or structures.
- Installation of telephone or power poles, fence posts, or guy wire anchors.
- Deep plowing operations
- Seismic geological survey activities, well logging operations, well drilling activities, or quarry and blasting work.
- Any unusual conditions or activities, which may have an effect on the pipelines.

**7.3
Inspection
Methods for
Crossings
under
Navigable
Waterways**

Operations Personnel may use or select a Third Party to employ one of the following methods for inspection of crossings under navigable waterways:

- Sonar
- Physical Probing
- Acoustic Systems
- Magnet Systems

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7.4
Notification of
Encroachment
Problems

The patrol operator performs the following procedure when potential encroachments are identified during a patrol survey. Notify Operations Personnel in accordance with HLI.28 *Right-of-Way Encroachment*.

7.5
Reporting and
Investigating
Patrol
Observations

Operations Personnel uses the following procedure for conditions identified by patrols.

Step	Activity
1	DOCUMENT the results of the Area's investigation and any other conditions found or reported that could adversely affect the safety, operation, or maintenance of the pipeline system on the applicable form(s) for <i>Encroachment, Foreign Line Crossing and Class Location HCA Report</i> . INCLUDE a description of conditions found and any remedial action required or taken.
2	COMPLETE the applicable form(s) for <i>Aerial Patrol Trouble Report</i> when the flight is completed. Include sketches, photos, or additional data to supplement reports where necessary.
3	INCLUDE on the applicable form(s) for <i>Aerial Patrol Trouble Report</i> a description of each activity on or adjacent to the pipeline right-of-way.



NOTE: Provide a distinct number for each individual report of activity documented on the applicable form(s) for *Aerial Patrol Trouble Report*.

Step	Activity
4	INVESTIGATE each activity reported using the applicable form(s) for <i>Aerial Patrol Trouble Report</i>
5	Operations Personnel TAKE immediate action if a condition is detected which could be a hazard to persons, environment or property in the area.
6	Operations Personnel ADVISE Director of Operations and/or Operations Manager and Integrity Department of the conditions, immediate actions taken and proposed future actions to resolve the condition. Integrity Department will inform the Director of Regulatory Compliance of these activities.
7	Operations Personnel DOCUMENT findings and actions taken on the applicable form(s) for <i>Line Patrol</i> .
8	Operations Personnel COMPLETE the process flow for an Abnormal Operation or Safety Related Condition, if applicable. REFER to SOP HLA.12 <i>Safety-Related Condition</i> , SOP HLA.15 <i>PHMSA / State Incident Reporting</i> and SOP HLA.13 <i>Response to Abnormal Operations</i> .
9	The Pipeline Integrity Department INITIATES through routine actions a program to recondition, replace, or abandon any line segment found to be in

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Step	Activity
	unsatisfactory condition. Pipeline Integrity Department, Director of Regulatory Compliance, and Director of Operations shall approve this program prior to initiation.
10	If required, INSPECT the pipeline visually for coating damage, gouges, corrosion, dents per <i>SOP HLD.35 Buried Pipe Inspection and Evaluations</i> .
11	If anomalies are found which are not acceptable by company standards, REPAIR them per <i>SOP HLI.06 Evaluating Pipeline Defects</i> .
12	Operations Personnel MAINTAIN records for 2 years as required by the activity resolving an unsatisfactory condition.

7.6 Crossings under Navigable Waterways Inspection Summary

Operations Personnel uses the following for inspections of crossing under navigable waterways.

Step	Task
1	For Crossings Under Navigable Waterways, OBTAIN information pertaining to the current profile of the pipeline in relation to the bottom of the navigable waterway. ADJUST frequency of inspection based on the condition of the crossing to ensure integrity of pipe, prevent hazards to navigation and continuity of safe operations. SCHEDULE repairs as necessary.
2	DOCUMENT results of the inspection and RETAIN at the field office for at least 2 years or until the next inspection is performed, whichever is longer.

8.0 Documentation Requirements

Record data in electronic database or utilize the following form(s) as applicable:

- A.12.A Safety Related Conditions Report
- A.13.A Abnormal Operations
- B.13.A Encroachment, Foreign Line Crossing and Class Location HCA Report
- I.21.A Line Patrol
- I.21.B Aerial Patrol Report
- I.21.C Aerial Patrol Trouble Report

The following table describes the reporting requirements of this SOP for the electronic database.

Activity	Reporting
Acknowledge the requirements as outlined in the SOP have been completed. Record exceptions in	Electronic Maintenance Database

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the description tab. Records of Patrols must be maintained for a minimum of 2 years. Inspections of Crossing under navigable waterways must be maintained for a minimum of 2 years or until the next inspection is performed, whichever is longer.



NOTE: For Third Party Operators not using G-Forms, they should provide the applicable forms and be retained on file for the life of the facility.

9.0 References

HLI.35 Buried Pipe Inspection and Evaluations
HLI.06 Evaluating Pipeline Defects
HLI.12 Pipeline Facilities Identification
HLI.28 Right-of Way Encroachments

Appendix A: OQ Task Requirements

The table below identifies the Operator Qualification (OQ) task requirements.

Task Description	OQ Task
Pipeline Patrol	PLOQ701B
Install and Maintain Pipeline Markers	PLOQ703



ENERGY TRANSFER

Protection of Pipeline Facilities from Blasting Operations

Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

Code Reference:	Procedure No.: HLI.23	
49 CFR: 195.442	Effective Date: 04/01/18	Page 1 of 6

**1.0
Procedure
Description** This Standard Operating Procedure (SOP) describes the steps and necessary precautions to be taken when blasting operations are to be conducted within 300 feet of the company's facilities.

**2.0
Scope** The SOP provides the guidance necessary to perform adequate analysis of blasting plans for blasting near company facilities.

**3.0
Applicability** This SOP applies when blasting operations occur within 300 feet of regulated company facilities.

**4.0
Frequency** As required: When Blasting activity takes place near company facilities.

**5.0
Governance** The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel / Engineering	Operations Manager	Director of Operations

**6.0
Terms and
Definitions** For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

**7.0
Protection of
Pipeline
Facilities from
Blasting
Operations** This SOP contains the following sections:

- Identify Potential Threats To Company Facilities
- Obtain Needed Information from the Parties Involved
- Analysis of the Proposed Blasting Plan
- Communicate Blasting Plan Requirements

Code Reference:	Procedure No.: HLI.23	
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- 7.1 Identify Potential Threats to Company Facilities** Operations Personnel follow these steps to identify potential threats to company facilities.

Step	Activity
1	INVESTIGATE any activity related to blasting or seismic operations that occur in the vicinity of the pipeline.
2	CONFIRM the limits of the blasting operation with the party performing the blasting.
3	DOCUMENT the results of the investigation on the applicable form(s) for <i>Encroachment, Foreign Line Crossing and Class Location HCA Reports</i> .

- 7.2 Obtain Needed Information from the Parties Involved** Operations Personnel follow these steps for obtaining needed information from the parties involved.

Step	Task
1	<p>OBTAIN a detailed blasting plan from the party performing the blasting operations. The following information is required:</p> <ul style="list-style-type: none"> • Date and time of proposed blasting operations • Location of blasting operations and distance from the nearest company facility • Rock configuration-degree of confinement, presence of free faces for rock to move toward, and relative elevations of pipe and blast holes • Hole size, spacing, burden, depth, and layout within drawing • Type of explosive, Energy Release Ratio (EER), and specific energy (calories per gram) • Total number of holes (charges) • Delay interval between charges • Maximum charge weight per delay • Drawing of the location depicting the relationship of the charges to company facilities (this drawing shall be provided by the party performing the blasting operations). • The blasting plan shall be provided by the party performing the blasting operations sufficiently in advance to allow for evaluation and to make arrangements for witnessing the operation. • Blasting permit and blaster license

Protection of Pipeline Facilities from Blasting Operations

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Step	Task
	<ul style="list-style-type: none"> Advise the company ROW Representative of the planned blasting operation
2	DETERMINE the characteristics of the pipeline in the area where blasting operations are planned. Information to be gathered includes the following: <ul style="list-style-type: none"> MOP of the pipeline(s) Pipe diameters Pipe wall thickness Pipe grade Pipe depth Type of joint (coupled, acetylene welded, etc.) Type of longitudinal joint Distance from the pipeline to the proposed blasting operations Known defects in the pipeline (this information can be gathered from recent In-line inspection runs – discuss with the Pipeline Integrity Engineer). Historical data such as leak history Operational data (local knowledge of the pipeline)
3	ADVISE the party performing the blasting operation that no blasting may occur until the company has had an opportunity to review and approve the blasting operations plan.
4	PROVIDE a copy of the proposed blasting plan, and the pipeline characteristics to the Engineering Department, Liquid Technical Operations Group, and / or Geology Department for analysis and review.

7.3 Analysis of the Proposed Blasting Plan

Engineering Department, Liquid Technical Operations Group, and / or Geology Department performs the following steps for analysis of the proposed blasting plan

Step	Activity
1	REVIEW the characteristics of the pipeline facilities that may be affected.
2	REVIEW the blasting plan to determine the variables to be used in the evaluation.
3	UTILIZE a computer modeling program specifically designed to evaluate the effects of blasting on a pipeline (such as Pipeline ToolBox or other equivalent).



NOTE: The pipeline ToolBox program does not take delay between charges into account.

Protection of Pipeline Facilities from Blasting Operations

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Step	Activity
4	To perform a proper evaluation of the blasting operation with delays between charges of 8 to 15 milliseconds, CONSIDER the charges as single individual point charges utilizing the nearest off-set distance from the pipeline as the off-set variable.
5	<p>If adjustments are needed in the blasting plan regarding types of explosives, burden, hole spacing, hole size, charge weight per hole, number of charges in front row, number of rows in grid, stand-off distance, etc., WORK with the blasting operator to arrive at a mutually agreed-upon plan that will allow for blasting without compromise of pipeline integrity or safety of personnel. The approved blasting plan conveys the following information:</p> <ul style="list-style-type: none"> • Acceptability of operating conditions for the approved blasting plan • Maximum allowable charge weight permitted if the pipeline operating pressure is to be maintained at its current level during blasting operations • Test blast requirements, number of seismographs required, and placement • Minimum required separation from blast source to the pipeline or facility • Highest safe operating pressure at which the pipeline may operate with the proposed blasting plan • What, if any, additional safety measures must be taken during or after blasting operations which may include manning of valves, reducing operating pressure, reinforcing couplings or acetylene welds, conducting post blast leakage surveys • Any other action felt to be prudent by the evaluator



CAUTION: Blasting operations within the confines of the pipeline ROW will not be allowed unless it is being conducted for the benefit of the company and under the direct supervision of a company representative, unless otherwise approved by the Director of Operations / Engineering.

7.4 Communicate Blasting Plan Requirements

Engineering Department, Liquid Technical Operations Group, and / or Geology Department follow the steps below once an approved blasting plan has been agreed upon to communicate requirements to the parties involved.

Step	Task
1	COMMUNICATE the requirements of the plan to Operations Personnel, Director of Operations, Operations Manager and the company ROW Representative.

Protection of Pipeline Facilities from Blasting Operations

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Step	Task
2	COMMUNICATE the requirements of the blasting plan to the blasting company, and CLARIFY to the blasting operator that any changes to any variable in the blasting plan MUST BE APPROVED by the company approved representative prior to blasting operations.
3	OBSERVE blasting operations. If the approved blasting plan requires that a company representative be present during initial blasting operations, MAKE arrangements for Company personnel to be on-site prior to commencement of blasting.

7.5 Post-Blast Requirements

Operations Personnel follow these steps for observing and monitoring the pipeline following individual blasts or blasting activities.

Step	Task
1	PERFORM a post-blast leakage survey following blasting in the vicinity of the pipeline. This survey shall include: use of gas detection equipment to monitor the pipeline ROW for indications of leaking petroleum or crude oil, surveillance of the ROW for indications of surface cracks, liquid sounds, hydrocarbon odors and leaking hazardous liquids. USE a probing bar to create holes in the ground surface to assist with identifying subsurface conditions.
2	If there are indications of ROW surface cracks, blast craters or if seismograph readings have significantly exceeded limits, EXPOSE the pipeline to inspect for damage. Evaluate the pipeline for any defects per <i>SOP HLI.06 Evaluating Pipeline Defects</i> and repair any defects per <i>SOP HLI.05 Pipeline Repair</i> .
3	MONITOR the pipeline for pressure loss or leak conditions. Report any pressure loss or leak conditions to Operations Management per <i>SOP HLA.04 Initial Reporting and Investigating Events</i> .

8.0 Documentation Requirements

Record data in electronic database or utilize the following form(s) as applicable:

B.13.A Encroachment, Facility Crossing and Class Location HCA Reports
Copy of the approved blasting plan
Pipe Inspection Report or Maintenance Record

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9.0 Pipeline Toolbox – PipeBLAST
References HLI.05 Pipeline Repair
HLI.06 Evaluating Pipeline Defects
HLA.04 Initial Reporting and Investigating Events

Appendix A: There are no Operator Qualification (OQ) tasks required for this SOP.
OQ Task
Requirements



Management of Depth of Cover and Evaluation

Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

Code Reference :	Procedure No.: HLI.24	
49 CFR: 195.248, 195.401	Effective Date: 05/01/17	Page 1 of 15

1.0 Procedure Description This Standard Operating Procedure (SOP) outlines activities directed at the management of depth of cover for the purpose of minimizing the possibility of damage to pipelines as a result of shallow cover or exposure.

2.0 Scope This SOP establishes depth of cover guidelines with minimum requirements for the inspection, remediation, and monitoring of shallow and exposed pipe conditions, including unintended spans.



NOTE: For additional guidance and inspection requirements of river/waterway approaches and river/waterway crossings requiring Contract Assisted River Crossing Survey (CARCS), refer to SOP HLI.21 Inspection of ROW – Crossings Under Navigable Waters.

3.0 Applicability This SOP applies to any regulated pipe segment where shallow cover and pipeline exposures can potentially occur.

4.0 Frequency

As required: Perform depth of cover surveys on regulated pipeline segments to determine pipe segments with existing shallow cover, exposures, or areas suspected of becoming shallow or exposed due to a threat from a weather, natural, or outside force.

As required at least once each calendar year at intervals not to exceed 15 months: Inspect all pipeline segments classified as **exposed**.

As required at least once every two calendar years, not to exceed 27 months: Inspect all pipeline segments classified as **elevated**.

As required at least once every three calendar years, not to exceed 39 months: Inspect pipeline segments classified as **monitored**.

As required: Develop a remediation action plan for pipeline segments classified as **immediate**.

As required: Inspect pipeline segments classified as **remediated**.

5.0 Governance The table below identifies responsibility, accountability, and authority for this SOP.

Function	Responsibility	Accountability	Authority
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Buried Pipeline Cover

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Managing Depth of Cover	Operations Personnel	Operations Manager	Director of Operations
Locating Shallow and Exposed Company Pipelines	Operations Personnel	Operations Manager	Director of Operations
Site Evaluations	Operations Personnel	Operations Manager	Director of Operations
Pipe Inspections	Operations Personnel	Corrosion Specialist	Director of Operations
Develop Remedial Action Plans	Operations Personnel and Pipeline Operations Specialist	Operations Manager	Director of Operations
Implement Remedial Action Plan	Operations Personnel and Pipeline Operations Specialist	Operations Manager	Director of Operations
Aerial Patrol Observations & Reporting	Operator Performing Patrol	Operations Manager	Director of Operations
Legal Action and Right-of-Way	Right-of-Way Representative	Right-of-Way Representative	Manager Right-of-Way

6.0 Terms & Definitions

Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

Terms	Definitions
Exposed Pipeline	A pipe segment which was designed and constructed according to the pipeline safety regulations in place at the time of construction, with sufficient cover to minimize damage by outside or natural forces, but which has experienced deterioration in the amount of cover originally provided, resulting in exposure of the pipe to the atmosphere.
Shallow Pipeline	A pipe segment which was designed and constructed according to the pipeline safety regulations in place at the time of construction, with sufficient cover to minimize damage by outside or natural forces, but which has experienced deterioration in the amount of cover originally provided.
Unintended Span	A pipe segment classified as Exposed and due to additional loss of surrounding soil has resulted in an unsupported span. (360° exposure)
Immediate Classification	A Shallow or Exposed Pipeline Segment such that without further intervention, damage to the pipeline is likely and

Buried Pipeline Cover

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Terms	Definitions
	remediation is warranted.
Elevated Classification	A Shallow pipeline segment in which an evaluation indicates a threat of becoming Exposed and due to the additional loss of cover, damage from outside or natural forces IS possible. Such a condition requires continued monitoring with no immediate action required.
Monitored Classification	A Shallow Pipeline Segment in which an evaluation indicates that the loss of cover does NOT increase the potential for damage or require remedial action to re-cover the pipe segment. Such a condition requires continued monitoring with no immediate action required.
Remediated	A Shallow or Exposed pipeline segment in which a remediation plan has been completed and the threat of a natural or outside force has been removed by either line lowering, additional soil, or structural protection.
Remediation Plan	A repair or mitigation activity used to reduce the likelihood of failure of the component being examined.

7.0 Management of Depth of Cover and Evaluation

This SOP contains the following sections:

- Depth of Cover Assessment – 7.1
- Location Description with Public Notification – 7.2
- Evaluation of Depth of Cover – 7.3
- Evaluation of Shallow Cover – 7.4
- Evaluation of Cultivated Lands with Shallow Cover – 7.5
- Evaluation of Exposed Pipeline Segments – 7.6
- Evaluation of Unintended Span – 7.7
- Monitored Conditions – 7.8
- Elevated Conditions – 7.9
- Immediate Conditions – 7.10
- Remedial Action Plans – 7.11
- Remediated Conditions – 7.12
- Reporting Requirements – 7.13

7.1 Depth of Cover Assessment

Operations Personnel, **REVIEWS** depth of cover information from multiple sources, **DETERMINES** additional areas needing depth of cover surveys to identify pipe segments with shallow cover and exposed conditions following the steps below.

Step	Activity
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Buried Pipeline Cover

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1	REVIEW collected depth of cover data. Data sources should include but not limited to the following: <ul style="list-style-type: none"> • 3rd Party Depth of Cover Survey • Construction As-Built • Pipe Inspections • Line locates/probing • Line Crossings • Right-of-Way Reclamation • Encroachments • CARC Survey • River Approach Inspection • Coupling locating
2	DETERMINE areas needing a depth of cover survey performed.
3	IDENTIFY and DOCUMENT pipe segments with shallow cover and exposed conditions from collected data and depth of cover surveys.

7.2

Location Description with Public Notification

Operations Personnel, upon initial investigation of pipe segments with shallow cover and or exposures will follow the steps below.

Step	Activity
1	COLLECT the following data on shallow and exposed pipe segments and document in the electronic Shallow Cover Database <ul style="list-style-type: none"> • Pipeline name • Begin Station and End Station Range • GPS coordinates from Pipeline Mapping System or approved handheld device • Upstream and Downstream Road Crossings • Area Pictures (Facing North, East, South, West) • Land Owner name, address, phone number • If applicable, Farmer/Tenant name, address, phone number • Legal Land Description (e.g. Section/Township/Range/Survey) • County
2	WORK with Right-of-way and make NOTIFICATION attempts to the Affect Public concerning shallow and exposed pipe segments. Refer to <i>SOP HLI.40 Public Awareness Plan</i> .
3	RECORD and DOCUMENT on form I.40A Public Awareness Contact Data
4	ATTACH a copy of form I.40A Public Awareness Contact Data to the electronic Shallow Cover Database Record

Buried Pipeline Cover

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7.3 Evaluation of Depth of Cover

Operations Personnel, will evaluate pipe segments with depth of cover deficiencies by collecting data on the pipe segments affected and the surrounding area. To evaluate and classify pipe segments, use the steps below.

Step	Activity
1	<p>COLLECT data on shallow and exposed pipe segments to allow for a potential damage evaluation. Data should include the following:</p> <ul style="list-style-type: none"> • Land use • Potential for third party damage • Potential for loading • Potential for additional loss of cover/erosion • Inadequate pipe support • Forces – Outside and Natural • Interacting threats (anomalies, low potentials, etc..) • Pipe properties (MOP, seam type, SMYS, w.t., O.D., etc..) • Water turbidity • Coating condition, if applicable • Soil Type • Slope Angle • Within an Identified HCA limit • Distance from structures or roadways • Extent of inadequate cover
<p>NOTE: UTILIZE information from a variety of sources, including:</p> <ul style="list-style-type: none"> • Construction activities • Landowner notifications • Depth of cover surveys • ILI data • GReporter Database • O&M Review • Encroachments • Corrosion surveys • Leakage surveys <p>Make note of any pipe segments with shallow cover and exposures located on cultivated land, and in addition, follow Section 7.5 – Evaluation of Cultivated Lands with Shallow Cover.</p>	
2	<p>In creeks, rivers, waterways, drainage ditches, wet-lands, and bar ditches associated with shallow or exposed pipe segments NOT listed in SOP</p>

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	HL.1.21 DETERMINE the minimum amount of cover between the top of the pipeline and the water to soil interface.
	WARNING: If a condition is encountered that results in doubt as to the safety of proceeding with obtaining depths for a creek, river, waterway, drainage ditch, wet-land, or bar ditch, consult the Operations Manager.
3	DETERMINE the expected maximum depth of the water level. CONSIDER future changes in the waterway bottom or route (migrating head-cut, severe stream bank erosion, reefs, etc.), allowing for further erosion and scour.
4	RECORD all information above using the electronic Shallow Cover Database Record
5	COMPLETE an electronic Pipe Inspection Report upon initial discovery of pipeline segments designed for below grade service exposed to the atmosphere. Refer to <i>SOP HL.D.35 Pipe Inspections and Evaluations</i> . Exclude pipeline segments under flowing turbid (cloudy, opaque, or thick with suspended matter) water, and where the water cannot be diverted safely.

7.4 Evaluation of Shallow Cover

Operations Personnel, will evaluate Shallow Cover as follows:

Step	Activity
1	USE the data collected in Section 7.3 - Evaluation of Depth of Cover and DETERMINE the classification.
2	If DETERMINED Immediate, DEVELOP a remediation action plan.
3	ATTACH a copy of the remediation plan to the electronic Shallow Cover Database Record.
4	COMPLETE remediation plan promptly.
5	If immediate remediation is NOT necessary, schedule next inspection in Electronic Maintenance System per classification definition.
6	SUBMIT electronic Shallow Cover Database Record for approval.

7.5 Evaluation of Cultivated Lands with Shallow Cover

Operations Personnel will evaluate cultivated lands with shallow cover as follows.

Step	Activity
1	In cultivated lands INCORPORATE the information below into the evaluation:

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Step	Activity
	<ul style="list-style-type: none"> • VERIFY external loading farming equipment does NOT exceed the safe limits. Refer to <i>SOP HL.I.27 Abnormal Loading_External Loads_Hwy_RR</i>. • ADVISE the entity responsible for operation and maintenance of the land of the company's damage prevention program. • DISCUSS farming methods and equipment utilized with the landowner/tenant/farmer. <p>DETERMINE maximum anticipated plow depth.</p>
NOTE: See Appendix B for typical farm data regarding cultivated fields.	
2	PROVIDE a minimum of 12 inches of cover between the maximum planned plow depth and the top of the pipeline in cultivated areas.
3	If DETERMINED the minimum distance between plow depth and the top of the pipeline cannot be provided, Classify as Immediate and DEVELOP a remediation action plan.
4	NOTIFY the Right-of-Way Department to advise them of the condition and involve them as necessary in the remediation plan.
5	ATTACH a copy of the remediation plan to the electronic Shallow Cover Database Record.
6	COMPLETE remediation plan promptly
7	If immediate remediation is NOT necessary, schedule next inspection in Electronic Maintenance System per classification definition.
8	SUBMIT electronic Shallow Cover Database Record for approval.

7.6 Evaluation of Exposed Pipeline Segments

Operations Personnel, will evaluate exposed pipe segments as follows:

Step	Activity
1	USE the data collected in Section 7.3 - Evaluation of Depth of Cover and DETERMINE the classification.
2	PERFORM an initial Atmospheric Pipe Inspection. Refer to <i>SOP HL.D.44 Atmospheric Pipe Inspection</i> . Reschedule pipeline segments under flowing turbid (cloudy, opaque, or thick with suspended matter) water, and where the water cannot be diverted safely to a time when water levels are lower.
3	If DETERMINED the pipe segment will remain exposed for any length of time, consider and implement one or more of the following:

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	<ul style="list-style-type: none"> Install a compatible and approved atmospheric coating over the existing underground coating. Recoat the pipe segment with an approved coating system. Consider the conditions and the need to install both a below ground and above ground system. Replace the underground coating systems with an atmospheric coating system. <p>Refer to <i>Engineering Standard Volume HL6 – Corrosion Control</i> for the current procedure regarding above and below ground coating systems.</p>
4	If DETERMINED Immediate, DEVELOP a remediation action plan.
5	DOCUMENT and RECORD remediation plan on form D.40.A Corrosion Control Remedial Action Report. Refer to <i>SOP D.40 Corrosion Control Remedial Action</i> .
6	ATTACH a copy of D.40.A Corrosion Control Remedial Action Report to the electronic Shallow Cover Database Record.
7	COMPLETE remediation plan promptly
8	If immediate remediation is NOT necessary, schedule next inspection in Electronic Maintenance System per classification definition.
9	SUBMIT electronic Shallow Cover Database Record for approval.
NOTE: In addition to inspections and documentation requirements of this SOP, exposed pipe segments with an atmospheric coating systems are subject to inspection and documentation in accordance with <i>SOP HL.D.44 Atmospheric Pipe Inspections</i>	



7.7 Evaluation of Unintended Span

- Operations Personnel, will evaluate Unintended Span pipe segments as follows:

Step	Activity
1	If an exposed pipe segment has become an Unintended Span, DETERMINE if the spanned pipe segment has adequate support upstream and downstream of affected area.
2	CONSULT with the Pipeline Operations Specialist to DETERMINE if pipe segment can remain a span.
3	IF evaluation allows being left a span REFERENCE <i>SOP HL.I.25 Aboveground Components – Overhead Crossings</i> for inspection requirements.
4	If DETERMINED Immediate, DEVELOP a remediation action plan.
5	DOCUMENT and RECORD remediation plan on form D.40.A Corrosion Control Remedial Action Report. Refer to <i>SOP D.40 Corrosion Control Remedial Action</i> .
6	ATTACH a copy of the D.40.A Corrosion Control Remedial Action Report

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	to the electronic Shallow Cover Database Record.
7	COMPLETE remediation plan promptly
8	SUBMIT electronic Shallow Cover Database Record for approval.

7.8 Monitored Conditions

Operations Personnel, performs the following actions for each monitored condition identified. No remediation is required unless subsequent evaluation determines it to be an immediate condition.

Step	Activity
1	DETERMINE locations for shallow cover or exposed markers based on site specific conditions.
2	VERIFY pipeline identification/location markers are present. MAINTAIN markers and signs until shallow pipeline segment is remediated.
3	CONSIDER installation of warning style pipeline markers at the beginning and end of the shallow or exposed areas on land.
4	INSPECT per Section 4.0 Frequencies or as directed by the Pipeline Operations Specialist to verify the integrity of the segment and evaluate for changes in condition.

7.9 Elevated Conditions

Operations Personnel, performs the following actions for each elevated condition identified. No remediation is required unless subsequent evaluation determines it to be an immediate condition.

Step	Activity
1	DETERMINE locations for shallow cover or exposed markers based on site specific conditions.
2	VERIFY pipeline identification/location markers are present. MAINTAIN markers and signs until shallow pipeline segment is remediated.
3	CONSIDER installation of warning style pipeline markers at the beginning and end of the shallow or exposed areas on land.
4	DETERMINE and form a remedial action plan and SUBMIT into the budget process.
5	ATTACH a copy of the remediation plan to the electronic Shallow Cover Database Record.
6	INSPECT per Section 4.0 Frequencies or as directed by the Pipeline Operations Specialist to verify the integrity of the segment and evaluate for changes in condition until remediate through the budget process.

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7.10 Immediate Conditions

For each identified Immediate Condition, Operations Personnel, performs the following actions in Section 7.11 Remedial Action Plan. Operations Personnel must consider and implement one or more of the remedial actions described, with the assistance of the Pipeline Operations Specialist. Appropriate remedial measures others than those listed, if required, are subject to company approval.

7.11 Remedial Action Plans

Operations Personnel, considers one or more of the remedial actions described in the following sub procedures for each pipeline segment with an Immediate or Elevated condition. Information documented in the remedial plan and in the shallow cover database include:

- Description of the situation
 - Inadequate cover evaluation, such as a profile survey
 - Remedial Action Plan
 - Proposed schedule of submitting into budget
 - Inspection interval
-

7.11.1 Remediation Priorities

Operations Personnel, prioritizes plans for remedial action for each shallow or exposed pipeline segment according to the following:

REMEDIAL ACTION PRIORITIZATION (AMAOP)

- Exposed pipe that operates at AMAOP
- Pipe that operates at AMAOP with less than 30” of cover
- Pipe that operates at AMAOP with 30” to 36” of cover (remediated by signage)

REMEDIAL ACTION PRIORITIZATION

1. Non-reinforced coupled pipe with unintended spans (360° exposure) with shallow cover extending over over-bends
2. Exposed pipe in cultivated lands
3. Non-reinforced coupled pipe with less than 24 inches of cover extending over over-bends
4. Exposed pipe in bar ditches parallel to roads
5. Pipe with less than 24 inches of cover in cultivated land
6. Pipe with 1 inch to 12 inches of cover in bar ditches parallel to roads (dirt and gravel roads)
7. Exposed pipe in creeks and river crossings
8. Exposed pipe in waterways, drainage ditches and wet-lands
9. Exposed pipe in non-cultivated land
10. Pipe with 1 to 12 inches of cover in creeks, rivers, waterways, drainage ditches

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and wet-lands.

11. Pipe with less than 24 inches of cover in non-cultivated land
12. Pipe with 12 to 24 inches of cover in creeks, rivers, waterways, drainage ditches, wet-lands, and bar ditches
13. Offshore pipelines with less than 3 feet of cover in water less than 200 feet deep

7.11.2 Negotiation of Plowing Risks

Operations Personnel is responsible for communications of the potential problems associated with plowing.



Step	Activity
1	MEET with the farmer and EXPLAIN the potential problems associated with damage to the pipeline.
2	NEGOTIATE with the farmer to plow at lesser depths.
3	CONTACT Right-of-Way Department and CONSIDER an agreement with the farmer for not cultivating above the pipeline.
4	CONSIDER lowering the pipeline. Refer to <i>SOPHL.I.08 Lowering or Raising In-Service Pipelines</i>
5	CONSIDER placing additional cover over the pipelines.
NOTE: If future erosion, other plans to re-contour the field or field drainage is a concern, additional cover may not be a long term solution.	

7.11.3 Pipeline Lowering

Operations Personnel is responsible for providing recommendation on lowering the pipeline, if required, to a depth that provides adequate depth of cover, or to a depth that provides sufficient cover in waterways and ditches. Future erosion and scour must be considered. Refer to *SOP HLI.I.08 Lowering or Raising In-Service Pipelines*.

7.11.4 Additional Cover



Operations Personnel, can place additional cover over the pipeline segments. If future erosion, drainage etc. is a concern, additional cover may not be a long term solution.

NOTE: Consider effects of addition weight on certain pipe seams and girth weld types.

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7.11.5 Structural Protection Operations Personnel provides recommendation on installing concrete slabs, mats, or blocks over the pipeline, if required, to achieve a barrier and protection from damage of outside or natural forces.

7.12 Remediated Conditions Operations Personnel, will evaluate Remediated Conditions as follows:

Step	Activity
1	CONSULT with the Pipeline Operations Specialist to DETERMINE if continued inspections to verify the integrity of the depth of cover and evaluate for changes in condition are needed.
2	INSPECT per Section 4.0 Frequencies or as directed by the Pipeline Operations Specialist.
3	CONSIDER Aerial Patrol to DOCUMENT and RECORD inspections.
4	IF Aerial Patrol is used, ATTACH a copy of the Aerial Patrol report to the electronic Shallow Cover Database Record.

7.13 Reporting Requirements To fulfill reporting requirements for this SOP, Operations Personnel uses the following steps:

Step	Activity
1	TRACK , at a minimum, the following items in the electronic Shallow Cover database: <ul style="list-style-type: none"> • Location Information • Depth of Cover evaluation • Changes from previous inspections • Dates of previous surveys • Who performed the previous surveys • Any problems discovered during previous surveys • Remedial actions taken • Remedial actions proposed
2	USE an electronic maintenance system for scheduling and permanently recording each inspection or survey to be done on a uniform recurring basis.
3	RETAIN the results of all surveys and outside consultant investigations for the life of the facility involved.
4	RECORD remediation information in the electronic Shallow Cover database.
5	If applicable, RECORD in electronic Pipe Inspection database.
6	If applicable, RECORD in electronic Corrosion Database

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8.0 Documentation Requirements Record data in electronic database or utilize the following form(s) as applicable:
Electronic maintenance system
Electronic Corrosion Database
Pipeline Inspection Database
Shallow Cover Database Record
I.40A Public Awareness Contact Data Form

9.0 References HL.A.01 Glossary and Acronyms
HL.I.40 Public Awareness Plan
HL.D.35 Buried Pipe Inspection
Engineering Standard Volume HL6 – Corrosion Control
HL.I.27 Determination of Abnormal Loading
HL.D.44 Atmospheric Pipe Inspections
HL.D.40 Corrosion Control Remedial Action
HL.I.25 Aboveground Components – Overhead Crossings
HL.I.08 Lowering or Raising In-Service Pipelines

Appendix A: OQ Task Requirements The table below identifies the Operator Qualification (OQ) task requirements.

Function	OQ Task
Underground Pipeline – Locate and Temporary Mark	PLOQ605
Pipeline Patrol	PLOQ701B
Install and Maintain Pipeline Markers	PLOQ703
Visual Inspection for Atmospheric Corrosion	PLOQ417
Visual Inspection of Buried Pipe and Components When Exposed	PLOQ401

Appendix B: Cultivated Fields Reference this appendix for typical farm data regarding cultivated fields.

Erosion, leveling, terracing, changes in grade, or changes in land use can reduce the depth of cover above pipelines in cultivated areas where farm equipment could damage the pipeline.

TYPICAL PLOW DEPTHS

The following typical plow depths are based upon discussions with agricultural

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agencies and farmers and are provided as a general guideline. However, actual depths may vary depending on the type of equipment used, soil conditions, type of crop, and individual farmer preferences. These depths are by no means an absolute limit on plow penetration.

CROP VARIATIONS

Some general differences in plow depth exist based upon the type of crops being planted. For instance, a rice farmer may not want to plow too deep so as to avoid breaking up the impervious soil layer that holds the water in the field; whereas, a cotton farmer may want to plow deep enough to break up a water holding layer. The following list of typical plow depths may be useful:

<u>Crop</u>	<u>Typical Maximum Plow Depth</u>
Cotton	18"
Wheat	12"
Peanuts	12"
Rice	10"
Soybeans	8"
Potatoes	8"
Milo	6"
Corn	6"
Grass	6"

PLOW METHODS

Provided below is a general outline of the frequency of use for various plowing methods and associated plowing depths.

Plow Method	Plow Depth	Frequency
Typical Plowing	< 12"	87%
Subsoiling*	12" – 18"	10%
Deep Subsoiling*	18" – 24"	3%
Custom Equipment*	24" – 30"	< 1/4%

**NOTE:* Subsoiling equipment typically requires a heavy duty four-wheel-drive tractor, which makes it less common due to the investment required. However, this form of "no till" farming is being promoted for better productivity and is on the increase.

LIVE LOADS FROM FARM EQUIPMENT

Farm equipment is designed to exert low ground pressure to minimize soil compaction. As a result, the consideration of the live loads from farm equipment is typically not of concern in cultivated fields since the cover needed to protect the pipe from mechanical damage should also provide protection from the live loads.

However, in areas where the pipeline has less than 24 inches of cover in non-plowed

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areas that may be crossed by heavy farm equipment, review the current procedure regarding pipeline road and rail crossings for live load considerations.



ENERGY TRANSFER

Aboveground Components / Overhead Crossings

Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

Code Reference :	Procedure No.: HLI.25	
49 CFR: 195.254	Effective Date: 03/01/14	Page 1 of 3

1.0 Purpose This Standard Operating Procedure (SOP) establishes minimum requirements for the inspection of pipeline bridges and spans crossing identified waterways.

2.0 Scope This SOP covers inspection and maintenance of pipeline bridge structures and spanned waterway crossings to verify safety and operational integrity

3.0 Applicability This SOP applies to pipeline bridge structures as well as spanned waterway crossings or spans supported by structures not owned by the company.

4.0 Frequency As required: Inspect each suspension bridge after adverse weather conditions such as hurricanes or strong wind events and update list of waterway crossings.

Annually, at intervals not to exceed 15 months: Inspect each pipeline bridge.

Every 10 years, not to exceed the tenth calendar year: Inspect all suspension bridges.

5.0 Governance The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Operations Manager	Director of Operations

6.0 Terms and Definitions Terms associated with this SOP and their definitions follow in the table below. For general terms and definitions, refer to *SOP HLA.01 Glossary and Acronyms*.

Terms	Definitions
Suspension bridge	The structure specifically designed to support a pipeline span.

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**7.0
Pipeline Spans
and Aerial
Crossing
Inspections**

The following procedures are described in this section:

- Above Ground Components
- Company List of Waterways
- Span Inspections
- Bridge Inspections

**7.1
Above Ground
Components**

The following regulations are taken from 49 CFR 195.254

- (a) Any component may be installed above ground in the following situations, if the other applicable requirements of this part are complied with:
- (1) Overhead crossings of highways, railroads, or a body of water.
 - (2) Spans over ditches and gullies.
 - (3) Scraper traps or block valves.
 - (4) Areas under the direct control of the operator.
 - (5) In any area inaccessible to the public.
- (b) Each component covered by this section must be protected from the forces exerted by the anticipated loads.

**7.2
Company List
of Waterways**

Operations Personnel maintain the company list of waterways and update it periodically.



NOTE: When classifying waterways, consider risk factors that potentially impact safety and continuity of service, including:

- Pipe size
- Operating stress level
- Volume of liquid transported
- Proximity of people
- Navigable waterways

**7.3
Bridge
Inspections**

Operations Personnel shall follow the procedure below for pipeline bridge inspection.

Step	Activity
1	INSPECT each pipeline bridge to verify proper support for the pipeline and to CONFIRM that no deterioration of the structure has taken place. REFER to <i>SOP HLD.44 Atmospheric Corrosion Inspections</i> . Complete the applicable form(s) for <i>Corrosion Control Remedial Action Report</i> , if appropriate.
2	INSPECT bridges, spans, or overhead crossings that may become submerged as a result of major rain events for damage to support structures, the pipe, and waterway banks. REMOVE accumulated debris on pipeline. MONITOR pipeline bridges frequently during such events.

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Step	Activity
3	COMPLETE an unplanned work order in EAM.
4	ARRANGE for the condition of all major suspension bridges to be reviewed by a contractor or suspension bridge consultant.
5	PLAN and IMPLEMENT corrective measures for any deficiency found.

**7.4
Span
Inspections**

Operations Personnel follows the procedure below for inspection of spans.

Step	Activity
1	INSPECT the surface conditions adjacent to pipeline span to detect bank erosion or other environmental change that might indicate damage or loss of cover to the pipeline. INSPECT pipeline marking signs for their condition and legibility. REFERENCE <i>SOP HLI.12 Pipeline Facilities Identification</i> . MAKE additional inspections if flooding has occurred or channel changes are detected during patrols or other opportunities for observation.
2	COMPLETE an unplanned work order in EAM.
3	SCHEDULE and IMPLEMENT maintenance, modifications, or corrective work to maintain adequate protection of facilities.

**8.0
Documentation
Requirements**

Record data in electronic database or utilize the following form(s) as applicable:

Complete electronic maintenance system or a similar system for reporting requirements. Maintain for ten (10) years or one (1) inspection cycle, whichever is longer. Results of all surveys and outside consultant investigations: Retain for the life of the facility involved.

**9.0
References**

HLD.44 Atmospheric Pipe Inspection
HLI.12 Pipeline Facilities Identification

**Appendix A:
OQ Task
Requirements**

The table below identifies the Operator Qualification (OQ) Task Requirements.

Task Description	OQ Task
Visual Inspection for Atmospheric Corrosion	PLOQ417
Right-of-Way Inspection	PLOQ701B

***Standard Operating Procedures****Applicable to Hazardous Liquids Pipelines and Related Facilities*

Code Reference :	Procedure No.:HLI.26	
49 CFR 195.442	Effective Date: 04/01/18	Page 1 of 13

1.0 Purpose This Standard Operating Procedure (SOP) establishes the requirements for identifying, investigating, and controlling mining operations, subsidence, and soil slippage.

2.0 Scope The investigation of proposed mining activities or unstable soils can reduce the possibility of pipeline damage due to earth movement or vibrations by identifying potential problem areas and allowing sufficient time to take preventive measures.

Methods of investigation include, but are not limited to, geological studies, installation of monitoring instruments, re-evaluation of existing pipe integrity, establishment of limitations, on-site field observation, and profile surveys.

3.0 Applicability This SOP applies to sections of regulated pipeline systems located in areas where mining operations and/or natural geological conditions can cause soil subsidence, landslides, sinkholes, increased stresses, or other problems.

4.0 Frequency As required: When a mining operation, soil subsidence, landslide, sinkhole, or other condition is identified.

5.0 Governance The following table describes the responsibility, accountability and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Operations Manager	Director of Operations

6.0 Terms and Definitions Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to SOP *HLA.01 Glossary and Acronyms*.

Terms	Definitions
Natural Occurrences	Landslides, sinkholes, earthquakes, flooding or high water events, etc.

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7.0

Mining Subsidence and Soil Slippage

This SOP contains the following sections:

- Communications
- Involvement of a Consultant
- Precautions for Room and Pillar Mining
- Preparations for Subsidence Caused by Longwall Mining
- Activities During Longwall Mining Subsidence
- Using Line Break Controls
- Protection of Pipeline from Soil Slippage
- Reporting



NOTE: Variations to these procedures may be approved by the Pipeline Integrity Group based upon project specific requirements.

7.1

Communications

Right-of-Way personnel perform the following steps to communicate with the entities involved.



CAUTION: In situations where coupled or acetylene pipelines are involved, make special considerations and consult Operations Personnel.

Step	Activity
1	ESTABLISH and MAINTAIN communications between Operations Personnel and the entities involved.



NOTE: This allows for keeping records of the areas where mining, subsidence, slippage, etc. is in progress and coordinating the company's monitoring and safety precautions with the entities involved.

Step	Activity
2	MONITOR pipeline conditions daily during the subsidence period or natural occurrences. MAINTAIN contact with the entities involved as required. ADVISE the Right-of-Way Representative of any conditions that appear to be abnormal.



NOTE: While most subsidence occurs during the first month after long-wall mining under the pipeline, additional subsidence can occur over the next 9-12 months.

Step	Activity
3	REVIEW each mining situation to determine the company's rights.

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7.2 Perform the following steps when involving a consultant.

**Involvement of
a Consultant**

Step	Activity
1	EVALUATE the potential for subsidence or other impacts from mining operations or natural occurrences based upon the site conditions and relative location of the pipeline.
2	ENGAGE a consultant, if necessary, to perform a geological study, to predict the effects and to provide the company with recommendations.

7.3 Take the following precautions for room and pillar mining.

**Precautions
for Room and
Pillar Mining**

Step	Activity
1	OBTAIN as much detailed information regarding the mining activities and the pillar and room sizes as possible when room and pillar mining is conducted beneath company pipelines.



CAUTION: Do not allow mining beneath Metering and Regulating (M&R) stations, pump stations, valve settings, or other similar facilities.

Step	Activity
2	CONSIDER the recommendations from the consultant.
3	CHECK the right-of-way above the mine as appropriate for the first month after the mining is complete and annually thereafter for any evidence of subsidence in the appearance of the ground surface.



NOTE: Use photographs, quadrangle maps, or consider establishing a benchmark for elevations on the pipeline that can be used to help in determining if subsidence is occurring.

7.4
**Preparations
for Subsidence
Caused by
Longwall
Mining**

If subsidence is predicted which may involve the pipeline, perform the following procedures prior to the subsidence period.

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7.4.1
Reviewing
Pipeline
Operating
Conditions

The Operations Personnel reviews the pipe operating conditions and Pipeline Integrity Group reviews information from ILI data, if available, for the affected area.



NOTE: For further investigation and possible replacement prior to the subsidence period, anomalies or other conditions which could cause problems as a result of the subsidence.



CAUTION: Where coupled and/or acetylene welded pipelines are involved, make special consideration and consult the Pipeline Integrity Group.

7.4.2
Reviewing
Stresses in the
Lowered
Pipeline

Perform the following steps when reviewing stresses in the lowered pipeline.

Step	Activity
1	PERFORM a preliminary analysis of the anticipated pipeline subsidence in accordance with <i>SOP HLI.08 Lowering or Raising In-Service Pipelines</i> .
2	If the final stresses are predicted to be excessive, CONSULT with the Pipeline Integrity Group regarding potential replacement with heavier wall pipe, or other remedial actions.

7.4.3
Determining
Allowable
Strain Level

The Pipeline Integrity Group determines the maximum allowable strain level per *SOP HLI.08 Lowering or Raising In-Service Pipelines* for use in monitoring the subsidence in accordance with section 7.5.2 “Monitoring Strain Gauges” below. Perform this action item in conjunction with the above stress calculations in section 7.4.2 “Reviewing Stresses in the Lowered Pipeline.”

7.4.4
Removing Soil
Overburden
from the
Pipeline

The Operations Personnel is responsible for the following steps during the removal of soil overburden from the pipeline.

Step	Activity
1	UNCOVER the entire length of pipeline to be affected by the subsidence.
2	STRIP both sides of the pipe to allow lateral movement during subsidence.
3	SLOPE or SHORE ditch banks properly in accordance with <i>SOP HLI.10</i>

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Step	Activity
	<i>Excavation and Backfill</i> to protect personnel who will be working in the ditch during the monitoring operations.
4	LEAVE a minimum number of small plugs of earth where necessary for access across the pipeline.



CAUTION: Plugs left in the ditch during subsidence can concentrate stresses and result in stress levels much higher than predicted values.



NOTE: Road crossings may need to be open cut and bridged across the pipeline. Involve the Right-of-Way representative for possible permitting requirements of the authority responsible for the roadway.

Step	Activity
5	DETERMINE if any measures are necessary to protect the pipeline coating from the environment after it has been exposed. CONSULT with the Corrosion Specialist to determine if any measures need to be taken to protect the pipeline coating from environmental forces during the time frame the pipeline is exposed and during subsidence.
6	PROVIDE drainage for creeks to prevent water from ponding in the trench. CONSIDER profile survey of the affected pipeline segment to determine cover, location of bends, etc. PERFORM an aerial survey of the proposed area to determine location(s) of nearby water bodies such as creeks, waterways, ponds, lakes, and other structures that might pose a risk to the pipeline during subsidence or other land movement conditions.

7.4.5 Radiographic Inspection and Repairing Welds

At the direction of the Pipeline Integrity Group or Welding Group, Operations will be responsible for radiographic inspection and repairing welds.

Step	Activity
1	VERIFY that all circumferential welds in the subsidence area are radiographed prior to the subsidence, as directed by Operations Personnel.
2	EVALUATE the welds.
3	REPAIR or REPLACE welds per <i>SOP HLI.08 Lowering or Raising In-Service Pipelines</i> .

7.4.6 Installing Strain Gauges

Perform the following steps for installing strain gauges.

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Step	Activity
1	INSTALL strain gauges on the pipeline as specified by the Engineering or the Liquid Technical Operations Group at approximately 100-ft. intervals and in other strategic locations where the highest stresses are anticipated, including panel edge and centerline, pipe bends, and road crossings. See Section 7.5.5 “Special Considerations for Cased Road Crossings.”
2	VERIFY that each location has three strain gauges: one at the top dead center, one at the three o’clock position, and one at the nine o’clock position.

7.4.7 Installing Temperature Measurement Equipment

Connect a temperature recorder or other method of monitoring the pipeline operating temperature to the bottom of the pipe in an area sheltered from the sun and weather.



NOTE:

- This is done to adjust the allowable strain value during and following subsidence for the temperature changes which occur after the strain gauges have been installed.
- The allowable strain level established per “Reviewing Stresses in the Lowered Pipeline” above may vary with pipe temperature since lower temperatures cause additional stress from axial contraction of the steel pipe.

7.4.8 Evaluating Material Requirements

The Operations Personnel is responsible for evaluating material requirements.

Step	Activity
1	OBTAIN sand bags, air bags, skids, erosion control fabric, silt fencing, fencing, signage, and other required materials as appropriate for installation during the pipeline excavation and subsidence.
2	INSTALL erosion control measures per company standards.
3	LOCATE pretested pipe as a precautionary measure in the event that problems arise. CONSIDER pre-positioning pipe at an approved bending contractor site in the event a bend must be replaced or modified.

7.4.9 Notification and Permits

Operations Personnel or Right-of-Way personnel perform the following tasks for notifications and permits.

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Step	Activity
1	CONTACT landowners in the area to make them aware of the work that must be done.
2	OBTAIN permits where appropriate.

**7.5
Activities
during
Longwall
Mining
Subsidence**

Perform the following activities from the time that the mining operation first approaches the pipeline until the mining is complete in the area and no significant additional subsidence occurs as determined by the Pipeline Integrity Group.

**7.5.1
Manning
Mainline
Block Valves**

Operations Personnel performs the following steps during manning mainline block valves.

Step	Activity
1	During the subsidence period, MAN mainline block valves bracketing the section of pipeline affected 24 hours a day unless otherwise directed by Pipeline Integrity.



NOTE: Manning the valves allows them to be closed immediately in the event of a pipe failure.

Step	Activity
2	ESTABLISH other means of isolation if a valve cannot be manned during the subsidence. Such as remotely operating from the control center and manning another valve nearby. CONSULT Liquid Technical Operations group to design a control scheme in the event a main line valve cannot be manned during the active subsidence

**7.5.2
Monitoring
Strain Gauges**

Operations Personnel takes the following steps in monitoring strain gauges.

Step	Activity
1	MONITOR the gauges and TAKE daily readings.
2	If any gauge registers a change in strain of over 90% of the allowable strain level established in “Determining Allowable Strain Level” above and has been adjusted for temperature, NOTIFY Operations Management to determine appropriate actions per “Monitoring Pipe Elevations” below.

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7.5.3 Monitoring Pipe Elevations

The Operations Personnel takes the following steps in monitoring pipe elevations.

Step	Activity
1	SET UP a benchmark outside of the subsidence area to ensure that the measurements are accurate.
2	RECORD daily elevations of the top of the pipe and the adjacent ground.
3	CONTACT the mine operator daily to obtain information on the location of the face.
4	PLOT the face location and strain gauge locations on a drawing along with pipe and ground elevations.
5	CALCULATE pipe strain based upon the change in pipe curvature to supplement the strain gauge readings, where necessary.
6	USE the elevation data to establish when the subsidence period begins and ends and in determining a plan of action in the event remedial measures are necessary.

7.5.4 Remedial Actions

The Operations Personnel performs the following tasks when taking remedial actions.

Step	Activity
1	If corrective measures must be taken to protect the pipeline when excessive strains or other unfavorable conditions occur during subsidence, DETERMINE the proper remedial action.
2	PERFORM the following if necessary: <ul style="list-style-type: none"> • INSTALL supports to maintain the pipeline at a constant elevation. • USE air bags to lift the pipe. • EXCAVATE additional pipeline to allow for lowering of the line. • REDUCE operating pressure. • In extreme cases, REMOVE the pipeline from service and cut the pipe to relieve the induced stresses.



CAUTION: Use of airbags induces extra stress into the pipeline. Consult with Pipeline Engineer prior to using airbags.

Step	Activity
3	PLAN any adjustments to the profile or alignment to reduce the amount of bending in the pipe in the area where the high stress is occurring while minimizing any increase in the bending of adjacent areas.

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**7.5.5
Special
Considerations
for Cased
Road Crossings**

The Operations Personnel performs the following steps when making special considerations for cased road crossings.

Step	Activity
1	INSTALL strain gauges on the pipeline at both ends of the casing to monitor for stress concentrations.



CAUTION: As a mining panel approaches a cased road crossing, the pipeline may begin subsiding at one end of the casing while the casing still remains at its original elevation. This could cause damage to the pipeline.

Step	Activity
2	UTILIZE temporary support methods to spread out excessive loads and to prevent the pipe from grounding to the casing end.



NOTE: Progression of the subsidence past the road should alleviate the differential settlement of the pipeline; however, if the road is at the final edge of the panel, the pipeline may need to be cut for the installation of bends.

**7.5.6
Backfilling**

The Operations Personnel performs the following steps during backfilling.

Step	Activity
1	EVALUATE the mining consultant's report and the reduction in the subsidence rate after the mining has passed to determine when the monitoring activities may be discontinued and when the pipelines may be backfilled.



NOTE: Once the mining process has passed beneath the pipeline, the subsidence period typically lasts for several more weeks.

Step	Activity
2	PROVIDE adequate support prior to backfilling per <i>SOP HLI.10 Excavation and Backfill</i> .

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7.6 Protection of Pipeline from Soil Slippage

The Operations Personnel performs the following actions to protect the pipeline from soil slippage.

Step	Activity
1	PERFORM protective measures when excessive deformations or significant increases of pipe stress are detected which may include the following: <ul style="list-style-type: none"> • Relocation of the pipeline into a more stable area • Removal of sliding soil • Stabilization of the land slippage area by drying the area with surface or subsurface drains • Excavation of a trench parallel to and immediately uphill of the pipeline to relieve lateral soil pressure on the pipe (This usually applies to cases where earth movement is approximately perpendicular to the pipeline.) • Combinations of the above methods



NOTE: In areas of unstable slopes where soil slippage is occurring, after an earthquake, or when a high potential for soil movement exists, monitor using visual observation, aerial patrol, and readings from instrumentation.

Step	Activity
2	DETERMINE the extent of the hazard and the appropriate remedial measures.
3	DISCUSS each case with Engineering Group and/or Liquid Technical Operations Group.

7.7 Reporting

The Pipeline Engineer performs the following actions when reporting.

Step	Activity
1	MAINTAIN a daily record of the survey and strain gauge data, and the reports from the mining company summarizing the progress of the mine.
2	Once each week, verbally REPORT to Engineering Group and/or Liquid Technical Operations Group on the status of mining and pipeline monitoring activities.
3	Upon completion of the mining operation, and after no significant additional subsidence occurs, PREPARE a formal report documenting the surveillance of the pipeline including all elevation and strain gauge data obtained during the mining period.
4	INCLUDE a copy of the report with the completion package.

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**8.0
Documentation
Requirements**

Record data in electronic database or utilize the following form(s) as applicable:
Mitigation plan as developed by the Operations Personnel and Engineering.

The following table describes the EAM reporting requirements of this SOP.

Activity	Reporting
Acknowledge the requirements as outlined in the SOP have been completed. Record exceptions, if any, in the comments section.	EAM 7T000PLW Unplanned Pipeline Work Order; retain for the life of the facility.

**9.0
References**

HLI.08 Lowering or Raising In-Service Pipelines
HLI.10 Excavation and Backfill

**Appendix A:
OQ Task
Requirements**

The table below identifies the Operator Qualification (OQ) task requirements.

Function	OQ Task
Backfilling Pipe and Coating Protection	PLOQ404



ENERGY TRANSFER

Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

Abnormal Loading Evaluation for Equipment, Highway & Railroad Crossing Type Loads

Code Reference :	Procedure No.: HLI.27	
49 CFR: Part 195.256	Effective Date: 04/01/18	Page 1 of 5

1.0 Procedure Description

This Standard Operating Procedure (SOP) describes how to evaluate the effects of abnormal external loading on the pipeline, highway and railroad crossings.

2.0 Scope

This SOP:

- Identifies the characteristics of the pipeline(s) and crossings that are impacted by the loading condition.
- Identifies the specific parameters of the abnormal loading condition.
- Identifies the steps required to develop and document a mitigation plan for reducing stress on the pipeline and crossings to acceptable limits.
- Communicates the requirements of the mitigation plan.

3.0 Applicability

This SOP applies to all regulated company pipelines that are impacted by abnormal loading conditions.

4.0 Frequency

As required: Gather information, submit the appropriate abnormal loading form, and submit for evaluation.

5.0 Governance

The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Operations Manager	Director of Operations

6.0 Terms and Definitions

Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

Terms	Definitions
Abnormal loading	Any condition either from third party entities, environmental conditions, or forces of nature that act upon the pipeline in such a manner as to increase the total combined hoop stresses beyond acceptable limits.

**Abnormal Loading
Evaluation for Equipment,
Highway & Railroad
Crossing Type Loads**

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Terms	Definitions
Mitigation plan	A plan developed to address protecting the pipeline from all forces that act upon it and to reduce the effects of the outside forces to acceptable levels.
Technical tools	Any tool, computer program, or model that may be utilized to quantify and evaluate outside forces that may be acting on the pipeline.

**7.0
Determination
of Abnormal
Loading**

The following procedures are described in this section:

- Report Potential Abnormal Loading
- Develop a Mitigation Plan

**7.1
Report
Potential
Abnormal
Loading**

Operations Personnel collects information related to potential abnormal loading.

Step	Activity
1	INVESTIGATE potential forces or activities that may pose an abnormal loading threat to the pipeline. These forces include but are not limited to: <ul style="list-style-type: none"> • Road, railroad, street, or equipment crossings • Pipe exposures in a stream • Unsupported Spans • Slippage of overburden on a slope • Build-up of debris on or near the pipeline in a stream • Flooding events • Other conditions that add load to the pipeline (dynamic compaction, impact loading, vibrations, stress risers, support points, etc.)
2	DOCUMENT the above information on the applicable form(s) or electronic database for <i>Weather Related and Outside Force Evaluation</i> . REFER to <i>SOP HLA.12 Safety-Related Condition Reporting</i> to VERIFY that the situation meets the criteria of a Safety Related Condition.

**Abnormal Loading
Evaluation for Equipment,
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Crossing Type Loads**

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Step	Activity
3	GATHER information regarding the type and nature of the force acting on the pipeline, including but not limited to: <ul style="list-style-type: none"> • Location of the problem • Alignment sheet numbers • Pipeline stationing • Line(s) involved • Pipe diameter(s) • Wall thickness • Pipe grade • Depth of cover • Operating conditions • MOP of line(s) involved • Length of any unsupported pipe • Inherent anomalies & quality of weldments • Quality of coating • Static or dynamic loading
4	COMPLETE the applicable form(s) for <i>Weather Related and Outside Force Evaluation</i> and SUBMIT to the Liquid Technical Operations and Pipeline Integrity Groups for review.

**7.2
Develop a
Mitigation Plan**

An Engineer performs the following steps to develop a mitigation plan.

Step	Activity
1	ANALYZE and EVALUATE the abnormal loading condition on the pipeline and DETERMINE whether the loading is within acceptable limits or if a mitigation plan should be developed. If information is inadequate, NOTIFY Operations Personnel to repeat steps 3 and 4 in <i>Section 7.1</i> .
2	DEVELOP a mitigation plan or CONTRACT for assistance from a third party to develop the plan. COMMUNICATE the requirements to involved parties.
3	MONITOR and VERIFY implementation of the mitigation plan.

**8.0
Documentation
Requirements**

Record data in electronic database or utilize the following form(s) as applicable:

Weather Related and Outside Force Evaluation

***Abnormal Loading
Evaluation for Equipment,
Highway & Railroad
Crossing Type Loads***

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9.0

HLA.12 Safety-Related Condition Reporting

References

**Appendix A:
OQ Task
Requirements**

The table below identifies the Operator Qualification (OQ) task requirements.

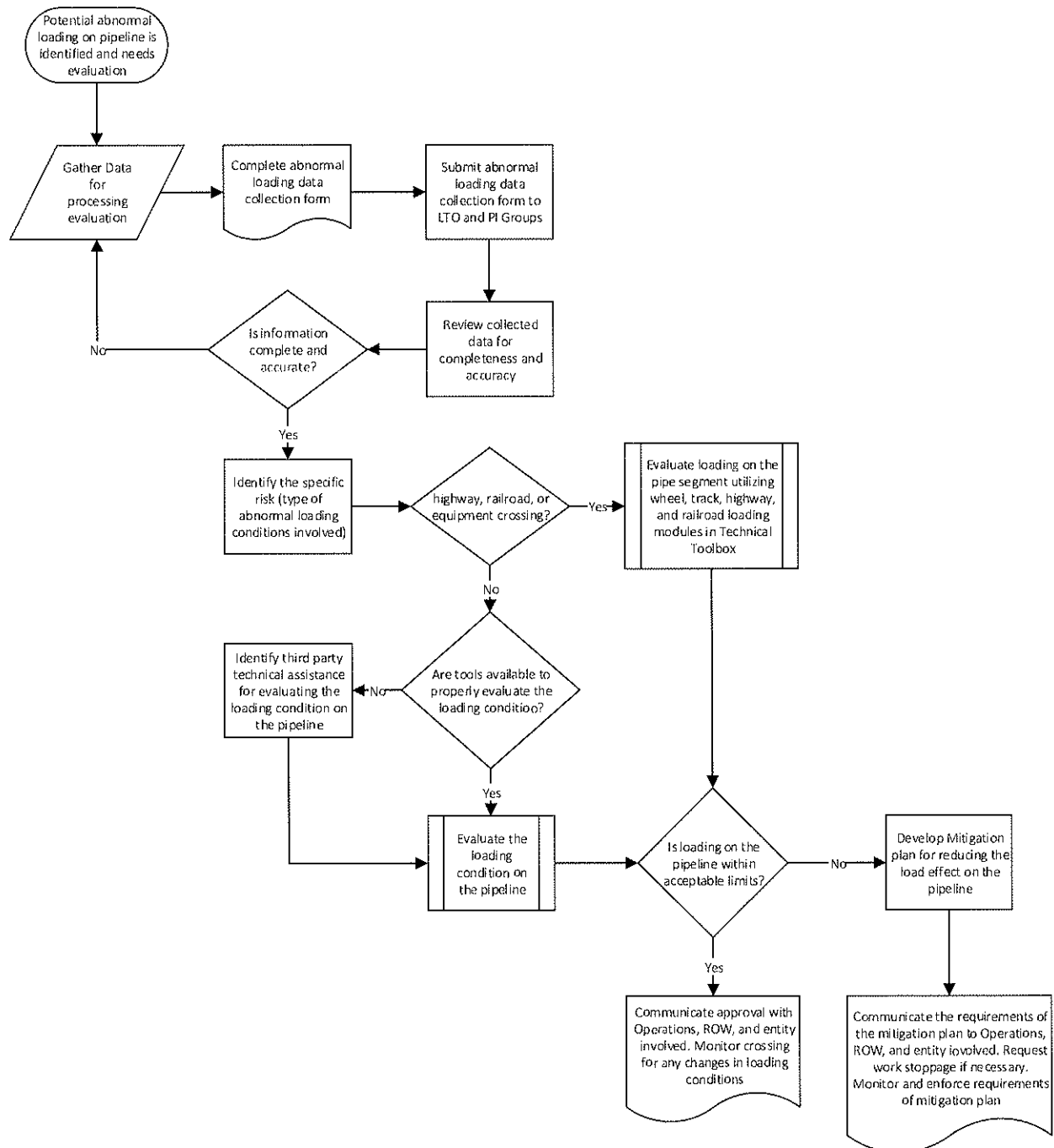
Function	OQ Task
Backfilling - Pipe and Coating Protection	PLOQ404
Underground Pipeline - Locate and Temporarily Mark	PLOQ605
Damage prevention during Excavation / Encroachment Activities	PLOQ607

**Appendix B:
Abnormal
Loading
Process Flow**

The following flow chart describes the process for evaluating the effects of abnormal loading.

Abnormal Loading Evaluation for Equipment, Highway & Railroad Crossing Type Loads

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ENERGY TRANSFER

Right-of-Way Encroachments

Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

Code Reference:	Procedure No.: HLI.28	
49 CFR 195.412, 195.442	Effective Date: 05/01/15	Page 1 of 30

1.0 Procedure Description This Standard Operating Procedure (SOP) describes how to manage Right-of-Way (ROW) encroachments.

2.0 Scope Use the guidelines in this SOP to control outside forces that could damage the pipelines or leave them vulnerable to future damage or an unsafe operating condition, including:

- Grading, excavation, ditching, drilling, ditch clean-out, blasting, or other construction or activities.
- Installation of certain trees, buildings, fixed mobile homes, utility lines, pipelines, roads, or other structures.
- Erosion or subsidence.

3.0 Applicability This SOP applies to encroachments on regulated pipelines, including foreign facility crossings.

4.0 Frequency As required: for all encroachment activity on or around company facilities.

5.0 Governance The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
Locating and Exposing Company Pipelines	Operations Personnel	Operations Manager	Director of Operations
Required Offsets	Operations Personnel	Operations Manager	Manager Right-of-Way
Investigation of Encroachments	Operations Personnel	Operations Manager	Director of Operations
Site Investigation of Proposed Encroachments	Operations Personnel	Operations Manager	Director of Operations
Restrictions on Encroachments	Operations Personnel	Right-of-Way Representative	Right-of-Way Representative
Construction Near Company Pipelines	Operations Personnel	Operations Manager	Director of Operations

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Function	Responsibility	Accountability	Authority
Directionally Drilled Crossings	Operations Personnel	Operations Manager	Director of Operations
Legal Action	Right-of-Way Representative	Right-of-Way Representative	Manager Right-of-Way

6.0 Terms and Definitions

Terms associated with this SOP are provided in *SOP HLA.01 Glossary and Acronyms*.

7.0 Right-of-Way Encroachments

This SOP contains the following sections:

- Locating and exposing company pipelines
- Required offsets
- Investigation of encroachments
- Site investigation of proposed encroachments
- Restrictions on encroachments
- Construction near company pipelines
- Directionally drilled crossings
- Legal action

7.1 Locating and Exposing Company Pipelines

Operations Personnel follows the procedures outlined in *SOP HLB.04 Pipe Location and Marking* for locating company facilities.



NOTE: Pipelines may be exposed by others only after proper notice to the company and only in the presence of a company representative.

Step	Activity
1	PROVIDE a company representative to field locate and stake the pipelines at given points prior to any work on or near the right-of-way by third-parties.
2	When other pipeline operators are in the shared ROW, VERIFY that the non-company pipeline is properly and accurately located and marked, on projects that they are performing on their own line. A Company representative will stand by the excavation until all digging has been completed, and a Company representative has verified that the other operator or contractor will not be doing any excavation near the Company lines.
3	CONFIRM excavation methods with <i>SOP HLI.10 Excavation and Backfill</i> .

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NOTE: The width of the pipeline right-of-way is controlled by the existing easement.

Step	Activity
4	COMPLETE the applicable form(s) for <i>Encroachment, Foreign Line Crossing, and Class Location HCA Report</i> .
5	DOCUMENT in the applicable electronic database, as required.

7.2 Required Offsets

In the case of undefined easements, Operations Personnel maintains the following offsets for proposed facilities.

Step	Activity
1	For foreign pipelines, VERIFY the offset distance is a minimum of 25 ft. on either side of the pipeline. If multiple pipelines exist, VERIFY the offset distance is 25 ft. to 33 ft. outside of the outermost pipeline (whether existing or proposed).



NOTE: The controlling easement may limit rights to less than 25 ft. or 33 ft.

Step	Activity
2	Prior to establishing offset distances of contractors, developers, landowners, and others, EXAMINE the terms of appropriate easements. Both construction requirements and easement restrictions may vary from location to location.
3	If additional line rights exist, AVOID allowing the new encroachments (e.g., buildings, trees, structures, or obstructions) to be within 25 ft. to 33 ft. of either side of the pipeline or proposed pipelines.
4	OBTAIN prior written approval of the Manager of Right-of-Way for any variance from the general footage requirements pertaining to encroachments.

7.3 Investigation of Encroachments

Operations Personnel follows the procedure below to monitor the pipeline system for encroachments.

Step	Activity
1	INVESTIGATE and DOCUMENT any encroachments in accordance with the following criteria.
2	TAKE the following immediate actions when Operations Personnel discovers or is notified of an encroachment which is currently in progress.
3	IDENTIFY the nature of the work and its potential to damage the pipeline or violate the company's rights.
4	STOP the unauthorized work, until appropriate notifications are made and the

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Step	Activity
	required response time has elapsed.
5	ADVISE the encroaching party of the nature of the product in the pipeline and the potential hazards that damage to the pipeline could create.
6	REMAIN at the work site until all unauthorized work has ceased to prevent damage to the pipeline or company facilities.
7	LEAVE a written notice if equipment is found unattended on the right-of-way, and FOLLOW UP as soon as possible to identify the operator and/or landowner.
8	EXCAVATE the pipeline and inspect for damage if the pipeline may have been excavated without a company representative present.
9	SEND a letter to excavators who are discovered to be performing work on the company's easement and have not used the One-Call system or other method to contact the company prior to commencing the work. REFER to <i>HLI.40 Public Awareness Plan – Communication with API RP1162 – defined Stakeholders.</i> •
10	SEND copies of the letter to whoever hired the excavator and the appropriate state One-Call system operator. KEEP a written record in accordance with <i>SOP HLI.40 Public Awareness Plan – Communication with API RP1162 – defined Stakeholders.</i>
11	NOTIFY Operations Support for response to one-call violations.



NOTE: In the letter, advise the excavator of company crossing requirements and the dangers of working around buried utilities without notice to the utility owner.

Step	Activity
12	COMPLETE the applicable form(s) for <i>Encroachment, Foreign Line Crossing, and Class Location HCA Report.</i>
13	DOCUMENT in the applicable electronic database.
14	If the company representative at the site reports that the parties performing the construction do not agree to stop immediately and discontinue work until a resolution is completed, CONTACT the Director of Operations.



NOTE: The on-site company representative has authority to contact local law enforcement to protect the company facilities.

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**7.4
Notification of
Potential
Encroachments**

Operations Personnel follows the procedure below when potential encroachments are identified.

Step	Activity
1	NOTIFY Operations Personnel regarding encroachment activities which could affect the pipeline. In the event Operations Personnel is not available, CONTACT Liquid Control.
2	RECORD the details of the activity, the name of Operations Personnel member who was notified, and the time of the notification using the applicable form(s) for <i>Aerial Patrol Trouble Report or Encroachment, Foreign Line Crossing, and Class Location HCA Report</i> .
3	If previously reported activities (or occurrences) have changed in a manner that might affect the pipeline, such as road construction, pipeline construction, or erosion on the right-of-way, NOTIFY Area Management regarding the activities.

**7.5
Site
Investigation of
Proposed
Encroachments**

The table below outlines the process to investigate sites with proposed encroachments.

Step	Task
1	CONDUCT a site encroachment investigation as far in advance of the start of work as practical and VERIFY the proper documentation of the investigation. REVIEW a copy of Appendix D: <i>Engineering and Construction Specifications</i> , with the third party.
2	If a proposed or potential encroachment is identified by a one-call or other means, PERFORM the investigation with the developer, landowner, or contractor, if possible.
3	DETERMINE if there is a conflict with company facilities or easement rights. VERIFY that construction activity does not commence until pertinent information is exchanged between the parties and the company gives proper authorization.

**7.5.1
Conflicts with
Company
Facilities**

If the proposed work will encroach upon the company's easement or if the investigation is unable to conclusively determine that there is no conflict with company facilities, follow the process below.

Step	Task
1	REVIEW the terms of the easement for the tract of land involved.

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Step	Task
2	DETERMINE the appropriate action to take based upon the nature of the work being performed.
3	REVIEW <i>Appendix B: Pressurized Pipeline Excavation Procedure</i> with the third party. Reference <i>SOP HLI.10 Excavation and Backfill</i> .
4	PROVIDE an appropriate informational letter to residential landowners. REVIEW this document with the landowner. <i>Appendix C: Request for Right of Way Encroachment</i> .
5	LOCATE and STAKE or FLAG the company's facilities.
6	COMPLETE the applicable form(s) for <i>Encroachment, Foreign Line Crossing, and Class Location HCA Report</i> .
7	KEEP a written record with all pertinent information concerning the sequence of events, dates, names, telephone numbers, action taken (locating and staking lines, etc.), and discussions with the parties involved.
8	ADVISE the encroaching party of the nature of the product in the pipeline and the potential hazards that damage to the pipeline could create.
9	If the work is conducted on the day of the visit, REMAIN on site until the work is completed.
10	If work is not completed on the day of the visit or is scheduled to begin at a later date, MONITOR the status of the project (by phone, site inspections, etc.) until the work begins.
11	COMPLETE the applicable form(s) or ENTER data in the applicable electronic database for <i>Encroachment Observation Report</i> to DOCUMENT that a company representative was present during the course of the project.

**7.5.2
No Conflict
with Company
Facilities**

If the investigation determines that there is no conflict with company facilities, the documentation required by 7.5.1 is sufficient.

**7.6
Restrictions on
Encroachments**

Operations Personnel follows these procedures regarding encroachments in the vicinity of the pipeline.

**7.6.1
Air Strips**

For air strips, contact the company Right-of-Way Representative.

**7.6.2
Blasting**

Follow the procedure to monitor blasting that is outside the right-of-way but is within 300 ft. of the pipeline in accordance with *SOP HLI.23 Protection of Pipeline Facilities From Blasting Operations* to verify that it is not detrimental to the existing facilities.

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WARNING:

- Do not allow blasting within the right-of-way easement without the permission of Director of Operations.
- Immediately stop blasting that endangers the pipeline.

**7.6.3
Bushes**

For bushes and other plants follow the procedure below.

Step	Activity
1	DO NOT ALLOW planting of bushes, shrubbery, decorative or dwarf trees, or other plants associated with landscaping, that will grow to more than 4 feet tall within the right-of-way confines.
2	CONTACT the Right-of-Way Representative for review of landscaping plans before permitting planting of landscaping plants.
3	VERIFY that any plants allowed do not hide or screen any pipeline marker.



NOTE: CONSIDER placing markers at **LINE-OF-SIGHT** intervals where practical.

Step	Activity
4	DO NOT ALLOW plantings, i.e. (trees, shrubs, etc) within the designated ROW that could interfere with the operation of the pipeline.

**7.6.4
Campgrounds**

Notify a Right-of-Way Representative when a campground is planned near a pipeline.

**7.6.5
Cemeteries**

Do not allow graves, markers, or structures on the easement.

**7.6.6
Dams or Dikes**

Do not construct dams or dikes on any part of the right-of-way confines. Do not permit removal of cover for the purpose of creating an impoundment of water.

**7.6.7
Ditches (Open)**

For open ditches, follow the procedure below.

Step	Activity
1	REPORT any proposals to place a ditch across or parallel to the pipeline to the Right-of-Way Representative.

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CAUTION: Do not allow open parallel ditches on the right-of-way.

Step	Activity
2	If a ditch is to be placed across the pipeline, VERIFY it crosses at or near right angles and that there is at least 36 inches of cover remaining at the lowest point of the ditch.
3	If there is less than sufficient cover over the pipeline, REFER to Director of Operations

7.6.8 Drain Tile

For drainage tile, follow the procedure below.

Step	Activity
1	ALLOW drainage tile crossings of pipelines for draining lands for agricultural purposes.
2	VERIFY that parallel drain headers are no closer than 20 ft. from the pipeline, unless previously approved by the Operations Manager.
3	VERIFY crossing is at or near right angles.

7.6.9 Dredging

For dredging operations, follow the procedure below.



WARNING: Stop any dredging operations near the pipelines immediately.

Step	Activity
1	NOTIFY the Right-Of-Way Representative and Operations Manager of dredging operations.
2	PROFILE waterways that cross pipeline where dredging is to be done.



CAUTION: Do not allow dredging to occur any closer than 6 ft. above and 10 ft. from each side of the pipeline.

Step	Activity
3	VERIFY a company representative is present during dredging operations.
4	REFER to <i>Section 7.6.2 Blasting</i> if blasting is to occur in conjunction with dredging.

7.6.10 Driveways (Residential)

For residential driveways follow the procedure below.

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Step	Activity
1	ALLOW driveways to cross pipeline at or near right angles.



NOTE: Hard surfaced driveways may parallel the pipeline, but are not normally within the easement.

Step	Activity
2	If a driveway is constructed of material other than asphalt, VERIFY that breaks are installed.
3	VERIFY that there is adequate working space on one side of the pipeline.
4	CONTACT Operations Manager for required depth at driveway crossings. Actual cover requirements may be determined by performing load calculations.
5	ADD cover, if necessary.



NOTE:

- Depth of cover should not exceed 7 ft. from the top of the pipe to final grade.
- If cover is expected to exceed 7 ft., contact Operations Manager and refer to Section 7.6.12 Equipment.

7.6.11 Earthwork (Berms)

For earthwork or berms follow the procedure below.

Step	Activity
1	DISCOURAGE earthwork within the easement unless approved by Operations Manager.
2	CONTACT a company Right-Of-Way Representative while the earthwork is still in the planning stage.
3	If earthmoving equipment is used, MAKE load calculations by Pipeline Integrity Engineer on the line to determine the combined stresses on the pipeline.
4	VERIFY that the remaining cover is at least 36 inches. ADD cover, if necessary.

7.6.12 Equipment (Hauling, Logging Earthmoving, Dozing, etc.)

Follow *SOP HLI.27 Determination of Abnormal Loading*

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7.6.13 Fences

For fences, follow the procedure below.

Step	Activity
1	ALLOW wire type fences, for agricultural purposes, to cross the right-of-way.
2	VERIFY that gates or walkovers are provided.
3	ALLOW stockade, decorative, or similar fences that can be easily removed and replaced to cross the pipeline at or near right angles.



CAUTION: Do not allow installation of stone, brick concrete, privacy, or similar fences or barriers. These may be placed parallel to the pipeline but not in the right-of-way confines.



NOTE: Fences should be no closer than 25 feet from the pipeline if they are parallel or nearly parallel to the pipeline.

7.6.14 Fiber Optics

For fiber optic cable, apply the following process as well as standard provisions for foreign line crossings.

Step	Task
1	VERIFY the fiber optic cable crosses the pipeline, when possible, at no less than 12 inches below the bottom of the existing pipeline. When the pipeline is unreasonably deep, fiber optic cable may cross over the pipeline.



CAUTION: Extra precautions are necessary when fiber optic communication lines cross the pipeline because of the potential liability of damaging one of these highly valuable lines.

Step	Activity
2	VERIFY the fiber optic cable is placed in a rigid non-metallic conduit with bags of concrete-mix placed directly above and below the conduit across the confines of the easement.
3	VERIFY that the contractor or owner of the cable has placed orange warning burial tape, the width of the right-of-way, at least 18 inches directly above the cable.
4	VERIFY that the contractor or owner of the cable has marked the crossing route clearly and permanently on each side of the easement.
5	REQUEST that the communication company mark both sides of the right-of-way with permanent identification.
6	SEND a letter to the communication company if it has refused to comply with the above guidelines, stating that due to their failure to comply with cable crossing standards, the company will not be responsible for damages due to

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Step	Activity
	maintenance work performed on the company pipeline easements.

**7.6.15
Guys and
Anchors**

For guys and anchors, follow the procedure below.



CAUTION: Do not allow a guy or anchor or portion thereof to be within the right-of-way confines.

Step	Activity
1	VERIFY that the encroaching third party place the guy wires across the pipeline only if there is a minimum overhead clearance of 25 feet at any point within the right-of-way.
2	CONTACT Corrosion Specialist for consideration of potential cathodic interference and all electrical crossings. REFER to <i>Section 7.6.39 Tower, Communication</i> .

**7.6.16
Irrigation Lines**

For irrigation lines, follow the procedure below.

Step	Activity
1	ALLOW irrigation line crossings of pipelines in subdivisions.
2	VERIFY that parallel irrigation lines are not within the easement.
3	VERIFY crossing is at or near right angles.

**7.6.17
Landfills**

Do not allow landfills, ash disposal, junk, garbage, or rubbish on the right-of-way.

**7.6.18
Material and/or
Equipment
Storage**

Do not allow any storage, temporary or permanent, on the right-of-way.

The Operations Manager approves proposed parking or temporary storage area plans.

**7.6.19
Mines**

For mining or quarrying, follow the procedure below.

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CAUTION: Do not allow surface mining or quarrying on the right-of-way.



NOTE: Consult Right-of-Way Representative to determine mineral rights versus easement rights.

Step	Activity
1	NOTIFY the Right-of-Way Representative immediately with proposals to mine or quarry near a pipeline. .
2	CONSULT Right-of-Way Representative and Director Pipeline Integrity for subsurface mining.
3	REFER to <i>SOP HLI.26 Mining Subsidence and Soil Slippage</i> .

7.6.20 Parking Areas

For parking areas, follow the procedure below.

Step	Activity
1	CONTACT the Right-of-Way Representative immediately when learning of plans for parking areas.
2	DISCOURAGE and/or minimize parking areas on the right-of-way.
3	CONSULT with Engineering Department to determine what level of pipeline protection is needed.
4	EXECUTE a signed, written agreement before any parking shall be allowed within the pipeline easement.
5	REPORT increases or decreases in existing parking area size to Right-of-Way Representative.

7.6.21 Pipelines (Onshore)

For onshore pipelines, Operations Personnel follows the procedure below.

Step	Activity
1	DETERMINE how the excavation of a foreign line crossing shall be made and by whom.
2	MARK the pipeline location before the crossing activity starts.
3	PERFORM corrosion related requirements before and during crossings as required.



NOTE: Operations Personnel must consult the Company Corrosion Specialist when a cathodically protected line is installed across a company pipeline to determine the need for installation of test lead stations on both the foreign facility and the company line.

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Step	Activity
4	REMAIN on-site, or VERIFY a company representative is present, during the installation of a foreign pipeline crossing and EVALUATE conditions to determine if cathodic protection test leads are to be installed.
5	OBSERVE the installation of a foreign pipeline crossing.



NOTE: It is the company's prerogative to uncover and dig around the company's pipelines, if necessary, before the foreign pipeline crossing begins.

Step	Activity
6	VERIFY that a proposed foreign pipeline that will cross the company's pipeline shall have a clearance equal to 12 inches, or greater. It should cross at or near right angles to and under the pipeline. COMPLETE and submit the applicable form(s) for <i>Foreign Line Crossing</i> or enter in the applicable electronic database.



CAUTION:

- Do not allow foreign structures, appurtenances, or related fittings in the right-of-way confines.
- Do not allow any foreign pipeline to be constructed parallel within the defined right-of-way.

Step	Activity
7	VERIFY that the third party approaches the Company's pipeline so that the pipeline is exposed a minimum length of time.
8	VERIFY that the third party uses bridging or matting when necessary to prevent damage to company pipelines by use of heavy construction equipment.



NOTE: The Operations Manager determines the type of bridging or matting to be used.

Step	Activity
9	REINFORCE couplings when exposed during crossings or other excavation activities.
10	If the normal crossing requirements present undue difficulties, CONTACT Operations Manager to consider the third party's proposal to cross over the pipeline with a minimum clearance of 12 inches.
11	PLACE a yellow warning tape a minimum of 18 inches above the foreign pipeline.
12	REQUIRE third party to install line markers on both sides of the right-of-way, when feasible.

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7.6.22

Poles

Do not allow any poles within the right-of-way easement, including:

- Signboards
- Supports
- Brace poles
- Telephone poles
- Power line poles

Poles may be allowed for company purposes at the discretion of Director of Operations.

7.6.23

Power Lines (Aboveground)

For above ground power lines follow the procedure below.

Step	Activity
1	ALLOW power lines to cross over the pipelines. The power lines must have a minimum vertical overhead clearance to grade of 25 feet.



CAUTION: Do not allow an overhead power line parallel within the right-of-way confines. Overhead power lines should cross as near to perpendicular as possible.

Step	Activity
2	REPORT to Operations Manager and Corrosion Specialist, the construction of any power line that substantially parallels the pipeline and is within 300 feet of the pipeline or the construction of a power line that crosses a pipeline at less than right angles.



CAUTION:

- Do not locate new power lines over existing blow-offs or relief valves.
- Do not allow towers to straddle the company pipeline right-of-way.
- Do not allow footing to encroach on the right-of-way.

7.6.24

Power Lines (Underground)

For underground power lines, follow the procedure below.

Step	Activity
1	REFER requests for the installation of buried electric cable crossings to Operations Manager, Right-of-Way Representative, and Corrosion Specialist, who will establish the requirements for each crossing location.
2	DETERMINE the crossing requirements for each location on a case by case basis.
3	ESTABLISH the requirements with consideration given to the number of cables, voltage, line loading, grounding system, spacing of cables, phase

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Step	Activity
	relationship of cables, and geometric relationship and proximity of transmission cable and load facilities to the pipeline; as well as depth of the pipeline, location of cathodic protection facilities, type of soil, and status of pipeline coating.
4	If cables are over 600 volts, VERIFY that the buried depth of the cable is at an elevation that is at least 36 inches below the bottom of the pipeline and remains at that elevation for the entire width of the right-of-way.
5	VERIFY the cable neutrals are externally, spirally wound and grounded on each side of the right-of-way.
6	VERIFY that the requesting party places the power line cable in a non-metallic rigid conduit with bags of concrete-mix placed directly above and below the conduit across the confines of the easement (25 feet on either side of the pipeline on open easements).
7	VERIFY that the requesting party places red warning burial tape at least 18 inches directly above the cable.
8	VERIFY that the requesting party marks the crossing route clearly and permanently on each side of the easement.
9	CONSULT Corrosion Specialist regarding the installation of test leads on both the foreign line and the company line when a cathodically protected cable is installed across a company pipeline.

7.6.25 Roads (Proposed and Existing) and Alleys

For proposed and existing roads and alleys, follow the procedure below.

Step	Activity
1	Upon notice of a proposed road crossing, VERIFY that Right-of-Way Representative and Operations Manager have reviewed the pipeline data to determine the physical status of the pipeline at the point that is affected.
2	Follow procedure HLI.27 Determination of Abnormal Loading



NOTE: Public road construction or modification plans must be approved by the Right of Way Representative and Director of Operations before construction to determine the possible need for pipeline alterations and to comply with Federal and State regulations.

Step	Activity
3	ALLOW roads to cross the pipeline at or near right angles.



NOTE: They may parallel the pipeline but cannot be on the right-of-way, except for special approved instances.

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Step	Activity
4	VERIFY the remaining cover at the shallowest point will be at least 36 inches.
5	BE PRESENT during the construction to observe that the pipelines are not damaged.

7.6.26 Seismography

For seismography activity, follow the procedure below.



CAUTION: Do not allow any seismographic activity within 300 feet of the pipeline without the approval of the Engineering Department.

Step	Activity
1	ADVISE the company performing the seismographic activity that they are responsible for any damage to the pipeline.
2	RECOMMEND that the seismic company call the respective One-Call center at least 48 hours prior to the start of their project.

7.6.27 Septic Systems (Residential)

Verify that all sewer lines, septic lines, or “finger systems”, crossing a pipeline are made of solid, impervious material extending the width of the right-of-way.



CAUTION:

- Do not allow septic tanks on the right-of-way.
- Do not place “finger systems” or leach beds in the right-of-way confines.



NOTE: A septic line or sewer line may be placed substantially parallel but not within the right-of-way limits.

7.6.28 Sidewalks

For sidewalks, follow the procedure below.

Step	Activity
1	VERIFY the sidewalks do not exceed 48 inches in width without approval from Operations Manager.
2	PLACE the sidewalks parallel but not within ten (10) feet of the pipeline.
3	CONSTRUCT all sidewalks within the confines of the right-of-way at the property owner’s expense and risk.



CAUTION: Do not make payments for sidewalks damaged due to operation and maintenance of the pipeline without checking the easement obligations.

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NOTE: Refer to the easement to determine if payment of the repair is at the company's expense.

**7.6.29
Signboards
(Public)**

Do not allow signboards to be placed in the right-of-way confines.

**7.6.30
Storm Drains
(Sewers)**

For storm drains and sewers, follow the procedure below.

Step	Activity
1	DETERMINE how the excavation of the crossing is made and by whom to assure the safety and integrity of the company facility.
2	BE PRESENT to OBSERVE the installation of a foreign storm drain pipeline crossing.
3	EVALUATE conditions and determine whether cathodic protection test leads should be installed. CONSULT Corrosion Specialist.
4	HAVE the third party construct the proposed system crossing the pipeline with a minimum clearance equal to 12 inches.
5	HAVE the crossing intersect at or near right angles to and under the pipelines.



CAUTION: Do not allow foreign structures, appurtenances, or related fittings in the right-of-way confines.

Step	Activity
6	VERIFY that approaches to the pipeline are made so that the pipeline is exposed a minimum length of time.
7	VERIFY that appropriate shoring or cribbing is used to prevent ditch cave-ins, if any company personnel must enter the ditch.
8	VERIFY that bridging or matting is used over the pipeline to prevent damage caused by the use of heavy construction equipment.



NOTE: Engineering Department specifies the type of bridging or matting to be used.

Step	Activity
9	If the normal crossing requirements present undue difficulties, CONTACT Operations Manager to consider the third party's proposal to cross over the pipeline with a minimum clearance of 12 inches.
10	PLACE green warning tape a minimum of 18 inches above the storm drain.

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**7.6.31
Structures**

Do not allow a structure with underground supports, foundations, or anchors to be erected within, above, or below the pipeline easement

Small, easily moveable structures that could be moved by two men without the use of mechanical equipment may be allowed at the discretion of Area Management.

The following types of storage tanks are considered permanent structures and should not be placed within the right-of-way:

- Butane
- Propane
- Oil
- Liquids
- Petroleum products
- Agricultural
- Other chemical

Complete the applicable form(s) for *Encroachment, Foreign Line Crossing, and Class Location HCA Report*. For any inhabited structure within 660 feet of a pipeline

**7.6.32
Swimming
Pools**

Do not allow installation of any above or below ground swimming pools on the right-of-way.

**7.6.33
Subdivisions**

Verify the developer supplies subdivision plats and submit to the Right-of Way department and Operations Manager for review and approval.

**7.6.34
Telephone
Lines
(Overhead)**

Allow telephone lines to cross the pipeline at or near right angles if overhead (vertical) clearance with the right-of-way boundaries is at least 25 feet.



CAUTION:

- Do not allow poles, H-frame structures, guy wires, or foundations within the right-of-way confines.
- Do not allow overhead telephone lines or communications lines, including TV cable lines, to be constructed parallel to the pipeline within the right-of-way confines.
- Do not allow overhead telephone lines to be installed over blow-off stacks or relief valves under any circumstances.

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**7.6.35
Telephone
Lines
(Underground)**

For underground telephone lines, follow the procedure below.

Step	Activity
1	BE PRESENT to OBSERVE the installation of the crossing.
2	EVALUATE conditions and determine if cathodic protection test leads are to be installed. CONSULT Corrosion Specialist.
3	MARK the pipeline location before the crossing activity starts.
4	VERIFY that third parties install communication lines, including TV cable lines, under the pipeline with a minimum clearance of 12 inches.
5	If it is impractical to install the line under the pipeline or splicing the line would be required to cross under the pipeline, ALLOW the third party to install the line above the pipeline with a minimum 12 inches clearance.
6	If the line is installed above the pipeline, REQUIRE the third party to encase the line in a non-metallic rigid conduit across the confines of the easement (25 feet on either side of the pipeline on open easements).
7	VERIFY that third parties mark the above mentioned line with orange warning tape at least 18 inches above the telephone line.
8	VERIFY that lines and cables cross the pipeline at or near right angles.



CAUTION: Do not install line or cable substantially parallel and within the right-of-way confines.

**7.6.36
Tennis Courts**

Do not allow construction of tennis courts on the right-of-way.

**7.6.37
Terraces**

For terraces, follow the procedure below.

Step	Activity
1	COOPERATE with landowners who propose to terrace land as an effort to control erosion, as much as possible.
2	If it is necessary to remove cover within the right-of-way confines, VERIFY the remaining cover is a minimum of 36 inches.
3	OBTAIN plans for terracing or cover removal.



NOTE: Plans are often available through the Consolidated Farm Service Agency (CFSA) or Soil Conservation Service (SCS).

Step	Activity
4	SEND these plans to the Right-of-Way Representative and Operations

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	Manager for review.
5	PERMIT cover to be removed only after the entire project is reviewed and found acceptable by the Right-of-Way Representative and Operations Manager.

**7.6.38
Tower,
Communica-
tion**

For communication tower, follow the procedure below.



CAUTION: Do not allow microwave or communications towers within the right-of-way confines.

Step	Activity
1	NOTIFY the Right-of-Way Representative and Corrosion Specialist of any plans to locate a tower owned by others within one mile of company microwave towers.
2	NOTIFY Aerial Patrol Pilots of the location of any new tower.

**7.6.39
Tower,
Power Lines**

Do not allow any power line towers, leg foundations, guy anchors, or any portion thereof within the right-of-way confines.

**7.6.40
Trailers,
Campgrounds**

For trailers and campgrounds follow the procedure below.



CAUTION: Do not allow trailers on right-of-way confines.

Step	Activity
1	REPORT any area near the pipeline being used or prepared for a camping site or for parking camping trailers, mobile homes, motor homes or other vehicles to the company Right-of-Way Representative.
2	REPORT increases or decreases in trailers or population.
3	MONITOR these sites to ascertain if any mobile residences become permanent.
4	COMPLETE the applicable form(s) for <i>Encroachment, Foreign Line Crossing, and Class Location HCA Report</i> , if any mobile residences become permanent.

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7.6.41 Trailers, House House trailers or Manufactured Housing structures are considered permanent structures. Refer to *Section 7.6.32 Structures*.

7.6.42 Trees Verify there is a clear corridor of no less than 15 feet between the projected drip lines of mature crop trees along the right-of-way.



CAUTION: Do not allow planting of any trees on the right-of-way that are classified as “deep rooted” or are projected to exceed an eventual growth height of four (4) feet.

7.6.43 Utility Buildings For utility buildings, refer to *Section 7.6.32 Structures*.

7.6.44 Water Impoundments For water impoundments, follow the procedure below.



CAUTION:

- Do not allow water impoundments on the right-of-way. This excludes water impoundments for such things as rice, cranberry bogs, and crawfish farming.
- Do not allow any portion of any dike, berm, or dam to be constructed on the right-of-way.
- Do not remove cover or overburden from the right-of-way in the construction of the dike, berm, or dam.

Step	Activity
1	PERMIT excavation and/or earthmoving equipment to cross the right-of-way provided that load calculations (due to the weight of the equipment on the pipeline) are made and found acceptable by Engineering Department.
2	USE matting or bridging to protect the line when external loads are considered to be excessive as directed by Engineering Department.*

7.6.45 Waterways For waterways, follow the procedure below.

Step	Activity
1	Immediately REPORT proposals to place waterways across the pipeline to the Right-of-Way Representative and Operations Manager.
2	DISCOURAGE waterways on the right-of-way.
3	If it is necessary to place a waterway across the pipeline, VERIFY that it crosses at or near right angles with at least 36 inches of cover remaining at the

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	lowest point of the waterway.
4	EVALUATE the pipeline for buoyancy and the need for river weights.
5	NOTIFY Operations Manager if the cover is less than 36 inches at any point.

7.6.46 Wells

For wells, follow the procedure below.

Step	Activity
1	REPORT wells drilled within 100 feet of the pipeline or facility to Corrosion Specialist.



CAUTION: Do not allow any wells (water, oil, gas, storage, disposal or other) to be drilled on the right-of-way confines.

Step	Activity
2	NOTIFY property owners of the company's cathodic protection and possible problems with their well.

7.7 Construction Near Company Pipelines

Perform these procedures when a pipeline is excavated by a contractor or other party.

Operations Personnel witnessing third party excavation or entering third party excavation refer to *SOP HLI.10 Excavation and Backfill* for safe excavation practices.

7.7.1 Locating the Pipeline

For locating the pipeline, perform the procedures outlined in *SOP HLB.04 Pipe Location and Marking*.

7.7.2 Backhoe Excavation and Backfill

For backhoe excavation, Operations Personnel follows the procedure below.

Step	Activity
1	REFER to <i>SOP HLI.10 Excavation and Backfill</i> .

7.8 Directionally Drilled Crossings

For directionally drilled crossings, Operations Personnel follows the procedures below.

Step	Activity
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Step	Activity
1	MEET with the boring contractor on site and review each party's responsibilities.
2	DETERMINE the depth of each pipeline within the work area at appropriate intervals. VERIFY the depth by probing.
3	DETERMINE if there are other buried facilities within the confines of the pipeline right-of-way.
4	LOCATE and STAKE the pipeline centerline(s) and the right-of-way boundaries.
5	VERIFY the boring contractor provides a sketch of the pipelines including the proposed location of the bored crossing.
6	REQUIRE a minimum 5-foot separation between company pipelines and the foreign line across the entire right-of-way if company pipelines can be exposed at the point of crossing to observe that the drilling and pulling process has not damaged it.



NOTE: These excavations are called potholes and must be deep enough to monitor the bottom of the pipe.

Step	Activity
7	If it is not practical to expose the company pipelines, CONTACT the Operations Manager. DETERMINE alternatives to assuring that the pipelines are not damaged by the drilling and pulling process.



NOTE: Alternatives include: Requiring a minimum 15-foot separation between company pipelines and the foreign line across the entire right-of-way Altering the point of crossing so that company pipelines can be exposed

Step	Activity
8	DETERMINE if the boring contractor maintains returns.



NOTE: Returns are the bentonite-containing drilling fluids that are usually brought back to the drilling machine and recycled. If fluids are not returned or recycled, it is possible that they could be lost into the earth, creating a cavity or other unstable foundation underneath the pipelines. This would be evident by a noticeable increase in the amount of drilling fluids being used.

Step	Activity
9	EXCAVATE the pipeline at the point of the proposed crossing on the side of the pipe that the drilling activity is coming from to determine that the drilling and installation process has not damaged the pipelines. MAKE several excavations, or potholes, if the boring is to be made parallel to the pipelines.
10	VERIFY that the boring machine anchorage and deadman locations do not interfere with the safe operation of the pipeline(s).
11	MONITOR that the boring equipment is calibrated and gives actual depth

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	and pitch readings.
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NOTE:

- On some machines, this can be accomplished beforehand by placing the drilling head on the ground and moving the locator a known distance away i.e., 10 ft.
- The measurements should be within a few inches.
- Perform a recalibration whenever batteries are replaced.
- If the locator cannot be calibrated within inches, then excavate the pipeline(s) at the point of crossing to verify no damage has occurred.

Step	Activity
12	VERIFY that the clearances between the bore and the pipeline(s) also account for the size of the back reamer and the straightening of the bore rods.
13	COMPLETE the applicable form(s) for <i>Encroachment, Foreign Line Crossing, and Class Location HCA Report</i> and ATTACH a copy of the sketch of the crossing, if available.



NOTE: The contractor normally provides an as-built sketch of the crossing showing the bored pipeline and company facilities.

**7.9
Legal Action**

If the encroachment activities persist with the potential to damage the pipeline or to violate the rights of the company, follow the procedures in this section to take legal action, if necessary.

**7.9.1
Contacting a
Local Attorney**

The Right-of-Way Representative follows the procedure below to contact a local attorney.

Step	Activity
1	DISCUSS the situation with Legal Department to determine if it is necessary to contact a local attorney to represent the company.
2	CONTACT a local attorney, if necessary.
3	INSTRUCT the attorney to contact the landowner's attorney or draft a letter to be sent to the landowner. TELEPHONE the parties involved concerning the company's position and the requirements for pipeline operation and maintenance.
4	VERIFY the local attorney verifies the same in writing and gives copies to the Director of Operations.

**7.9.2
Verifying the
Work Has
Stopped**

The Right of Way Representative performs the following procedure to verify the work has stopped.

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Step	Activity
1	CONTACT the company representative as soon as the previous action is completed to determine if the work has stopped.
2	If the work has not stopped, DETERMINE the status of the project and future plans of the parties performing the work.
3	RELAY this information immediately to Director of Operations

7.9.3 Taking Legal Action

The Right-of-Way Representative performs the following procedure to take legal action.

Step	Activity
1	If it is decided to take legal action and the action is considered to be of a normal legal nature, NOTIFY the company's attorney in the area by telephone to file for an injunction to stop work on the project.
2	DOCUMENT this action in writing.
3	MAIL copies of the correspondence to all the parties involved.
4	KEEP correspondence, written records, field notes (on staking, marking, and flagging the pipelines), and photographs (identified with dates, etc.) for use as evidence if litigation is required.
5	COMPLETE the applicable form(s) for <i>Encroachment, Foreign Line Crossing, and Class Location HCA Report</i> .

8.0 Documentation Requirements

Record data in electronic database or utilize the following form(s) as applicable:

- Pipeline Inspection Database
- B.13.A Encroachment, Foreign Line Crossing, and Class Location HCA Report.
- B.04.A Encroachment Observation Report

9.0 References

HLB.04 Pipe Location and Marking
HLI.10 Excavation and Backfill
HLI.23 Protection of Pipeline Facilities from Blasting Operations
HLI.26 Mining Subsidence and Soil Slippage
HLI.27 Determination of Abnormal Loading
HLI.36 Pipeline Road and Rail Crossings (Best Practice)
HLI.40 Public Awareness Plan – Communication with API RP1162-defined Stakeholders

Appendix A: OQ Task Requirements

The table below identifies Operator Qualification (OQ) task requirements.

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Task Description	OQ Task
Visual Inspection of Buried Pipe and Components When Exposed	PLOQ401
Backfilling – Pipe and Coating Protection	PLOQ404
Underground Pipeline – Locate and Temporarily Mark	PLOQ605
Damage Prevention During Excavation/Encroachment Activities	PLOQ607

Appendix B: The Right-of-Way Representative presents the following when initiating contact for a
Request for right-of-way encroachment.
Right-of-Way
Encroachment

Dear property owner:

Re: Requests for right-of-way encroachment

Company owns and operates hazardous liquid pipelines. These pipelines are a vital link in the energy network. It is imperative that these lines be protected. Therefore, any encroachment onto the easement area is a serious matter that must be reviewed carefully by the company and permitted in writing. In order to facilitate this review, it is necessary for you to submit the following information:

1. A copy of the signed encroachment report form. The form must include your name, address, phone number and fax number.
2. A copy of the deed, contract for deed, representative's deed, etc. (dependent upon how title is held by the current landowner.) This is needed to verify the legal owners and correct description of the property.
3. The case number assigned to your project by the local building inspector or planning and zoning officials.

Additional requirements for land developers:

4. Development plans or plats clearly depicting company's easement across the property.
5. Drawing depicting the encroachment in relation to company's pipeline and easement boundaries. The drawing must be on legal size (8.5" x 14") paper.

If the encroachment is permitted by company, an agreement will be drafted by the Right-of-Way Department. No encroachment into the easement area is allowed until the agreement has been signed. No verbal approvals of early construction will be given. Requests will be processed as quickly as possible.

These procedures have been enacted for the safety and protection of all who live and work around the pipeline. Thank you for your cooperation.

"Safety in Every Decision: Believed, Practiced, Promoted...Uncompromised."

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Sincerely,

Right-of-Way Department

Appendix C: The following applies during Third Party Construction Activities:
**Engineering
and
Construction
Specifications**

1. Owner shall provide a minimum of forty-eight (48) hours notice to company, prior to any installation, construction, excavation, or demolition work on the easement area, and to ensure further safety owner shall also call appropriate ONE CALL for a locate. A company representative must be present when any work is done on the easement area. The onsite company representative will have the authority to shutdown work by the contractor if the contractor's activities are judged to be unsafe by the company representative. The company representative will be invited to participate in contractor's safety meetings. This provision applies each time the company's pipeline facilities are crossed.
2. Normal ground cover (a minimum of three feet [3'] of pipeline cover) is to be maintained over the subsurface pipeline facilities within the easement area. Three feet (3') of minimum cover will also be required over the pipeline facilities at all equipment crossings for standard FDOT maximum axle load vehicles (20,000 lbs. per axle).
3. For vehicles and/or construction equipment requesting approval to cross a company facility, each crossing location will be reviewed on a case-by-case, site specific basis, which will include the execution of a wheel load calculation to be completed and approved on every vehicle and/or construction equipment attempting to cross a company facility. On occasion, matting or other suitable material will be requested to be installed so to achieve the necessary support for such crossing. This too will be site specific and case-by-case only.
4. Where consent for roadway crossings has been granted, a minimum of forty-eight inches (48") of cover, including thirty-six (36") of undisturbed or compacted soil, shall be maintained within the easement area.
5. Where the encroachment includes for utilities, all such utilities crossing the easement area must have a minimum separation of eighteen inches (18") between the utility and company pipeline(s) at the point of crossing and must cross at a 90° angle. No utilities shall be constructed above the easement area or between the surface of the easement area and the top of the subsurface pipeline facilities. No parallel utilities are permitted within the easement area.
6. Where consent for utility lines has been granted, electric lines must be encased in steel throughout the easement area; fiber optic, telephone and cable television lines must be encased in PVC

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throughout the easement area. Cables energized to 600 volts or more should cross a minimum of three feet (3') below the subsurface pipeline facilities, be encased in concrete, color coded red, across the entire right-of-way width, and have external, spiral wound, neutrals grounded on each side of the right-of-way. The cable crossing should be clearly and permanently marked on each side of the right-of-way where permissible.

7. Where consent for fencing has been granted, the owners must install and maintain a vehicle access gate at least twelve feet (12') in width at each point in the fence line(s) crossing the Easement area. Posthole excavations for fencing placed on the easement area shall not be greater than eighteen inches (18") below the ground surface elevation. No fence posts shall be placed over the pipeline facilities or closer than five feet (5') on either side of the pipeline facilities. Any such fence shall be constructed and maintained by owner in such a manner that does not prevent company personnel from viewing the easement area from the ground level through the fence(s) (i.e. no solid fences allowed). No fencing parallel to the company pipeline facilities will be allowed within the easement area. Company access to its pipeline facilities shall be maintained by owner. If the gate is locked with owner's lock, owner shall provide company with keys or allow a company lock to enable access.
8. No above or below ground utility appurtenances, junction boxes or retention ponds shall be allowed within the easement area.
9. No roto-mixing or vibrating machinery is allowed within the easement area.
10. All pile driving operations within 20' of a company pipeline and or facility or adjacent to a company easement will be required to pre-drill or auger all pilings to 3' below the bottom elevation of the pipeline(s).
11. Ditches shall be sloped or shoring will be used to allow entry into the excavation. Time will be allowed for company representative to inspect and make coating repairs as the subsurface pipeline facilities are exposed.
12. Twelve inches (12") of backfill around the subsurface pipeline facilities shall be sand or clean fill; free of rocks and debris. Rock Shield may be installed around pipeline facilities.
13. No more than twenty feet (20') of pipe shall be exposed at any given time; if more than twenty feet (20') of pipe is to be exposed, engineering stress calculations must be performed by company engineering and approved by company operations prior to allowing any more than the twenty feet (20') of exposed pipe.
14. Excavators shall be equipped with toothless buckets when digging or excavating within 3 feet of the pipeline facilities. All mechanical excavation performed within 3 feet of the pipeline will be performed parallel to the pipeline (i.e. track-hoe can not reach over the pipeline to dig on the opposite side of the pipeline).
15. All excavation within 18" from the top or 36" from the side or bottom of the pipeline shall be by manual means. After top exposure, excavation up to 12" from the side or bottom of the exposed

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pipeline may proceed by mechanical means if company representative is satisfied it may be done safely with the equipment and operator available.

16. All metallic foreign line crossings shall have Micarta board placed between the company Pipeline facilities and the foreign crossing to prevent any interference with the cathodic protection system and equipment from the foreign crossing.
17. Barriers adequate to prevent vehicular damage to any exposed pipeline facilities shall be installed and maintained at all times.
18. Cathodic protection test lead wires shall be protected from damage by construction activity.
19. No installation, construction, excavation, or demolition work shall be performed within the easement area on weekends or holidays unless owner agrees to reimburse company for its cost, including overtime costs, associated with inspection during those periods.
20. The Developer or Contractor shall provide and install temporary construction fence along the easement boundaries for the entire length of the proposed work area to preserve and protect the pipeline(s). The fence must be maintained for the duration of the development or construction activity. Access across the company's easement will be granted at specific locations for vehicle and equipment traffic once a Wheel Load Calculation has been completed. Additional cover or matting may be required. Any changes to this requirement must be approved in writing by the Company prior to start of work.
21. Where consent for landscaping has been granted, owner shall not plant any trees and shrubs on the easement area which are classified as "deep rooted" or are projected to exceed an eventual growth height of four (4) feet. Trees and shrubs shall be planted so that no part, at its ultimate growth, shall be closer than ten feet (10') to the pipeline facilities.
22. These Engineering and Construction Specifications address activities on the easement area for which the company has not granted consent to owner to include as part of the encroachment. Notwithstanding anything to the contrary contained in these Engineering and Construction Specifications, the company consent is and shall be limited to the encroachment as described and limited by the Encroachment Agreement to which this Appendix is attached.

SIGNATURES:

OWNER (ENERGY TRANSFER)

OPERATOR REQUESTING CROSSING

Owner Representative

Authorized Operator Representative

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Title

Title

Date

Date



ENERGY TRANSFER

Right-of-Way Maintenance

Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

Code Reference:	Procedure No.: HLI.29	
49 CFR: 195.412, 195.410	Effective Date: 04/01/18	Page 1 of 6

1.0 Procedure Description This Standard Operating Procedure (SOP) establishes the requirements for maintenance of pipeline right-of-way as it pertains to clearing the Right-of-Way (ROW), providing erosion control remediation, maintenance of pipeline markers and test sites, restoring exposed or shallow pipelines, and maintaining access roads.

2.0 Scope This SOP describes activities involved in ROW maintenance and establishing priorities for these activities.

3.0 Applicability This SOP applies to regulated pipelines where ROW clearing or remediation is required.

4.0 Frequency As required: When performing ROW clearing or remediation.

5.0 Governance The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Operations Personnel	Operations Manager

6.0 Terms and Definitions For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

7.0 Right-of-Way Maintenance The following procedures are described in this section:

- Clearing the Right-of-Way
- Erosion Control Measures
- Maintaining Pipeline Markers and Test Sites
- Restoring Exposed or Shallow Pipelines
- Working with Landowners
- Identifying Unsafe Conditions
- Identify Potential for Damage Caused by Flooding
- Inspect Pipeline Facilities After Flooding has Occurred

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- Inspection and Protection of a Pipeline after a Railway Accident

7.1 Clearing the Right-of-Way

Operations Personnel perform the following steps to clear the right-of-way. Work with the Operations Manager to set up priority for ROW clearing activities.

Step	Activity
1	REVIEW the right-of-way periodically to verify sufficient visibility for proper inspection of the right-of-way by aerial and ground patrols. CONSIDER activities that will require someone to walk or transverse the pipeline, such as right-of-way inspections and construction. CHECK visibility at ditch line crossings along plowed fields to VERIFY that farmers can see line markers next to the field.
2	CONSIDER the soil stability, natural vegetation, and the adjacent area when deciding the clearing method to be used.
3	CUT the vegetation on the right-of-way using a bush-hog or other appropriate means.



NOTE: Other agencies or right-of-way agreements may stipulate time restrictions for maintenance activities.

Step	Activity
4	CONSIDER appropriate usage of ground-applied herbicide following mechanical cutting in those areas where woody brush exists.
5	NOTIFY landowners where applicable on clearing and mowing projects where herbicides are utilized.
6	USE the chemical MSDS and manufacturer's information brochure when making contact.



NOTE:

- Chemicals requiring a license shall be handled only by licensed applicator and must be on the company's approved chemicals list.
- Aerial spray is prohibited.

Step	Activity
7	TRIM the vegetation at fence and road crossings neatly to a uniform level, at minimum around the line marker so that the pipeline markers are visible from the edge of the road.
8	PAINT all fence posts within the right-of-way appropriately in accordance with <i>SOP HLI.12 Pipeline Facilities Identification</i> , at the discretion of company Area Management.
9	Before demobilizing from the area, properly DISPOSE of trees and other vegetation cleared from the right-of-way.

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Step	Activity
10	CUT tree stumps which are adjacent to roads and other areas of public view to ground level or REMOVE them for disposal.



CAUTION: Do not burn brush debris directly over the pipelines.

7.2 Erosion Control Measures

Operations Personnel perform the following activities as appropriate to help control erosion on the pipeline right-of-way.

Step	Activity
1	AVOID clearing the right-of-way of surface vegetation and topsoil. If this does occur, RESTORE and STABILIZE the surface.
2	CONSTRUCT terraces and other erosion control devices where necessary to prevent soil erosion on sloped section of the right-of-way.
3	REPAIR existing erosion sites as soon as practical after discovery.
4	If right-of-way vegetation has been damaged by natural causes and a potential for erosion exists, SEED or PERFORM other measures.
5	STABILIZE stream banks as necessary to prevent erosion where rights-of-way cross streams and other bodies of water.
6	CONDUCT installation on the right-of-way in such a manner as to minimize damage to shorelines, recreational areas, and fish and wildlife habitats.
7	PLACE pipeline markers above each pipeline on both sides of any navigable body of water in accordance with <i>SOP HLI.12 Pipeline Facilities Identification</i> .

7.3 Maintaining Pipeline Markers and Test Sites

Operations Personnel perform the following procedure to maintain pipeline markers and test sites.

Step	Activity
1	INSPECT all pipeline identification markers for damage while performing right-of-way maintenance.
2	REPAIR markers if necessary.
3	PLACE or RESTORE pipeline markers in accordance with <i>SOP HLI.12 Pipeline Facilities Identification</i> .
4	INSPECT corrosion control test station for obvious damage.
5	REPORT damage to the Operations Personnel.
6	DOCUMENT conditions needing attention on Inspection Report or

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Step	Activity
	Maintenance Record

**7.4
Exposed or
Shallow
Pipelines**

Operations Personnel report all shallow and exposed pipelines to Operations Manager for inclusion into the Shallow Cover Database. Refer to *SOP HLI.24 Management of Depth of Cover and Evaluation* for remediation/mitigation of shallow or exposed pipelines.

**7.5
Working with
Landowners**

Operations Personnel follow these steps for working with landowners.

Step	Activity
1	COORDINATE contacts with owners/tenants with right-of-way personnel where access problems exist.
2	DIRECT questions about the company's rights and agreements with owners and tenants to the right-of-way representative.
3	CONSULT Area Management and the Right-of-Way representative for any special reasonable considerations requested by the landowner regarding clearing or restoration activities.
4	COMPLETE the applicable form(s) for <i>Right-of-Way Damage Report</i> , if necessary.

**7.6
Identifying
Unsafe
Conditions**

Operations Personnel follow these steps to identify unsafe conditions.

**7.7
Identifying
Unsafe
Conditions**

Operations Personnel follow these steps to identify unsafe conditions.

Step	Activity
1	ADVISE Area Management of any condition that could endanger the pipeline or the public, such as exposed pipe, leaks, evidence of heavy vehicular crossings, landslides, etc.
2	ADVISE company Area Management immediately if the pipeline or the public is considered to be in danger.
3	EVALUATE the problem and DETERMINE the appropriate corrective

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	measures.
4	REFER to SOP <i>HLA.12 Safety Related Condition Reporting</i> and COMPLETE the applicable form(s) for <i>Discovery of Potential Safety Related Condition</i> , if necessary.

**7.8
Identify
Potential for
Damage
Caused by
Flooding**

Operations Personnel follow these steps to identify areas where potential damage to pipeline facilities could be caused by flooding.

Step	Activity
1	EVALUATE accessibility to valve settings
2	EXTEND regulator vents & relief stacks above flood level, as appropriate
3	COORDINATE with Emergency & Spill responders
4	COORDINATE with other pipeline operators and establish emergency response centers

**7.9
Inspect Pipeline
Facilities After
Flooding has
occurred**

Operations Personnel follow these steps to inspect a pipeline facility once the area has experienced flooding

Step	Activity
1	DEPLOY personnel so that they will be in position to respond to an emergency
2	DETERMINE if normally above ground facilities that have been submerged need to be MARKED with temporary buoys, as appropriate
3	PERFORM more frequent and/or additional patrols to EVALUATE changing right-of-way conditions during flooding and after flood waters subside. This should include evaluating any newly exposed pipelines as a result of erosion.
4	Depending on the severity of the flood, PERFORM surveys to evaluate depth of cover and the condition of any exposed pipelines. Use divers where necessary to EVALUATE pipelines normally underwater.
5	ENSURE that line markers are still in place and adequate, REPLACE markers in a timely manner.

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7.10

Inspection and Protection of a Pipeline after a Railway Accident

Following a railway accident, the potential exists for damage to adjacent pipeline facilities. In areas where pipeline facilities and the related right-of-ways are in the vicinity of a railway accident, Operations Personnel should work closely with rail operators, contractors and emergency response personnel during emergency response operations to protect pipelines from the movement of heavy equipment and inspect their facilities in a timely manner to ensure pipeline integrity. Operators should also reevaluate depth of cover and clearly mark location of pipeline facilities during remediation activities.

8.0

Documentation Requirements

Record data in electronic database or utilize the following form(s) as applicable:

- I.10.D Right-of-Way Damage Report
- A.12.B Discovery of Potential Safety Related Condition

The following table describes the documentation reporting requirements of this SOP.

Activity	Reporting
Acknowledge the requirements as outlined in the SOP have been completed. Record exceptions, if any, in the comments section.	Electronic Maintenance System Unplanned Pipeline Work Order or appropriate maintenance record; retain for the life of the facility.

9.0

References

HLA.12 Safety Related Condition Reporting
HLI.12 Pipeline Facilities Identification
HLI.24 Management of Depth of Cover and Evaluation

Appendix A: OQ Task Requirements

The table below identifies Operator Qualification (OQ) task requirements.

Task Description	OQ Task
Install and Maintain Pipeline Markers	PLOQ703

***Standard Operating Procedures****Applicable to Hazardous Liquids Pipelines and Related Facilities*

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**1.0
Purpose**

This Standard Operating Procedure (SOP) outlines the actions which need to be followed by company personnel to verify the integrity of the pipeline where mechanical damage is suspected. Mechanical Damage may be caused by First, Second, or Third Parties.

**2.0
Scope**

This SOP assists with the recognition, evaluation, and remediation of mechanical damage in order to protect the public and the serviceability of the pipeline. First party damage may occur when company employee(s) or equipment damage a company pipeline or facility. Second party damage may occur when the company's contractor or equipment causes damage to a company pipeline or facility. Third party damage may occur from the encroachment of construction or farm equipment, vehicular traffic, welding operations, nearby blasting, or other causes.

**3.0
Applicability**

This SOP applies but is not limited to pipelines where surveillance or other activities indicate the potential for mechanical damage. The damage may have been caused by First, Second or Third Parties.

**4.0
Frequency**

As required: As mechanical damage threats are identified.

**5.0
Governance**

The following table describes the responsibility, accountability, and authority for this SOP.

Function	Responsibility	Accountability	Authority
All Field Operations	Operations Personnel	Operations Manager	Director of Operations
Investigation of Mechanical Damage Event	Damage Prevention Group	Supervisor of Damage Prevention	Sr. Manager of Operations Services

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**6.0
Terms and
Definitions**

Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to *SOP HLI.01 Glossary and Acronyms*.

Terms	Definitions
First Party Damage	Damage to a pipeline facility inflicted by the company or equipment.
Mechanical Damage	A defect caused by impact of mechanical equipment such as a shovel, back hoe bucket, road grader blade, etc.
Second Party Damage	Damage to a pipeline facility inflicted by the company's contractor or equipment.
Third Party Damage	Damage to a pipeline facility inflicted by an external contractor or equipment.

**7.0
Third Party
Damage**

This SOP contains the following sections:

- Pipeline Surveillance
- Field Investigation of Mechanical Damage
- Notification
- Evaluation of Pipeline Damage
- Remediation of Pipeline Damage
- Investigation of Mechanical Damage Event

**7.1
Pipeline
Surveillance**

Operations Personnel perform the following steps to survey the pipeline for mechanical damage.

Step	Activity
1	SURVEY the pipeline according to <i>SOP HLI.21 Pipeline Surveillance</i> . USE additional information from <i>SOP HLI.24 Shallow Cover and Exposed Pipe Evaluation</i> to identify actual or potential Mechanical Damage.
2	If work is being performed by third parties within the right-of-way, REFER to <i>SOP HLI.28 Right-of-Way Encroachments</i> and DETERMINE the nature of the work and its potential to damage the pipeline.
3	INSPECT pipelines per <i>SOP HLI.28 Right-of-Way Encroachments</i> during excavation activities.
4	If nearby blasting has occurred that could reasonably affect the pipeline, CONDUCT and DOCUMENT a leak survey. REFER to <i>SOP HLI.23 Protection of Pipeline Facilities from Blasting Operations</i>

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**7.2
Field
Investigation of
Mechanical
Damage**

Operations Personnel investigate mechanical damage which is suspected from surveillance activities or where the mechanical equipment is still on site.

Step	Activity
1	If the mechanical equipment is still on site EVALUATE the need for immediate measures to protect the public and the equipment operator.
2	DETERMINE if One-Call notifications were made and if the pipeline was properly marked. If a One-Call Violation is suspected IMMEDIATELY complete and SEND the applicable form(s) for <i>One-Call Violation Report</i> . Report should be sent to the One Call and Damage Prevention Groups no later than 5 days after the event.
3	OBTAIN as much information as is known from the initial notification of damage so an assessment of the pipeline may begin.
4	INVESTIGATE suspected mechanical damage if evidence exists on the ROW such as disturbed earth that crosses the pipeline. Pictures are recommended.
5	CONSIDER in those cases either exposing the pipeline or conducting an above ground electrical survey which can detect coating damage. CONTACT the Corrosion Specialist for advice on the appropriate technique.



CAUTION:

- Impact damage caused by mechanical equipment can result in defect(s) which are unstable. Consider the need for an immediate pressure reduction prior to any other activity near the pipeline.
- Immediately notify the Area Management, Pipeline Integrity Group and Director of Regulatory Compliance for additional direction.

**7.3
Notification**

Operations Personnel use the following steps to notify agencies or other company departments about mechanical damage.

Step	Activity
1	If a safety-related condition or incident exists, REFER to <i>SOP HLA.04 Initial Reporting and Investigating Events</i> , <i>SOP HLA.12 Safety-Related Conditions</i> and <i>HLA.15 PHMSA / States Incident Reporting</i> to notify the applicable agencies.
2	REPORT to Area Management and the One Call Group instances of non-compliance with One-Call laws.
3	If an One-Call Violation occurred, the One Call Group will report the violation to the state agency, where applicable
4	If a failure has occurred, FOLLOW the requirements of <i>SOP HLA.04 Initial Reporting and Investigating Events</i> and <i>SOP HLA.11 Investigations of Failures</i> .

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**7.4
Evaluation of
Pipeline
Damage**

Operations Personnel evaluate any discovered damage per *SOP HLI.06 Evaluating Pipeline Defects*.

**7.5
Remediation of
Pipeline
Damage**

Operations Personnel remediate any damage that may affect the serviceability of the pipeline per *SOP HLI.05 Pipeline Repair*.

**7.6
Investigation of
Mechanical
Damage Event**

Damage Prevention Group uses the following steps to investigate mechanical damage events or near hits.

Step	Activity
1	If an One-Call Violation occurred, REVIEW the <i>One-Call Violation Report</i> for the details of the event and violation. If initiating event is not related to One Call, GATHER details from Operations.
2	If an One-Call Violation occurred, COMMUNICATE with violator detailing federal, state and company requirements for excavating on Company ROW.
3	PERFORM a root cause investigation per <i>SOP HLA.04 Initial Reporting and Investigating Events</i>
4	COMMUNICATE results of root cause investigation to Operations Management including any causal factors, root cause(s), lessons learned, recommendations, and corrective actions.
5	DOCUMENT results on Damage Prevention Root Cause Summary Report

**8.0
Documentation
Requirements**

Record data in electronic database or utilize the following form(s) as applicable:

- Pipe Inspection Database
- I.30.A One-Call Violation Report
- I.30.B Damage Prevention Root Cause Summary Report

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- 9.0**
References
- HLA.04 Initial Reporting and Investigating Events
 - HLA.11 Investigations of Failures
 - HLA.12 Safety-Related Condition Reporting
 - HLA.15 PHMSA / States Incident Reporting
 - HLA.29 Damage Prevention Plan
 - HLI.05 Pipeline Repair
 - HLI.06 Evaluating Damage to Pipelines
 - HLI.21 Inspection of ROW & Crossings Under Navigable Waters
 - HLI.23 Protection of Pipeline Facilities from Blasting Operations
 - HLI.24 Management of Depth of Cover and Evaluation
 - HLI.28 Right-of-Way Encroachments

Appendix A:
OQ Task
Requirements

The table below identifies the Operator Qualification (OQ) task requirements for this SOP.

Task Description	OQ Task
Visual Inspection of Buried Pipe and Components	PLOQ401
Measure and evaluate pipeline defects	PLOQ418A
Damage Prevention During Excavation / Encroachment Activities	PLOQ607

***Standard Operating Procedures****Applicable to Hazardous Liquids Pipelines and Related Facilities*

Code Reference :	Procedure No.: HLI.31	
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**1.0
Procedure
Description**

This Standard Operating Procedure (SOP) describes the guidelines to prepare for, manage, and respond to One-Call notifications.

**2.0
Scope**

This SOP establishes the requirements for One-Call notification and response, as well as utilization of the One-Call Program system.

In order to prevent damage to company facilities, the company participates in One-Call Systems and reacts proactively to One-Call System notifications for their pipelines per state and federal requirements.

**3.0
Applicability**

This SOP applies to the One-Call systems and company pipeline facilities in each state in which the company operates.

**4.0
Frequency**

As required: Respond to One-Call notifications and locate company pipeline facilities per state and federal requirements.

**5.0
Governance**

The following table describes the responsibility, accountability, and authority for this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Operations Manager	Director of Operations
Implement the One-Call Program	One Call Group	One-Call/Damage Prevention Manager	Sr. Manager of Operations Services

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**6.0
Terms and
Definitions**

Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

Terms	Definitions
American Public Works Association (APWA) color coding	WHITE - Proposed Excavation PINK - Temporary Survey Markings RED - Electric Power Lines, Cables, Conduit and Lighting Cables YELLOW - Gas, Oil, Steam, Petroleum or Gaseous Materials ORANGE - Communication, Alarm or Signal Lines, Cables or Conduit BLUE - Potable Water GREEN - Sewers and Drain Lines PURPLE - Reclaimed Water, Irrigation and Slurry Lines
One-Call Program	An electronic database application utilized to receive, respond to, and document One-Call activities.
One-Call System	An organization that allows any person, homeowner, professional, public, or private entity planning to excavate to place one phone call to notify all of the organization's member companies and organizations that are recorded as having underground company pipeline facilities in the area of intended excavation work. One-Call systems are required by state and federal regulation, which include a minimum time required for notification.
Excavation Activities	Any activity being conducted in the vicinity of company pipeline facilities where it is required to provide markings and inspection to prevent damage and maintain the integrity of company pipeline facilities.

**7.0
One-Call
System
Response**

Operations Personnel and One Call Group follow these procedures for One-Call system response:

- One-Call Program or Equipment
- One-Call System
- One-Call Response
- Delays of Start of Work
- Reporting

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7.1
One-Call
Program or
Equipment

Operations Personnel and One Call Group establish and maintain One-Call programs or equipment including (but not limited to):

- Telephones/smart phones or other types of communication equipment to receive and send information regarding the One-Call System.
- Electronic mapping programs or maps illustrating the pipeline location to assist in locating the proposed encroachment with respect to the pipeline
- Electronic locators and or probes used for detecting and accurately locating buried pipelines.
- Computers and software for electronic ticket management
- Appropriate database or filing system to maintain and follow up on One-Call notifications and documentation.

7.2
One-Call
System

One Call Personnel are responsible for running and maintaining the One-Call program.

Step	Activity
1	PROVIDE required company pipeline facility information for the One-Call System.
2	ESTABLISH and ASSIGN unique Call Directing Code (CDC) to areas.
3	VERIFY One-Call tickets receive a positive response where required.
4	IDENTIFY failed responses and respond accordingly.



NOTE: Most states require excavators as well as private landowners to provide 48 hour prior notification before any kind of digging occurs with power equipment, **except for Pennsylvania, which requires a 72 hour (3 business days) notification.**

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7.3 One-Call Response

Operations Personnel follow the steps below to respond to notifications in the One-Call Program.

Step	Activity
1	REVIEW a One-Call notification and RESPOND within the prescribed time limit per state requirements for the area by phone, electronic positive response, or other means of communication.



NOTE: The following are responsible for responding to One-Call Program notifications:

- During normal working hours - Operations Personnel
- After hours, weekends, and company holidays - Gas Control receives emergency One-Call notifications or phone calls.



WARNING: Emergency One-Call notifications shall be reviewed per state requirement using alignment sheets and appropriate maps or other methods available to locate lines.

Step	Activity
2	When responding to a One-Call system notification, USE the appropriate response. This includes, but is not limited to, the examples in Table 1 below.



NOTE: Table 1 only lists typical One-Call Program responses, additional responses are provided and used in states requiring a specific positive responses.

Table 1 Typical One-Call Systems

Response Type	Response Format
Under Investigation / Monitor	<i>Company name</i> is currently working on clearing this One-Call notice. Please wait for further instructions from a company representative. Monitor - <i>Company name</i> will require more information from the contractor in order to clarify. Please contact us.
Cleared No Conflict	Based on the information you provided the One-Call center, our <i>Company name</i> pipeline facility is cleared from the work area described on the One-Call center ticket.
Marked	Pipeline marked by two of three processes: painted , staked or flagged Monitor - Please contact us. A company representative must be present while work is being done.

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7.3.1 When the subject of the One-Call notification does not present a conflict with company
Call Response – pipeline facilities, Operations Personnel use the following procedure.
No Conflict

Step	Activity
1	SELECT NO CONFLICT in the response section of the One-Call Program and complete the ticket.
2	The One-Call Program will RESPOND to the entity placing the One-Call to confirm the company has received the One-Call notification and that there are no conflicts with company pipeline facilities.

7.3.2 When the subject of the One-Call notification does present a conflict with company
Call Response – pipeline facilities, Operations Personnel performs a site visit and locates the
Conflict underground company pipeline facility following the steps below.

Step	Activity
1	PLACE the ticket <i>IN PROGRESS / UNDER INVESTIGATION / MONITOR</i> in the One-Call program
2	REFERENCE the requirements per <i>HLI.28 Right-of-Way Encroachments</i>
3	DOCUMENT all contact with the One-Call initiator, including name, date, time, and a brief description of the conversation in the comment section of the One-Call ticket.
4	MARK the approximate location of underground company pipeline facilities per <i>HLB.04 Pipe Location and Marking</i> within the timeframes per state requirements.
5	MARK the approximate location of underground pipelines using American Public Works Association (APWA) color-coding by means of stakes, paint, flags, or a combination thereof.
6	VERIFY the viability of temporary pipeline markings for 14 days and refresh as required.
7	When required, INDICATE the nominal diameter of pipelines greater than 6 inches at every other mark.
8	VERIFY the distance between marks clearly define the route and changes in direction of underground pipeline and or comply with state requirements. Clearly INDICATE lateral connections at the point where the change in direction or connection occurs.



WARNING: If during the course of marking, a customer or non-marked foreign owned facility is discovered, make a reasonable effort to notify the One-Call initiator.

Step	Activity
9	If it is determined marking of the underground company pipeline facility is

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	not possible, CONTACT the Operations Manager. NOTIFY the One-Call initiator within 48 hours, via e-mail, phone or other verifiable electronic method, no excavation is to take place until company on-site assistance is provided.
10	CONTACT the One-Call initiator to confirm the start time of the excavation in order to have a company representative present.
11	DETERMINE if underground company pipeline facilities may be damaged by excavation activities. COMPLETE inspections as frequently as necessary during and after the activities to verify the integrity of the company pipeline facilities.
12	PROVIDE information to the Damage Prevention department for reporting to appropriate Regulatory Agency(s), all damages to Company's pipeline facilities within 5 days of actual knowledge of the damage incident.

7.4 Delays of Start of Work

When the subject of the One-Call notification presents a conflict, but work will not begin as stipulated on the One-Call notification, responsible Operations Personnel follow the steps below.

Step	Activity
1	SELECT UNDER INVESTIGATION / MONITOR in the response section of the One-Call Program when there is a conflict but work is delayed beyond the start date on the One-Call ticket.
2	MARK the approximate location of underground company pipeline facilities per <i>HLB.04 Pipe Location and Marking</i> within the timeframes per state requirements.
3	MAINTAIN communication and contact with One-Call initiator to confirm the start time of the excavation activities.
4	DOCUMENT all contact with the One-Call initiator, including name, date, time, and a brief description of the conversation in the comment section of the One-Call ticket.
5	DOCUMENT monitoring the site until the work begins in the comment section of the One-Call ticket.

7.5 Reporting

Operations Personnel use the process below to fulfill reporting requirements during One-Call system response.

Step	Task	Done By
1	Maintains the One-Call ticket lifecycle.	One Call Group
2	Completes the applicable form(s) and document in comment section of One-Call Program	Operations Personnel

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8.0 Record data in the electronic One-Call Program database
Documentation
Requirements

9.0 HLB.04 Pipe Location and Marking
References HLI.28 Right-of-Way Encroachments

Appendix A: The table below identifies the Operator Qualification (OQ) task requirements for this
OQ Task SOP.
Requirements

Task Description	OQ Task
Damage Prevention During Excavation / Encroachment Activities	PLOQ607
Underground Pipeline – Locate and Temporarily Mark	PLOQ605



ENERGY TRANSFER

Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

Use of Ultrasonic Thickness Equipment for Measurement of Wall Thickness

Code Reference :	Procedure No.: HLI.34
49 CFR: 195.585, 195.587	Effective Date: 03/01/14 Page 1 of 4

1.0 Purpose

This Standard Operating Procedure (SOP) describes the use of Ultrasonic Thickness (UT) Equipment to determine existing or remaining wall thickness measurements on pipeline facilities. The wall thickness measurement may be needed for but not limited to pipe wall thickness verification, lamination verification and dimensions, internal corrosion verification, and hot tap placement.

2.0 Scope

. This SOP details the use of ultrasonic thickness equipment for measurement of wall thickness of steel pipe, tanks, and structures.

3.0 Applicability

This SOP applies to all company facilities where a wall thickness measurement will be taken.

4.0 Frequency

As required: When wall thickness measurements are required.

5.0 Governance

The following table describes the responsibility, accountability, and authority of this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Operations Personnel	Operations Manager

6.0 Terms and Definitions

Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

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**7.0
Use of
Ultrasonic
Thickness
Equipment for
Measurement
of Wall
Thickness**

The following procedures are covered in this SOP:

- Operation of Ultrasonic Thickness Equipment
- Use of Wall Thickness Measurement

**7.1
Operation of
Ultrasonic
Thickness
Equipment**

Operations Personnel performing the function follow the instructional operating manual of the ultrasonic thickness equipment that they are using to perform the wall thickness measurement.

**7.2
Use of Wall
Thickness
Measurement**

Operations Personnel apply the wall thickness measurement to the uses as outlined below.

**7.2.1
Pipe Wall
Thickness
Verification**

Operations Personnel apply the following steps when the wall thickness measurement is used to verify pipe wall thickness.

Step	Activity
1	VERIFY calibration of the ultrasonic meter in accordance with manufacturer's procedures.
2	PREPARE pipeline for examination. Pipeline should be clear of coating and free of debris.
3	PERFORM and record thickness measurement readings to determine pipe wall thickness measurement verification.
4	DOCUMENT wall thickness measurements in the pipe inspection database.

**7.2.2
Lamination
Verification &
Dimensions**

Operations Personnel apply the following steps when the wall thickness measurement is used to verify and measure the dimensions of lamination in the pipe.

Step	Activity
1.	VERIFY calibration of the ultrasonic meter in accordance with

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Step	Activity
	manufacturer's procedures.
2.	PREPARE pipeline for examination. Pipeline should be clear of coating and free of debris.
3.	GRID pipeline and RECORD thickness measurement readings to determine the potential for lamination.
4.	EXPAND grid and CONTINUE to record thickness measurement readings until lamination dimension is determined. <i>SEE SOP HLI.06 Evaluating Pipeline Defects.</i>
5.	DOCUMENT ultrasonic readings and dimensions of the lamination in the pipe inspection database.

7.2.3
Internal
Corrosion
Verification

Operations Personnel apply the following steps when the wall thickness measurement is used to verify internal corrosion.

Step	Activity
1	VERIFY calibration of the ultrasonic meter in accordance with manufacturer's procedures.
2	PREPARE pipeline for examination. Pipeline should be clear of coating and free of debris.
3	GRID pipeline and RECORD thickness measurement readings to verify the presence of internal corrosion. REFER to <i>SOP HLD.35 Buried Pipe Inspection.</i>
4	DOCUMENT ultrasonic readings and dimensions of the internal corrosion in the pipe inspection database.

7.2.4
Hot Tap
Location

Operations Personnel apply the following steps when the wall thickness measurement is used for hot tap placement on the pipeline.

Step	Activity
1	VERIFY calibration of the ultrasonic meter in accordance with manufacturer's procedures.
2	PREPARE pipeline for examination. Pipeline should be clear of coating and free of debris.
3	PERFORM and RECORD thickness measurement readings to determine pipe wall thickness measurement verification and confirm no presence of lamination, internal corrosion, and longitudinal seam.

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NOTE: Amonium persulfate etching can be beneficial in conjunction with ultrasonic inspection to verify the location of ERW longitudinal seams.

4	COMPLETE documentation using the applicable form or electronic database in accordance with <i>SOPs HLD.35 Buried Pipe Inspection</i>
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**8.0
Documentation
Requirements**

Record data in electronic database or utilize the following form(s) as applicable:

Refer to these SOPs for documentation requirements as needed
HLD.35 Buried Pipe Inspection
HLI.06 Evaluating Pipeline Defects.

**9.0
References**

HLD.35 Buried Pipe Inspection
HLI.06 Evaluating Pipeline Defects

**Appendix A:
OQ Task
Requirements**

The table below identifies the Operator Qualification (OQ) task requirements.

Task Description	OQ Task
Demonstrate Proper Use of Pipe Thickness Gauge (Ultrasonic)	PLOQ008



ENERGY TRANSFER

Hot Tapping

Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

Code Reference :	Procedure No.: HLI.37
49 CFR: 195.422	Effective Date: 03/01/14
	Page 1 of 4

1.0 Purpose This Standard Operating Procedure (SOP) outlines the technical requirements for performing hot taps in a safe manner.

2.0 Scope This SOP contains the minimum requirements for performing hot taps.

3.0 Applicability This SOP applies to steel pipelines in Hazardous Liquids service.

4.0 Frequency As Needed.

5.0 Governance The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Project Manager	Operations Manager	Director of Operations

6.0 Terms and Definitions Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to *SOP A.01 Glossary and Acronyms*.

Terms	Definitions
Hot Tap	<p>The procedure for making a branch connection to an in-service, pressurized pipeline.</p> <p>Where the term "hot tap" or "tap" is used herein, the Procedure items also apply to the installation of stopples unless specifically or obviously excluded.</p>

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7.0

Hot Tapping

- General Requirements
- Branch Connection Design
- Welding, Inspection, Tapping and Examination
- Hot Tap Machine Design
- Inspection and Installation of Tapping Machine

7.1

General Requirements

1. Hot taps shall be installed only by crews qualified by training and experience, and personnel making hot taps shall be familiar with the particular tapping machine to be used.
2. A written procedure must be available on the construction site indicating the sequence of events to be followed and the tools and materials required. This procedure must incorporate the manufacturer's equipment operating and maintenance procedures.
3. Prior to making a hot tap, it shall be determined by the project engineer or coordinator, in consultation with the location supervisor, if any condition exists that would require the reduction of line pressure. No-flow conditions are hazardous and shall be avoided. A liquid velocity sufficient to control heat in the weld area shall be determined and maintained.
4. Hot tapping entails risks, not only to the safety of the hot tap crew, but to the continuous operation of the pipeline. All safety precautions shall be carefully noted and followed. The company's Health and Safety Department shall be notified prior to all hot tap operations, and a Hot Work Permit shall be required for all hot taps. Hot Work Permit procedures are contained in the Safety and Health Handbook.

7.2

Branch Connection Design

1. The attachment of the branch connection shall either be made by welding or by an approved mechanical design.
2. A qualified engineer shall approve all mechanical branch connection designs.
3. A qualified engineer shall make calculations in accordance with ASME B31.4, 404.3.1, to determine the size of the reinforcements for any branch connection two inches or greater.
4. All fillet welds shall be in accordance with ASME B31.4, 404.3.1.
5. Unless approved by engineering, welding or hot tapping closer than 18 inches to a flange or threaded connection, or closer than 3 inches to a weld seam, including a longitudinal seam, shall be avoided.
6. The branch connection shall be positioned to allow for the installation, operation, and removal of the hot tapping machine.
7. The hot tap valve shall be of adequate size and rating, be of proper metallurgy, and

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be a full opening valve. The valve shall meet the minimum requirements of API 6D or it's equivalent.

8. A pressure test shall be performed on all branch connections prior to the tapping operation. The test pressure should be at least equal to the current operating pressure of the line to be tapped but shall not exceed more than 10% of the operating pressure, in order to avoid possible internal collapse of the pipe wall.

7.3 Welding, Inspection, Tapping and Examination

1. All welding, inspection, tapping and examinations will be in accordance with Company Engineering Standard Volume 7 Welding 150.

7.4 Hot Tap Machine Design

1. All hot tapping machines shall be designed and constructed to with stand the temperatures, pressures, and mechanical stress, which may be imposed during their operation.
2. The seals and materials of construction of the hot tap machine shall be compatible with the contents in the piping.
3. The hot tap machine shall be able to remove the cut blank or coupon.

7.5 Inspection and Installation of Tapping Machine

1. Before the hot tapping process is performed, the machine, cutter, and pilot bit shall be carefully inspected to ensure that they are in satisfactory condition and capable of being left in service, if necessary, in the event of mechanical problems or hot tap valve leakage.
2. Adequate support of the hot tap machine shall be provided to prevent any undue or excessive weight or stresses from being placed on the branch connection during the hot tap operation.

8.0 Documentation Requirements

Record data in electronic database or utilize the following form(s) as applicable:

Activity	Reporting
<ul style="list-style-type: none"> • Fill out a Pipe Inspection Record tap details that may be needed in the future, e.g., actual size of tap hole. • Inspect the hot tap coupon for internal corrosion. Document 	Pipe Database Program

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observations on the Pipe Inspection Form	
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**9.0
References**

Engineering Standard Volume 7 Welding 150

**Appendix A:
OQ Task
Requirements**

The table below identifies the Operator Qualification (OQ) task requirements.

Task Description	OQ Task
Hot Tapping and Stoppling	PLOQ611



ENERGY TRANSFER

Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

Public Awareness Plan— Communication with API RP1162- defined Stakeholders

Code Reference :	Procedure No.: HLI.40	
49 CFR: 195.440; RRC 8.235, 8.310, 8.315	Effective Date: 04/01/18	Page 1 of 8

1.0 Purpose API RP 1162 requires pipeline operators to communicate with specific stakeholders. This Standard Operating Procedure (SOP) establishes the guidelines for the communication with the following four audience groups – Affected Public, Emergency Officials, Public Officials and Excavators – under the Public Awareness Plan.

2.0 Scope This SOP describes the requirements of the Public Awareness Plan to communicate with the API RP1162 defined stakeholders on a regular frequency and records the results of these communications.

3.0 Applicability This SOP applies to all pipelines under the requirements of the company's Public Awareness Plan.

4.0 Frequency As specified in *SOP HLA.17 Public Awareness Plan*, the baseline frequency for communicating and documenting communication with each stakeholder audience is defined below.

- Affected Public are every 2 years
- Emergency Officials are annually
- Public Officials are every 3 years
- Excavators are annually

Supplemental frequency for a specified area, pipeline, or other designation, determined under the Public Awareness Plan and this SOP: Documented by the Public Awareness Manager.

**Public Awareness Plan—
Communication with API
RP1162-defined
Stakeholders**

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**5.0
Governance**

The following table identifies the responsibility, accountability, and authority for communication with the API RP1162-defined stakeholder audiences.

Function	Responsibility	Accountability	Authority
Communicate messages about pipeline safety and interact with Affected Public, Emergency Officials, Public Officials and Excavators	Area Management / Operations Personnel	Public Awareness Manager	Senior Manager, Operations Services
Determine the Message	Public Awareness Manager	Public Awareness Manager	Senior Manager, Operations Services
Distribute communication messages via targeted mail	Public Awareness Manager	Public Awareness Manager	Senior Manager, Operations Services
Determine Supplemental Messages, Frequencies, and Activities	Public Awareness Manager	Public Awareness Manager	Senior Manager, Operations Services
Develop and Maintain the Public Awareness Database	Public Awareness Manager	Public Awareness Manager	Senior Manager, Operations Services

**6.0
Terms and
Definitions**

Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to *SOP HLA.01 Glossary and Terms*.

Terms	Definitions
Affected Public	The Affected Public includes people who occupy structures on land on which the pipeline is buried. A partial list includes homeowners, homeowners associations, farmers, tenants, landowners, businesses, and industrial facilities.
Emergency Officials	State and local law enforcement departments, emergency medical services, fire departments, 911 operators/emergency dispatch centers or others that can benefit from

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	communication of pipeline safety, incident response and related public awareness messages, and interaction.
Public Officials	Mayors, city, town, or county managers, planning boards or committees that serve the public in a capacity that can benefit from communication of planning or pipeline safety and related public awareness messages.
Excavator	Anyone who may dig in the vicinity of pipelines with manual or mechanized equipment with the potential to cause damage or create an incident on the pipeline or related facilities. For the purpose of this SOP, residents are not considered excavators, since public awareness communications with residents occurs under <i>SOP HLA.17 Public Awareness Plan</i> .

7.0

Public Awareness Plan— Communication with API RP112- defined Stakeholders

This procedure contains the following sections:

- Communicate Message and Interact with Affected Public
- Communicate Message and Interact with Emergency Officials
- Communicate Message and Interact with Public Officials
- Communicate Message and Interact with Excavators
- Targeted Distribution of Print Materials to API RP-1162 defined Stakeholders
- Determine the Message for the Affected Public
- Develop and Maintain the Public Awareness Database
- Determine Supplemental Messages, Frequencies and Activities
- Documentation Requirements



NOTE: Persons occupying property within 660 feet of the centerline will be included.

7.1

Communicate Message and Interact with the Affected Public

Area Management is responsible for maintaining contact and communications with the Affected Public in their areas. Communications focused on pipeline safety with a particular stakeholder that occur during the normal course of business are considered per occurrence contact. Area Management is responsible for documenting the per occurrence contact within the public awareness database.

The Public Awareness Manager is responsible communicating with the Affected Public on a recurring basis via targeted distribution of print materials.

The Public Awareness Manager is responsible for documenting targeted distribution of print materials within the public awareness database.

**Public Awareness Plan—
Communication with API
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**7.2
Communicate
Message and
Interact with
Emergency
Officials**

Area Management is responsible for maintaining contact and communications with Emergency Officials in their areas. Area Management may communicate and interact with emergency officials through formal and informal interactions. Communications focused on pipeline safety with a particular stakeholder that occur during the normal course of business are considered per occurrence contact. Area Management will also communicate and interact with emergency officials via a formalized group meeting hosted by an association/third party.

Area Management is responsible for documenting the per occurrence contact within the public awareness database. The Public Awareness Manager is responsible for documenting the group meetings with emergency officials within the public awareness database.

Area Management can perform the communication with company employees, with a contractor, a third party (such as an area damage prevention group), or a combination. The use of a contractor or a third party should include the evaluation of the contractor's programs to verify that they meet the requirements of the first edition of American Petroleum Institute's Recommended Practice 1162 (RP-1162) and the company. The general guideline for conducting Emergency Official meetings is listed below.

Step	Activity
1	PREPARE meeting materials.
2	INCLUDE an overview of normal operations and emergency procedures.
3	FOCUS discussions on mutual concerns related to emergency response and pipeline safety.
4	EXCHANGE emergency contact lists.
5	ACQUAINT the Emergency Officials with company facilities and ability to respond to emergency situations.
6	REVIEW local area emergency plan.
7	DETERMINE their ability to provide emergency assistance.
8	DISCUSS mutual assistance for leaks, ruptures, fires, or other emergency situations.
9	SEND meeting materials to those that cannot attend the meeting.
10	FOLLOW-UP on requests for additional information or training.
11	PLAN for and CONDUCT emergency simulations as required.
12	DOCUMENT attendees so they can be added to the Public Awareness Database.
13	DOCUMENT communication in public awareness database.

**Public Awareness Plan—
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**7.3
Communicate
Message and
Interact with
Public Officials**

Area Management is responsible for maintaining contact and communications with Public Officials in their areas and for documenting the contact and communication.

The Public Awareness Manager is responsible for maintaining a current schedule of mailings to Public Officials. The schedule makes efficient use of company resources while maintaining the frequency necessary for effective communication.

The following steps detail the process for the mass mailings to Public Officials.

Step	Task	Done By
1	NOTIFY Director, GIS / Engineering Records of readiness to mail to Public Officials.	Public Awareness Manager
2	SEND centerline shape files of pipeline assets and facilities to mail vendor.	GIS Analyst
3	WORK with vendor to ACQUIRE data to IDENTIFY addresses. APPLY mailing buffer, CLASSIFY addresses and CONDUCT mailing.	Public Awareness Manager
4	RECEIVE documentation and proof of mailing from USPS. REVIEW mail receipts.	Public Awareness Manager
5	RECEIVE returned mail, DOCUMENT and SEND addresses to vendor for further analysis to ascertain why an address was undeliverable.	Public Awareness Manager
6	RETRIEVE documentation from vendor and LOAD documentation of mailing into company's the Public Awareness Database.	Public Awareness Manager

**7.4
Communicate
Message and
Interact with
Excavators**

Area Management is responsible for maintaining contact and communications with Excavators in their areas. Area Management may communicate and interact with emergency officials through formal and informal interactions. Communications focused on pipeline safety with a particular stakeholder that occur during the normal course of business are considered per occurrence contact. Area Management will also communicate and interact with emergency officials via a formalized group meeting hosted by an association/third party.

Area Management is responsible for documenting the per occurrence contact within the public awareness database. The Public Awareness Manager is responsible for documenting the group meetings with emergency officials within the public awareness database.

Area Management can perform the communication with company employees, with a

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contractor, a third party (such as an area damage prevention group or a state one call center) or a combination. The use of a contractor or a third party should include the evaluation of the contractor's programs to verify that they meet the requirements of RP-1162 and the company. The general guideline for conducting excavator meetings is listed below.

Step	Activity
1	PREPARE meeting materials.
2	DESCRIBE the company's Damage Prevention Program per <i>SOP HLI.30 Third Party Damage</i> .
3	DISCUSS the company's use of One-Call Notification System.
4	EXPLAIN the requirements for notification prior to any excavation regardless of the presence of established markers.
5	EXPLAIN the requirements for a company representative to locate the pipeline before any excavation begins.
6	DESCRIBE the potential consequences of damages and incidents.
7	PROVIDE information on reporting damages and incidents.
8	SEND meeting materials to those that don't attend the meeting.
9	FOLLOW-UP on requests for additional information.
10	DOCUMENT attendees so they can be added to the Public Awareness Database.
11	DOCUMENT communication in the Public Awareness Database.

**7.5
Determine the
Message for
Targeted
Distribution of
Print Materials**

The Public Awareness Manager is responsible for determining the message content of print materials. Baseline messages, by audience and type of pipeline system, should be determined using API RP 1162. Updates to the initial baseline message follow the process identified below and include supplemental content or contact frequencies as necessary.

**7.6
Targeted
Distribution of
Print Materials
to API RP-1162
defined
Stakeholders**

The Public Awareness Manager is responsible for maintaining a current schedule of mailings to API RP1162-defined stakeholders. The schedule makes efficient use of company resources while maintaining the frequency necessary for effective communication. The Public Awareness Manager can develop a sub-process for smaller mail outs. The following steps detail the process for the targeted distribution of print materials.

Step	Task	Done By
1	NOTIFY Director, GIS / Engineering Records of readiness to mail to Public Officials.	Public Awareness Manager

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Step	Task	Done By
2	SEND centerline shape files of pipeline assets and facilities to mail vendor.	GIS Analyst
3	WORK with vendor to ACQUIRE data to IDENTIFY addresses. APPLY mailing buffer, classify addresses and CONDUCT mailing.	Public Awareness Manager
4	RECEIVE documentation and proof of mailing from USPS. REVIEW mail receipts.	Public Awareness Manager
5	RECEIVE returned mail, DOCUMENT and SEND addresses to vendor for further analysis to ascertain why an address was undeliverable.	Public Awareness Manager
6	RETRIEVE documentation from vendor and LOAD documentation of mailing into company's the Public Awareness Database.	Public Awareness Manager

**7.7
Develop and
Maintain the
Public
Awareness
Database**

The Public Awareness Plan master database resides within a web-based application. All information that is available in electronic format or that can reasonably be converted to electronic format is stored in the Public Awareness Database. In addition to the master database, the remaining Public Awareness materials are stored in a common area on the data servers.

These following steps are completed on a regular basis to maintain a current status in the Public Awareness Database.

Step	Task
1	INCORPORATE Field Data into the Public Awareness Database, per contact occurrence.
2	VERIFY contact information is in the Public Awareness Database
3	COORDINATE the correction of any discrepancies.
4	VERIFY that messages are attached to the database records following the mail out.

**7.8
Determine
Supplemental
Messages,
Frequencies,
and Activities**

Supplemental techniques such as increased message frequency, supplemental messages, or the deployment of different communication methods may be necessary for the development of effective public awareness communication with each stakeholder audience. Following the evaluation of the Public Awareness Plan effectiveness in *SOP HLA.17 Public Awareness Plan*, the resulting recommendations regarding supplemental messages, frequencies and activities should be incorporated into the methods used for communicating with stakeholders.

Code Reference :	Procedure No.: HLI.40	
49 CFR: 195.440; RRC 8.235, 8.310, 8.315	Effective Date: 04/01/18	Page 8 of 8

8.0

**Documentation
Requirements**

Record data in electronic database, utilize the following form(s) as applicable:

- I.40.A – Public Awareness Contact Data Form

Records and other documentation that reflect communications to stakeholder audiences are retained for a minimum of five years within the Public Awareness Database and central storage location in electronic format. Records that cannot be readily converted to electronic format are kept by the Public Awareness Manager with copies existing in the source location as necessary for a minimum of five years.

Documentation of the following is required under this SOP:

- Document contact (per occurrence) with RP1162-defined stakeholders in public awareness database. Utilize the applicable form(s) for Public Awareness Contact Data Form or data can be entered directly into public awareness database.
- Contact data for the in the Public Awareness Database.
- Documentation related to targeted distribution of print materials – schedules, brochures, postal certificates, mail lists -- in the Public Awareness Database.
- Documentation related to formalized meetings with stakeholders -- meeting sign-in sheets, invitations, contact lists in the Public Awareness Database.
- Supplemental activities in the Public Awareness Database.

9.0

References

HLA.03 Management of Change
HLA.17 Public Awareness Plan
I.40.A Public Awareness Contact Data Form

**Appendix A:
OQ Task
Requirements**

There are no Operator Qualification (OQ) task requirements for this SOP.

Exhibit SPLP MG-11

SPLP
MG-11



ENERGY TRANSFER

Hazardous Liquids Pipeline Shutdown and Startup

Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

Code Reference :	Procedure No.: HLL01	
49CFR: 195.402	Effective Date: 04/01/18	Page 1 of 8

1.0 Procedure Description This Standard Operating Procedure (SOP) establishes requirements for starting up and shutting down any part of the pipeline in a manner designed to assure operation within the MOP limits prescribed by this SOP, plus the build-up allowed (110%) for operation of pressure-limiting and control devices.

2.0 Scope The SOP includes procedures for startup and shutdown of liquid pipelines.

3.0 Applicability This SOP applies to liquid pipeline facilities to assure operation within proper pressure ranges.

4.0 Frequency As required: For the startup or shutdown of liquid pipeline facilities.

5.0 Governance The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Operations Manager	Director of Operations

6.0 Terms and Definitions For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

7.0 Hazardous Liquids Pipeline Shutdown and Startup Working closely with Liquids Control, Operations Personnel use this SOP to verify that startup or shutdown of a liquid pipeline does not result in pressures above Maximum Operating Pressure (MOP) plus the build-up allowed (110%) for operation of pressure-limiting and control devices. This procedure contains the following sections:

- Shutdown and Startup Plan
- Selection of Flare or vent location if applicable
- Shutdown Procedures
- Requirements for Controlled Intentional Releases
- Startup Procedures

Hazardous Liquids Pipeline Shutdown and Startup

Code Reference :	Procedure No.: HLI.01	
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NOTE: Document each occurrence when a pipeline segment MOP is exceeded as a result of a startup or shutdown activity using *SOP HLA.13 Recognizing and Responding to Abnormal Operations*.

7.1 Shutdown and Startup Plan

For normal operating conditions, Operations Personnel develop a pipeline shutdown and startup plan prior to depressurizing or pressurizing a pipeline segment.



NOTE: If the intention is to depressurize the pipeline, prior to shutdown **CONSULT** with Pipeline Integrity Group to review the anomaly data to determine whether smart tool indications that are scheduled for future remediation will be in the shutdown section, and if indication should be investigated, remediated, and/or repaired during the shutdown.



WARNING: Prevent pressures in a pipeline segment from exceeding its MOP during startup or shutdown. Take into account the variations in elevation for the length of the pipeline. Take immediate action to correct the situation if it does occur. Refer to *SOP HLA.12 Safety-Related Condition Reporting* and *SOP HLA.13 Recognizing and Responding to Abnormal Operations* for potential abnormal operations reporting requirements.

Step	Activity
1	PREPARE site-specific shutdown or start up work-plan when applicable, VERIFY liquids are sent to flare, recirculated back into the system, or vented within appropriate limits.
2	VERIFY that the work-plan has detail and contents adequate for the particular pipeline segment and operating conditions.
3	BASE the work-plan on maintaining pressures at or below the segment MOP. REVIEW input and delivery points to verify all sources of liquids have been considered.
4	MAINTAIN pipelines above vapor pressure of the product to prevent vaporization, unless the intent is to evacuate the pipeline.
5	EVALUATE complexity. CONSIDER such things as the number of people involved, sequence of valve operations and what effect the operation may have on customers. INCLUDE visual aids, such as maps, drawings or sketches, in the work-plan when helpful.

Hazardous Liquids Pipeline Shutdown and Startup

Code Reference :	Procedure No.: HLI.01	
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Step	Activity
6	REVIEW the work-plan with all personnel involved in the operation, including Liquids Control, prior to making any pressure changes and outages. VERIFY that each person involved knows their responsibility, who is in charge, and what to do if pressure limits are exceeded.
7	VERIFY valves to be used are in working condition.
8	REVIEW the work-plan with the Environmental Department as necessary to determine if federal or state reporting requirements apply or if there are environmental restrictions that may affect the operation.
9	If abnormal operations arises during implementation, TAKE corrective action. REFER to <i>SOP HLA.13 Recognizing and Responding to Abnormal Operations</i> .
10	VERIFY that Liquids Control is kept advised of progress or changes in schedule.

7.2 Selection of Flare or Vent Location

Use the table below to select a flare or vent location.



NOTE: Crude Oil Pipeline Operations will require drain lines to containment.

Step	Activity
1	When selecting flare / vent locations, consideration should be given to the safety of public and employees. CHOOSE a location suitable to minimize the impact to the environment and the public. MONITOR for flammable or toxic vapors as appropriate.
2	TAKE steps to prevent accidental ignition, noting especially the location of overhead power lines.
3	CONSIDER access for special equipment to be used such as flares, diffusers, liquid separators, and absorption units.
4	CONSIDER the possibility that liquids may be entrained in the vapors.

Hazardous Liquids Pipeline Shutdown and Startup

Code Reference :	Procedure No.: HLL01	
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7.3 Shutdown Procedures

Once the work-plan has been prepared, Operations Personnel use the following guidelines to shutdown the pipeline segment.

Step	Activity
1	MAKE appropriate notifications.
2	SHUTDOWN pump stations or injections associated with the section to be shutdown according to local procedures.
3	ISOLATE section as appropriate, including tie-ins. UTILIZE Lockout Tagout Procedures as appropriate. Refer to <i>HLB.06 Hazardous Energy Control (Lockout Tagout)</i>

7.4 Requirements for Controlled Intentional Releases

Prior to flaring / venting of vapors, Operations Personnel should utilize the following guidelines:



NOTE: Crude is not considered a HVL according to PHMSA's definition.

Step	Activity
1	<p>NOTIFY the following agencies, officials, and persons, if applicable, at least 24 hours in advance of the flare or venting.</p> <ul style="list-style-type: none"> • Emergency coordinators which are located within a 10 mile radius of the flaring or venting site. • State police which are located within a 10 mile radius of the flaring or venting site. • Local fire officials (city and county fire departments). • Residents located within close proximity to the flaring or venting site (minimum of 300 ft.). • Aerial Patrol Pilot • The Federal Aviation Administration – see FAA contact list in Appendix B. <p>Liquids Control will NOTIFY other pipeline companies in the general area.</p>
2	PROVIDE information concerning the flaring or venting of vapors, such as location, time, product and duration in the notification.

Hazardous Liquids Pipeline Shutdown and Startup

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7.5 Startup Procedures

Once the work that required the shutdown has been completed and the line is ready to be returned to service, follow the purge and pack procedures that were prepared during the planning of the job. Refer to *SOP HLB.03 Purging*.

- During the shutdown and startup, **MONITOR** pipeline pressure until steady state pressure and flow conditions are reached to assure operation within MOP limits.

Step	Activity
1	MAKE appropriate notifications. Before purging, once again make all the notifications required above in Section 7.4, Requirements of Liquid Releases
2	PRIOR to purging and/or packing, CONSIDER disarming automated shutdown controls to PREVENT unintentional errant valve closures.



NOTE: If the shutdown did not require evacuation of the liquids in the pipeline and the line was shut in with a positive pressure and that positive pressure was continuously maintained, purging will not be required prior to repacking the line.

Step	Activity
3	PURGE & PACK the line segment according to <i>HLB.03 Purging</i>
4	REMOVE lockout tagout, return all valves to their normal operating position per local procedures.
5	STARTUP pump stations or injections associated with the section to be started according to local procedures.
6	RE-ESTABLISH automated shutdown controls previously disarmed.
7	NOTIFY Liquids Control that the pipeline is back in normal operating configuration.

8.0 Documentation Requirements

Record data in electronic database or utilize the following form(s) as applicable:

A file for retaining records of pipeline startup and shutdown activities.
If there is a work-plan, retain a copy of the work-plan for three (3) years.
Use a Company approved application for documenting the activities

9.0 References

HLA.12 Safety Related Condition Reporting
HLA.13 Recognizing and Responding to Abnormal Operations
HLB.03 Purging
HLB.06 Hazardous Energy Control (Lockout Tagout)

Hazardous Liquids Pipeline Shutdown and Startup

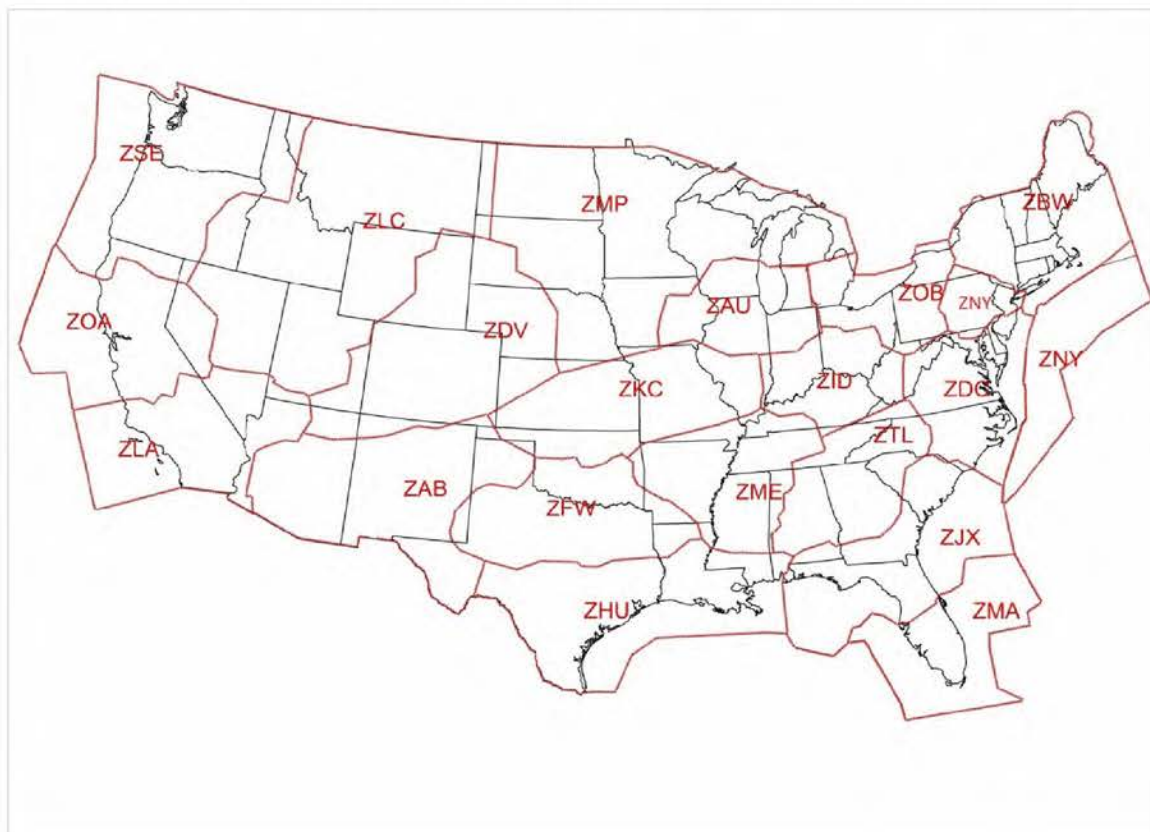
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Appendix A: The table below identifies the Operator Qualification (OQ) task requirements.
OQ Task Requirement

Task Description	OQ Task
Operating Pipeline Valves	PLOQ007
Start-up / shutdown of pipeline / facilities to assure operation within MOP	PLOQ601

Appendix B: The table below identifies the Operator Qualification (OQ) task requirements.
FAA Contacts

FAA Air Traffic Control Center - Sectors and Contact #'s



Hazardous Liquids Pipeline Shutdown and Startup

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	Air Traffic Control Center	Contact #
ZAB	Albuquerque	505-856-4500
ZAU	Chicago	630-906-8341
ZBW	Boston	603-879-6655
ZDC	Washington	703-771-3470
ZDV	Denver	303-651-4248
ZFW	Fort Worth	817-858-7504
ZHU	Houston	281-230-5560
ZID	Indianapolis	317-247-2242
ZJX	Jacksonville	904-549-1537
ZKC	Kansas City	913-254-8504
ZLA	Los Angeles	661-265-8205
ZLC	Salt Lake	801-320-2560
ZMA	Miami	305-716-1588
ZME	Memphis	901-368-8234
ZMP	Minneapolis	651-463-5580
ZNY	New York	631-468-1080
ZOA	Oakland	510-745-3331
ZOB	Cleveland	440-774-0312
ZSE	Seattle	253-351-3520
ZTL	Atlanta	770-210-7622

***Hazardous Liquids
Pipeline Shutdown and
Startup***

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Instructions/Guidelines

- Call the appropriate FAA/Air Traffic Control Center and ask that a Temporary Flight Restriction (TFR) be issued for a scheduled gas release. Recommend this to be a minimum of 1 mile radius and a minimum of 2000 feet above the ground if possible. Large gas releases may require larger TFR's.
- Provide GPS coordinates of the location in deg., min., and seconds (i.e. – N30 03 59, W095 32 51)
- Provide the date and estimated time frame for the TFR (i.e. – May 6 from 8:00 am – 3:00 pm local time). Recommend asking for enough time in case the gas release is delayed.



Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

Code Reference :	Procedure No.: HLI.05	
49 CFR: 195.214, 195.228, 195.230, 195.234, 195.422	Effective Date: 04/01/18	Page 1 of 17

1.0 Purpose This Standard Operating Procedure (SOP) establishes the requirements for repairing pipelines when the strength of the pipe has been reduced by corrosion, mechanical damage, weld defects, material defects, or other injurious defects per *SOP HLI.06 Evaluating Pipeline Defects*.

2.0 Scope This SOP determines and describes the appropriate repair methods, based on pipeline defects, required to verify the continued integrity of the pipeline.

3.0 Applicability This SOP applies to regulated company pipelines requiring repair.

4.0 Frequency As required, including failures, leaks, pipeline damage, or wall loss without leaks are discovered.

5.0 Governance The following table describes the responsibility, accountability, and authority of the operations.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Operations Manager / Manager of Pipeline Integrity	Vice President of Pipeline Integrity

6.0 Terms and Definitions Terms associated with this SOP and their definitions follow in the table below. Refer to *SOP HLI.06 Evaluating Pipeline Defects* for additional terms and definitions associated with this SOP not covered in the table below. For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

Terms	Definitions
Alternative Repair	Any method approved by the Pipeline Integrity Group or QA/QC Group that is not covered under a specific category. This may include new methods not known at the time the SOP was written, other repair methods not normally used except under special circumstances, or any method not specifically stated as acceptable for a given type of defect.

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Terms	Definitions
Composite Sleeve	A full encirclement repair consisting of composite layers such as fiber glass or carbon fiber that adhere with an epoxy.
File Repair	Removal of a defect, or of the detrimental aspects of a defect, through the use of a hand held file.
Force Screw Type Leak Clamp	An apparatus consisting of a band that encircles the pipe and a cone point on a screw. The screw is tightened forcing the cone into the pipe, sealing a small leak.
Grind Repair	Removal of a defect, or of the detrimental aspects of a defect, through the use of an abrasive disc attached to a power tool.
Pressure Containing Type "B" Sleeve	A full encirclement repair consisting of steel sections designed to fit over the carrier pipe. The sections are welded to each other and the ends are then fillet welded to the carrier pipe such that the sleeve is capable of containing any material or pressure that leaks from the pipe.
Pressure Reinforcing Type "A" Sleeve	A full encirclement repair consisting of steel sections designed to fit over the carrier pipe. The sections are welded to each other on either side. The ends are not fillet welded to the carrier pipe.
Pumpkin (Type C)	A full encirclement repair consisting of steel sections designed to fit over the carrier pipe and a raised feature such as a weld or coupling. The sections are welded to each other and the ends are then fillet welded to the carrier pipe such that the sleeve is capable of containing any material or pressure that leaks from the pipe. This is one type of sleeve covered in Specialty Steel Sleeves.
Weld Reinforcement Sleeve	A full encirclement repair consisting of steel sections designed to fit over the carrier pipe and a raised feature such as a weld.
Split Sleeve Bolt-On Clamp	A full encirclement repair consisting of two steel halves held together with a series of bolts.
Stress Concentrator	Any sharp feature or linear indication that can increase the amount of stress at a localized point.
Weld Pad	A steel encirclement sleeve added at pipe supports to prevent vibrations and movements from damaging the carrier pipe.

7.0 Pipeline Repair

This SOP contains the following sections:

- Defect to Repair Correlation
- Replacement of Pipe Section
- Grinding and Filing
- Split Sleeve Type Bolt on Clamp
- Force screw Type Leak Clamp
- Repairs Using Welded Encirclement Sleeves
- Welded Encirclement Sleeves: Specialty Steel Sleeves
- Composite Reinforcement Repairs

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WARNING: Operations Personnel shall take **IMMEDIATE** steps to protect the public from hazardous leaks or failures, and to repair any pipeline in which damage or imperfections are found that could affect the serviceability or safe operation of the pipeline.



CAUTION: If an immediate repair cannot be made, the segment of pipeline is to be removed from service, or the pressure reduced to a safe level based on the remaining strength of the segment until temporary or permanent repairs can be made.



NOTE:

- Follow all excavation and repair pressure reduction requirements per *SOP HLL.11 Pipeline Pressure Limit Criteria*.
- Conduct a pre-job safety meeting to discuss the work procedures prior to commencement of work.
- Refer to *Safety Procedure S-020 Asbestos Removal and Maintenance* before removing coating, if appropriate.
- Clean the pipe to bare metal in the area of repairs.
- Document the type, location, and size of all repairs in the Pipe Inspection Report or Maintenance Record.
- Clean and coat all bare surfaces prior to backfilling.
- Upon completion, Backfill per *SOP HLL.10 Excavation and Backfill* after the coating has cured.
- Submit the project documentation and as-built data to Engineering Records per *SOP HLB.11 Project Documentation and As-Built Process*

**7.1
Defect to
Repair
Correlation**

This SOP contains multiple repair types, each of which is applicable to a number of different defects. Each defect therefore can typically be repaired using one of several methods. The following table can be used to correlate the defects identified by *SOP HLL.06 Evaluating Pipeline Defects* to the correct repair.



WARNING:

- This procedure should only be used as a guideline in the field. If any abnormalities or questions arise, final repair type determination is the responsibility of the Pipeline Integrity Group.
- If multiple types of anomalies interact, confirm the repair methods with a Corrosion Specialist or a member of the Pipeline Integrity Group.
- Verify repairs made in the Company's pipeline systems are made in a safe manner and are made to prevent damage to persons or property.
- The Company may not use any pipe, valve, or fitting, for replacement in repairing pipeline facilities, unless it is designed and constructed as required by 49 CFR 195.

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NOTE:

- Notify Liquids Control regarding all proposed repair work and follow excavation pressure reduction requirements per *SOP HLL.11 Pipeline Pressure Limit Criteria*.
- Only those repair methods listed can be used unless an exception is made by the Pipeline Integrity Group. The repair methods are listed in the order generally preferred by the company such that the first repair listed should be the first type of repair considered. However, this order is not firm and repair methods further down on the list may be used based on other factors and preferences so long as a defect is repaired to an acceptable level.

**7.2
Replacement of
Pipe Section**

Operations Personnel or Company Approved Contractor follows this procedure, before a section of pipe is replaced. Refer to *SOP HLL.01 Hazardous Liquid Pipeline Shutdown and Startup* in conjunction with this SOP.

Step	Activity
1	Operations will DEVELOP and IMPLEMENT a project specific plan for the replacement of pipe.

**7.3
Grinding or
Filing**

Operations Personnel follows the procedures below to make repairs by grinding or hand filing.



WARNING:

- Do not exceed 10% nominal wall thickness removal for the purpose of performing a repair by grinding unless further approval is given by the Pipeline Integrity Group.



CAUTION:

- Prior to performing any grinding, advise Liquids Control of the proposed repair work.
- This section is not intended to be used for weld repair. Refer to the Company's Engineering Standards-Welding, and any other requirements as specified by Integrity Management.
- Do not grind as a means of repair for the following defects:
 - Acetylene weld defect
 - Single submerged arc weld (SSAW) defect
 - Lap weld defect
 - Pre-1970 electric resistance weld (ERW) defect
 - Electric flash weld (EFW) defect that is deeper than the cap

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NOTE:

- If there is a concern regarding the ability to accurately, measure the depth of a defect or the integrity of the pipe at the defect in consideration of a more stringent pressure reduction than outlined in *SOP HLL11 Pipeline Pressure Limit Criteria* may be employed as directed by Pipeline Operations Specialist.
- Defect characteristics which may impair serviceability include but are not limited to:
 - Sharp edges
 - Stress concentrators
 - Surface breaking linear indications
 - Hard spots
 - Arc burns
 - Gouges

Step	Activity
1	ESTABLISH the actual wall thickness of the pipe in the area to be repaired prior to grinding by means of an ultrasonic procedure.
2	VERIFY the absence of laminations or internal corrosion pits with a compression wave ultrasonic procedure.
3	If in a weld cap, CONSIDER using shear wave ultrasonics to VERIFY the defect does not extend below the weld cap.
4	USE a power-driven coarse abrasive disk or a hand held file for grinding. Typical power equipment includes an angle grinder with a 40 to 80 grit flap or tiger style disc. A pencil-style grinder with ceramic tip may be allowed when access is limited.
5	Begin to REMOVE the defect by moving the grinder slowly across the impairing characteristic. Move back and forth in smooth even strokes to avoid digging into any localized area.
6	Periodically STOP and DETERMINE if the serviceability impairing characteristics have been removed or appear to be worsening. USE magnetic particle inspection (MPI) as necessary.
7	If repairing an arc burn or hard spot, REFER to that section at this time.
8	With an ultrasonic procedure, periodically CHECK the amount of metal removed during the process to ensure the limitation of a safe pressure has not been exceeded.
9	VERIFY that the serviceability impairing characteristics of the defect are completely removed.
10	CONTOUR the area around the defect to provide a smooth transition to meet the surrounding unaffected pipe surface.
11	ORIENT final scratch marks as nearly as possible in the circumferential direction.
12	EVALUATE the defect after grinding using a black-white, wet magnetic particle inspection (MPI) method to verify that no linear indications are present. If linear indications are discovered after reaching the maximum approved repair depth, CONSULT the Pipeline Integrity Group.

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Step	Activity
13	EVALUATE the area repaired by grinding per <i>SOP HLD.47 Evaluation of Remaining Strength of Pipe with Metal Loss</i> in order to establish a safe operating pressure. For defects in dents and welds, REFER to <i>TABLE-01</i> .
14	If the safe operating pressure of the grind repair does not meet the required MOP of the pipeline section, CONSIDER additional pressure reduction and repair.
15	CONSULT the Technical Operations Group to determine any further pressure reductions and repairs per <i>SOP HLI.11 Pipeline Pressure Limit Criteria</i> and this procedure.

7.3.1 Arc Burns & Hard Spots



In addition to the repair guidelines of this procedure, Operations Personnel or Company Approved Contractor employs an additional inspection as outlined below for the repair of arc burns or hard spots.

CAUTION:

- Follow all Steps, Notes, Cautions, and Warnings in the Grinding and Filing section as appropriate in addition to those presented here.
- Ammonium Persulfate, when applied to pipe, leaves a salt residue that can be detrimental to the adherence of pipe coating systems.

Step	Activity
1	EVALUATE arc burns and hard spots periodically during repair with a 20 percent Ammonium Persulfate and distilled water etch.
2	CONTINUE the repair until no darkening occurs after the application of the etch solution or until the maximum depth of repair limits are reached.
3	CLEAN pipe surfaces that have been contaminated with Ammonium Persulfate either by scrubbing with soap and water or by applying an acid wash such as Oakite 33 or Oxalic acid.

7.4 Split Sleeve Type Bolt-On Clamp



Operations Personnel or Company Approved Contractor follows the procedure below for using a bolt on, full encirclement, split sleeve.

NOTE: Bolt-On split sleeve may be utilized on onshore pipelines as a temporary repair only until it is feasible to make a permanent repair.

Step	Activity
1	SUPPORT the pipe with sandbags within four (4) feet of each end of the clamp installation location.

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2	PLACE the clamp around the pipe and tighten the bolts in accordance with the manufacturer's guidelines.
3	RESTRAIN the clamp against any movement or rotation until all bolts have been tightened.
4	MAINTAIN the support of the pipe with sandbags within 4 feet of each end of the clamp and RESTORE the pipeline to the original operating pressure once the repair has been completed.
5	For onshore applications, SCHEDULE for permanent repair.

7.5 Force Screw Type Leak Clamp

Operations Personnel or Company Approved Contractor follows the procedure below for using a force screw type leak clamp.



CAUTION: Do not use a mechanical leak clamp if the pipe section being repaired applies to any of the following locations unless it has been approved as temporary by the Pipeline Integrity Group :

- The repair is made within the right-of-way of a road.
- The pipe section is located in highly populated areas.
- The pipe is located in an HCA.
- The pipe section is located in a cultivated field with the potential for shallow cover.

Step	Activity
1	VERIFY the sealing surface of the clamp is not installed over an area of general wall loss
2	MINIMIZE the disturbance of the coating at the location of the leaking defect.
3	CLEAN the leak area thoroughly to determine the correct size and type of leak repair device and accessory to use on the leak.
4	USE a soapstone or paint stick, MARK the leak device and pipe with matching cross hair lines to VERIFY the leak device is centered over the leak.
5	FOLLOW manufacturer's recommended installation and testing procedures to insure the device is appropriately installed.

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7.6 Repairs Using Welded Encirclement Sleeves

Operations Personnel or Company Approved Contractor shall follow the procedure below when making repairs using welded encirclement Type A or B sleeves.



WARNING:

- Do not weld sleeve ends to the carrier pipe if any evidence of linear indications, laminations, reduced wall thickness, or other defects are discovered at the weld positions.
- Consult with the Pipeline Integrity Group if a linear indication may be covered.



CAUTION:

- Prior to installation of welded encirclement sleeves, Liquids Control should be advised of the proposed repair work and in-service welding.
- Prior to performing in-service welding, contact the QA/QC Group to perform the appropriate analysis in order to minimize the risk of burn-through and / or hydrogen cracking.
- Take care to minimize pipe movement and ensure proper support since the stiffness of the sleeves concentrate any stresses at the ends of the sleeve, especially between sleeves.



NOTE:

- Butt Welded Seam Design–Type B Sleeve is designed with the sides of each sleeve beveled so they can be butt welded to join the two halves together. A groove is made beneath the bevel so that a 1/16" thick steel backing strip can be placed beneath the joint prior to welding while still allowing the sleeve to fit flush against the pipe on either side of the joint. The ends of the sleeve must be fillet welded to the carrier pipe.
- Sleeves made by the company, a contractor, or manufactured sleeves purchased from a third party can be used for this section so long as the integrity is verified and the design is consistent with the applicable Engineering Standard.
- Alternative cleaning methods may be employed with approval of Technical Operations Group.
- Minimum sleeve length is 6 inches unless approved by Technical Operations Group.
- Multiple sleeves may be installed adjacent to one another with the approval of Pipeline Integrity Group and Technical Operations Group. The sleeves must all fit tightly around the pipe, and each sleeve must be supported with sand bags. Type A sleeves do not need to be welded together; however, the sleeves may be welded by either using a butt weld with a backing strip or by fillet welding an external bar around the outer circumference of the sleeves.

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- Do not install two sleeves, with the ends fillet welded, any closer than one pipe diameter from each other unless approved by the Pipeline Integrity Group or Technical Operations Group.
- Only allow 2 adjacent sleeves over a leaking defect, without approval of Pipeline Integrity Group and Technical Operations Group

Step	Activity
1	Prior to installation of welded encirclement sleeves, ADVISE Liquids Control of the proposed repair work and in-service welding.
2	PROVIDE proper support of sleeves and adjacent pipe using sandbags.
3	VERIFY that the encirclement sleeve is designed, tested, fabricated, and installed in accordance with Section ETWM-155 of the Company's Welding Procedures Manual, and any other requirements as specified by Integrity Management. OBTAIN mill test reports and company purchase order numbers for the sleeve material.
4	VERIFY that the sleeve is long enough to cover the defect and extends an additional 2 inches beyond each end of the defect, and the ends (including the HAZ) do not come within 2 inches of another anomaly or girth weld. EXTEND the sleeve as necessary. Refer to the diagram (Figure 1) at the end of this section for clarification.
5	For Type B sleeves, PERFORM magnetic particle inspection (MPI) and zero degree ultrasonic inspections for the full circumference, in a 4" wide strip centered at the proposed sleeve end locations. Refer to the diagram at the end of this section for clarification.
6	REPAIR the new anomaly with an alternate method per Table 1, if a sleeve repair is not sufficient.
7	If necessary TEST FIT the sleeve on the pipe if there are any concerns with proper alignment and fit up. VERIFY that the gaps between sleeve halves or sections are not situated over the defect area.
8	For pipe with a longitudinal seam with a raised weld cap that prevents tight fit-up, REFER to one of the methods listed in the following sub-sections.
9	FILL any deviations from pipe roundness (corrosion, dents, etc.) with a two-part, 100% solids epoxy filler material such as Armor Plate 360 or an approved equal. If a question regarding approved filler material arises, CONSULT with a Corrosion or Integrity Specialist.
10	CONTOUR the filler material to restore the original surface and roundness of the pipe, and to fill voids between the pipe and sleeve. ENSURE contact between the sleeve and defect area for good reinforcement.
11	FIT the sleeve over the pipe; VERIFY a tight fit up such that no unfilled voids are present. TIGHTEN the sleeve for welding using a jack and chains or other appropriate method.
12	VERIFY that any gap beneath the end of a sleeve to be fillet welded to the carrier pipe is no greater than 1/16-inch prior to welding. ADD a small amount of weld metal to the underside of the end of the sleeve prior to installing it on the pipe, if necessary, to obtain proper alignment.

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Step	Activity
13	GRIND and FIT the extra weld material to minimize the gap beneath the end of the sleeve.
14	WELD sleeves in accordance with the company Welding Manual and Procedures.
15	MAKE in-service welding consideration in order to minimize risk of burn through and hydrogen cracking. CONSULT the QA/QC Group.
16	Fully COMPLETE the fillet welding of one of the sleeve ends prior to commencing the welding of the second end.



NOTE:

- For sleeve sizes 14" or larger, two or more welders are required.
- Any one or a combination of adverse conditions can result in an in-service weld susceptible to burn through or hydrogen cracking.

Step	Activity
17	REMOVE by grinding any lugs or attachments applied for lifting.
18	INSPECT all welds in accordance with the company Welding Manual.
19	For Type A Sleeves where seal welding is not performed, APPLY a two-part, 100% solids epoxy filler material to the ends of the sleeve, lap bar sides, and other abrupt edges such as Armor Plate 360 or an approved equal. If a question regarding approved filler material arises, CONSULT with the Corrosion or Integrity Specialist.
20	For leaks ALLOW the Type B sleeve to pressure up and check for leaks after installation and prior to capping the nipple and bottle. SEAL the nipple and bottle with a weld cap after allowing the sleeve to pressure up to test for leakage.
21	VERIFY proper support of sleeves and adjacent pipe using sandbags prior to backfill.

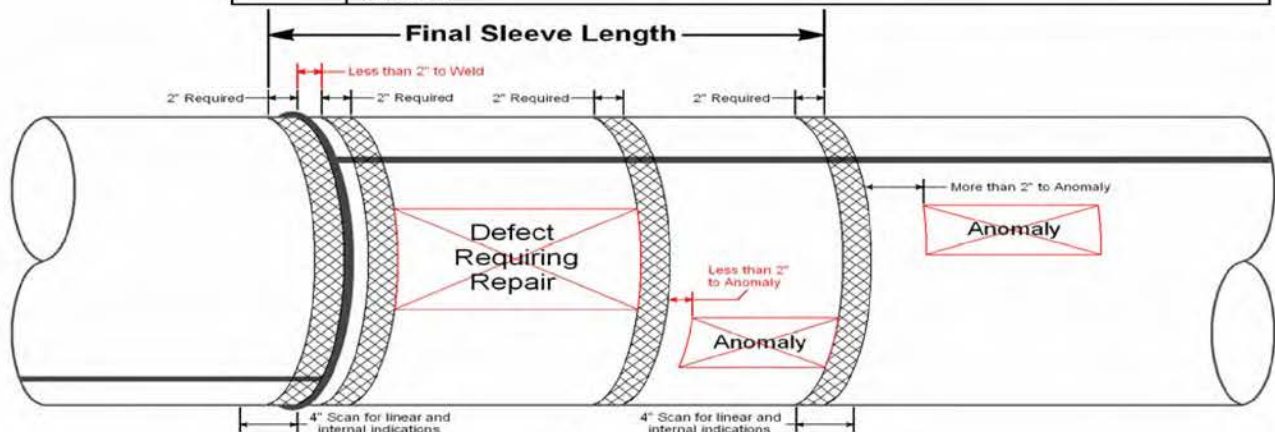


Figure 1

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**7.6.1
Installing
Type "A"
Sleeves Over
Pipe Seams:
Position the
Sleeve with the
Gap Over the
Seam**

Operations Personnel or Company Approved Contractor follows the procedure below when installing Type A sleeves over pipe seams by positioning the sleeve with the gap over the seam. Refer to *Step 17* in the table in *Section 7.6*.



CAUTION: This method can only be used when the defect is at least 3" away from the long seam.

Step	Activity
1	INSTALL a Type A sleeve with the gap between the two sleeve halves positioned along the longitudinal weld seam on the carrier pipe with the external bar spanning the gap. This positioning allows the sleeve to fit flush against the pipe on either side of the seam without having to grind the underside of the sleeve to fit over the weld.
2	INSTALL a three-part sleeve if necessary to ensure that the defect area is in contact with sleeve material. This ensures that the sleeve material, instead of the gap, covers a defect located 180° from the seam weld.

**7.6.2
Installing
Sleeves Over
Pipe Welds and
Seams:
Grinding the
Underside
of the Sleeve**

Operations Personnel or Company Approved Contractor follows the procedure below when installing sleeves over pipe girth welds and long seams by grinding into the sleeve.



NOTE: The QA/QC Group determines the acceptable depth to which a groove can be ground.

Step	Activity
1	GRIND a rounded groove in the inside surface of the sleeve to fit over a longitudinal seam, provided that sufficient sleeve wall thickness remains to meet the company sleeve design guidelines and no sharp corners are created. FOLLOW the acceptable methods described in the following diagram.

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Step	Activity
2	VERIFY a smooth groove with a U-shaped profile has been created, See Figure 2. V-shaped profiles or any other profile with corners in it are not acceptable.
3	USE a two-part, 100% solids epoxy to CONTOUR the weld to the adjacent pipe, and to VERIFY that no voids will exist between the weld and the sleeve.

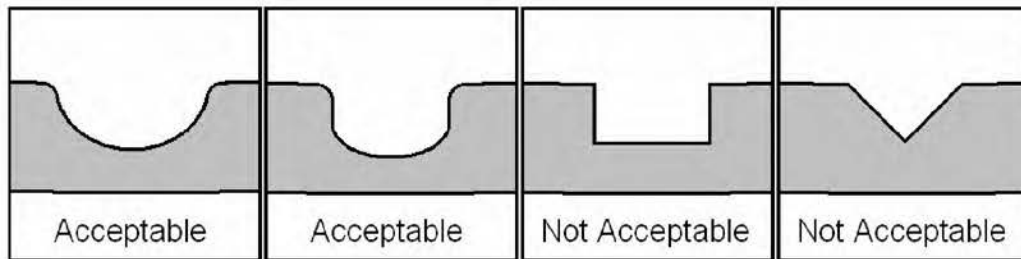


Figure 2: Acceptable Grooves

7.6.3 Installing Sleeves Over Pipe Welds and Seams: Grinding of the Cap

Operations Personnel or Company Approved Contractor follows the procedure below when installing sleeves over pipe girth welds, long seams or helical (spiral) seams by grinding the cap.



CAUTION:

- The Technical Operations Group must provide approval before removal of the weld cap for the purpose of fitting a sleeve.
- Do not grind the longitudinal seam weld on:
 - Pre 1970 or Low Frequency Electric resistance welded (ERW)
 - Single submerged arc welded (SSAW)
- Do not grind flush girth welds being spanned by a sleeve where the weld has not been X-rayed and the X-ray interpretation is acceptable per the latest edition of *API 1104* to verify its integrity. Never grind acetylene girth welds.



NOTE:

- Irregularities in the weld cap may be ground to a profile which is consistent with the remainder of the girth weld as long as the minimum weld cap height and smooth contour called for in the company welding procedures is maintained.
- When the integrity of the weld has been verified and the purpose of grinding is only for sleeve fit up, a more aggressive disc can be used. If preferred a solid ceramic "cutting" disc can be used.

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Step	Activity
1	VERIFY the integrity of the seam using black and white magnetic particle inspection (MPI) and ultrasonic inspection prior to grinding.
2	GRIND the seam such that it is flush for approximately 2" beyond the end of the sleeve. Then angle the grind to reach the original weld cap profile. CONTOUR the weld to remove any sharp edges.

7.6.4
Installing
Sleeves Over
Helical (Spiral)
Seams: Custom
Manufactured
Sleeve

Operations Personnel or Company Approved Contractor follows the procedure below when installing sleeves over spiral seams welds by using a custom manufactured sleeve.



NOTE: This method can result in a several day delay between the assessment and the repair while a sleeve is manufactured and delivered.

Step	Activity
1	CONTACT the Pipeline Integrity Group with the sleeve length, seam orientation, and outside diameter to find an acceptable sleeve manufacturer, if possible.
2	VERIFY the manufactured sleeve provides a tight fit-up over the defect area.

7.7
Welded
Encirclement
Sleeves:
Specialty Steel
Sleeves

Operations Personnel or Company Approved Contractor follows the procedure below when making repairs using a Specialty Steel Repair Sleeve.



STOP: Except for defects within 6 inches of a coupling, bend, or other oddity that prevents the installation of standard sleeves this section (and all "pumpkin" style sleeves) should not be used.



CAUTION:

- This section is limited to manufactured steel repair sleeves that do not adhere to the company standards for sleeve designs.
- Composite repair sleeves such as those made by Armor Plate® or Clock Spring® are covered in a separate section

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NOTE:

- Consult with the Pipeline Integrity Group if any questions or concerns arise about the type of specialty sleeve being used.
- Examples of manufactured steel repair sleeves include, but are not limited to:
 - Pumpkins
 - Sleeves designed to fit over a coupling
 - Sleeves without a straight profile

Step	Activity
1	FOLLOW the steps, warnings, cautions, and notes to install a typical steel sleeve and any other manufacturer instructions.
2	If a coupling or other object is present VERIFY the sleeve has enough clearance to pass over the object and still fit tight at the ends.
3	REFER to any special instructions provided by the Director of Pipeline Integrity for the specific installation.

7.8
**Composite
Reinforcement
Repairs**

Operations Personnel follows the procedure below for performing Composite Reinforcement Repairs. Contact the Corrosion Specialists regarding Composite Sleeve repair option.



WARNING: Composite Repairs shall only be performed with approval from the Director of Pipeline Integrity and only approved manufacturers shall be utilized, which may include:

- Clock Spring Composite Sleeve by Clock Spring Company, L.P
- Armor Plate Pipe Wrap by Armor Plate, Inc.
- Aquawrap by Air Logistics Corporation
- PermaWrap by WrapMaster Inc.
- A+Wrap by Pipe Wrap, LLC



NOTE:

- All composite material repair sleeves are to be installed in accordance with the manufacturer's recommendation.
- All employees and or contractors which are directly participating in the installation of a composite material repair sleeve must be trained and certified by a composite material repair technique certified trainer.
- The composite repair must extend a minimum of two (2) inches beyond each end of the defective area.

Step	Activity
1	FILL all sharp geometry changes such as edges and lips with epoxy (as allowed by the manufacturer) to provide a smooth transition to the pipe and aid in coating.

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2	VERIFY all composite repairs are appropriately identified with magnets or bands for ILI detection.
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8.0 Record data in electronic database or utilize the following form(s) as applicable:

Documentation Requirements

Pipe Inspection Report or Maintenance Record
Project Book (Welding, NDE, Design, Inspectors notes, Etc.)
As-Built Drawings
I.05.D Pre-Job Safety Meeting;

9.0 HLB.11 Project Documentation and As-Built Process
References HLD.47 Evaluation of Remaining Strength of Pipeline Metal Loss
HLI.06 Evaluating Pipeline Defects
HLI.10 Excavation and Backfill
HLI.11 Pipeline Pressure Limit Criteria
Safety Procedure S-020 Asbestos Removal and Maintenance
Coating Procedures Manual
Company Welding Procedures Manual

Appendix A: The table below identifies any Operator Qualification (OQ) task requirements for this
OQ Task SOP.
Requirements

Task Description	OQ Task
Install mechanical clamps and sleeves -- bolted	PLOQ707
Apply Permanent field repair using composite materials - PermaWrap™ / WeldWrap™ (WrapMaster Products)	PLOQ706A
Apply Permanent field repair using composite materials - PipeWrap A+ Wrap™	PLOQ706B
Clockspring	PLOQ706C
Fabricate and fit-up repair sleeves	PLOQ708
Repair of steel pipe by grinding	PLOQ704
Visual Inspection of Welding and Welds	PLOQ203
Apply composite reinforcement products for repair of mechanically damaged or corroded pipe	PLOQ706

Appendix B:
Company
approved
Permanent
Repair method

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DEFECT TYPE AND LOCATION		COMPANY APPROVED PERMANENT REPAIR METHODS (1) (8)					
		Repair By Grinding	Type A Sleeve (9) (11)	Type B Sleeve (10) (11)	Composite Reinforcement (12)	Mechanical Type B Sleeve	Mechanical Leak Clamp (12)
EXTERNAL METAL LOSS ≤ 80% W.T.	Pipe Seam	No	Yes (2)	Yes (2)	Yes (2)	Yes (3) (4)	No
	Girth Weld	No	Yes (2)	Yes (2)	Yes (2)	Yes (3) (4)	No
	Pipe Body	No	Yes (2)	Yes (2)	Yes (2)	Yes (3) (4)	No
	Pipe Bend	No	Yes (2)	Yes (2)	Yes (2)	Yes (3) (4)	No
EXTERNAL METAL LOSS > 80% W.T.	Pipe Seam	No	No	Yes (2)	No	Yes (3) (4)	No
	Girth Weld	No	No	Yes (2)	No	Yes (3) (4)	No
	Pipe Body	No	No	Yes (2)	No	Yes (3) (4)	No
	Pipe Bend	No	No	Yes (2)	No	Yes (3) (4)	No
INTERNAL METAL LOSS ≤ 80% W.T.	Pipe Seam	No	Yes (4)	Yes	Yes (4)	Yes (3) (4)	No
	Girth Weld	No	Yes (4)	Yes	Yes (4)	Yes (3) (4)	No
	Pipe Body	No	Yes (4)	Yes	Yes (4)	Yes (3) (4)	No
	Pipe Bend	No	Yes (4)	Yes	Yes (4)	Yes (3) (4)	No
INTERNAL METAL LOSS > 80% W.T.	Pipe Seam	No	No	Yes	No	Yes (3) (4)	No
	Girth Weld	No	No	Yes	No	Yes (3) (4)	No
	Pipe Body	No	No	Yes	No	Yes (3) (4)	No
	Pipe Bend	No	No	Yes	No	Yes (3) (4)	No
DENTS WITH STRESS CONCENTRATORS OR METAL LOSS	Pipe Seam	No	Yes (5) (2)	Yes (5)	Yes (5) (2)	Yes (3) (4) (5)	No
	Girth Weld	No	Yes (5) (2)	Yes (5)	Yes (5) (2)	Yes (3) (4) (5)	No
	Pipe Body	No	Yes (5) (2)	Yes (5)	Yes (5) (2)	Yes (3) (4) (5)	No
	Pipe Bend	No	Yes (5) (2)	Yes (5)	Yes (5) (2)	Yes (3) (4) (5)	No
PLAIN DENTS	Pipe Seam	No	Yes (2)	Yes (2)	Yes (2)	Yes (3) (4)	No
	Girth Weld	No	Yes (2)	Yes (2)	Yes (2)	Yes (3) (4)	No
	Pipe Body	No	Yes (2)	Yes (2)	Yes (2)	Yes (3) (4)	No
	Pipe Bend	No	Yes (2)	Yes (2)	Yes (2)	Yes (3) (4)	No
(GOUGES) MECHANICAL DAMAGE	Pipe Seam	Yes (13)	Yes (6) (2)	Yes (6)	Yes (6) (2)	Yes (3) (4) (6)	No
	Girth Weld	Yes (13)	Yes (6) (2)	Yes (6)	Yes (6) (2)	Yes (3) (4) (6)	No
	Pipe Body	Yes (13)	Yes (6) (2)	Yes (6)	Yes (6) (2)	Yes (3) (4) (6)	No
	Pipe Bend	Yes (13)	Yes (6) (2)	Yes (6)	Yes (6) (2)	Yes (3) (4) (6)	No
SURFACE BREAKING LINEAR INDICATIONS	Pipe Seam	Yes (13)	Yes (7) (2)	Yes	Yes (7) (2)	Yes (3) (4)	No
	Girth Weld	Yes (13)	Yes (7) (2)	Yes	Yes (7) (2)	Yes (3) (4)	No
	Pipe Body	Yes (13)	Yes (7) (2)	Yes	Yes (7) (2)	Yes (3) (4)	No
	Pipe Bend	Yes (13)	Yes (7) (2)	Yes	Yes (7) (2)	Yes (3) (4)	No
LEAKS	Pipe Seam	No	No	Yes	No	Yes (3) (4)	No
	Girth Weld	No	No	Yes	No	Yes (3) (4)	No
	Pipe Body	No	No	Yes	No	Yes (3) (4)	Yes (4) (14)
	Pipe Bend	No	No	Yes	No	Yes (3) (4)	Yes (4) (14)
WELD FLAWS	Pipe Seam	No	No	Yes	No	Yes (3) (4)	No
	Girth Weld	No	No	Yes	No	Yes (3) (4)	No
WRINKLES (1)	All	No	No	No	Yes	No	No
ARC BURN/HARD SPOT	Pipe Body	Yes (13)	Yes (5)	Yes	Yes (5)	Yes (3) (4)	No
OBSOLETE MATERIALS (1)	All	No	No	No	No	No	No
LAMINATION	Pipe Body	No	Yes	Yes	Yes	Yes (3) (4)	No
	Pipe Bend	No	Yes	Yes	Yes	Yes (3) (4)	No

Table-01 Company Approved Permanent Repair Method

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**Notes for
Table-01**

The following notes apply to the *Table 1*:

1. Pipe replacement should be performed whenever practical, other repairs may acceptable with approval from the Pipeline Integrity Group.
2. A hardenable, incompressible filler shall be used to fill the annular space between the anomaly and the sleeve.
3. Shall only be utilized offshore or within navigable waters.
4. May be utilized on onshore pipelines as a temporary repair until it is feasible to make a permanent repair.
5. Stress concentrators will be removed by grinding prior to installing the sleeve. If no grinding is performed or the stress concentrators are not completely removed, then a Type B sleeve shall be used.
6. The mechanical damage will be removed by grinding to a smooth contour prior to installing the sleeve. If the remaining thickness is less than 20% W.T. after removal, then a Type B sleeve shall be used. If no grinding is performed or the stress concentrators are not completely removed, then a Type B sleeve shall be used.
7. The SCC shall be removed by grinding. If the remaining thickness is less than 20% W.T. after removal, then a Type B sleeve shall be used.
8. Other repair methods may be used provided they are based on sound engineering practices and reviewed and approved by Pipeline Integrity prior to their use.
9. Type A repair sleeves are designed not to be pressure containing and shall only be used on non-leaking defects. The ends of the sleeve shall be sealed to prevent migration of water between the sleeve and the carrier pipe.
10. Type B repair sleeves are designed to contain pressure and/or carry substantial longitudinal stress imposed on the pipeline by lateral loads. The circumferential ends of the sleeve are fillet-welded to the carrier pipe.
11. The design of all Type A and Type B sleeves shall be reviewed by Engineering.
12. Only with approval from the Pipeline Integrity Group and only approved manufacturers shall be utilized.
13. With prior approval from the Pipeline Integrity Group, Grinding is permitted to a depth of 10% of the required wall thickness with no limit on length or; Grinding is permitted to a depth greater than 10% up to a maximum of 40% of the required wall thickness with metal removal confined to a length given by the equation in paragraph 851.42 of ASME B31.8-2003.
14. For isolated through wall pits only

**Standard Operating Procedures***Applicable to Hazardous Liquids Pipelines and Related Facilities*

Code Reference :	Procedure No.: HLI.06	
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1.0 Procedure Description This Standard Operating Procedure (SOP) describes the steps required to consistently characterize and evaluate defects in a pipeline.

2.0 Scope This SOP determines the characteristics of pipeline defects required to verify integrity and necessity for repair or replacement.

3.0 Applicability This SOP applies to the characterization of any defect affecting the integrity of pipeline facilities.

4.0 Frequency As required: Upon discovery of pipeline defects.

5.0 Governance The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Pipeline Integrity Personnel or Corrosion Specialist	Vice President of Pipeline Integrity

6.0 Terms and Definitions Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

Terms	Definitions
Arc burn	A hard spot or gouge caused by the arc of a welding tool or any unknown source.
Constrained Dent	A dent that is not free to rebound or reround, because the indenter is not removed (a rock dent is an example of a constrained dent).
Crack	A fracture type discontinuity in the pipe wall with sharp tips.
Dent	Permanent deformation of circular cross section produces a decrease in diameter and is concave inward.

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Terms	Definitions
Dent involving a weld	Any dent that involves either a longitudinal or girth weld.
Dent with metal loss	A dent with metal loss that is associated with; scratches, gouges, grooves, or corrosion.
Gouges and other metal loss	Scratches, gouges, mill pits, grinding marks
HAZ	Heat affected zone
Lamination	An internal metal separation that creates layers in the pipe wall which are generally parallel to the longitudinal axis of the pipe surface
Longitudinal seam weld anomaly	Any anomaly that is caused by, constrained to, or specific to, the longitudinal weld. Anomalies vary based on weld type but may result from manufacturing or be time dependent such as: Hook cracks, Inclusions, Lack of fill, Lack of fusion, Porosity, Selective seam weld corrosion, Toe crack, Undercut, or others.
Other defects	Any defect that doesn't meet the characteristics of the above referenced defects but may impact the serviceability of the pipeline
Ovality	A flattening of the pipe in which the circular cross section becomes elliptical (ovular); and where the length is typically significantly greater than the ovality percent. This is caused by outside forces and may be due to land movement or heavy loading across the line.
Plain Dent	A depression that produces a disturbance in the curvature of the pipe wall without reducing wall thickness that does not interact with any other anomalies such as corrosion, gouges, hard spots, or linear indications.
Stress Corrosion Crack (SCC)	A crack or colony of cracks in the pipe wall that are classified as being environmentally assisted. SCCs are generally, but not always, associated with piping that meets the criteria identified in ASME B31.8 S
Surface breaking linear indication	A linear accumulation of magnetic powder on the surface of the pipe body found using magnetic particle inspection in accordance with <i>SOP HLD.45 Wet Magnetic Particle Inspection</i> .
Weld defect	Weld defects are characterized as, but not limited to, the following: Porosity, wormholes, slag, inclusions, cavities, cracking, lack of fusion, or undercut.
Wrinkle	A circumferential pipe deformation found on the inside bend radius of a pipe caused during the construction process to obtain pipeline alignment.

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7.0

Evaluating Pipeline Defects

This section describes these procedures for evaluating pipeline defects:

- Evaluation
- Corrosion, general metal loss, and wall thickness deviations
- Gouges and other metal loss
- Plain Dents
- Dents with metal loss
- Dents involving welds
- Inclusions
- Laminations
- Surface breaking linear indications
- Stress corrosion cracks
- Longitudinal seam weld defects
- Wrinkles
- Internal metal loss
- Obsolete materials or installations, and other defects
- Arc burns
- Ovality

7.1

Evaluation

Perform the following process in order to evaluate defects in pipelines.

Step	Task
1	CHARACTERIZE defects in the pipeline in order to determine the extent to which the serviceability of the pipeline has been impaired.
2	ESTABLISH inspection pressure reduction per <i>SOP HLI.11 Pipeline Pressure Limit Criteria</i> . CONFIRM pressure reductions required for all pipeline segments.
3	If there is a question regarding the characterization of a defect, CONSULT with the Pipeline Integrity Group
4	EVALUATE defects based upon one or a combination of the methods described in this SOP.
5	CONFIRM all evaluations of pipeline corrosion, damage, or other defects.



NOTE: Establish a safe excavation per *SOP HLI.10 Excavation and Backfill*.

7.2

Corrosion, General Metal Loss, and Wall Thickness Deviations

Operations Personnel or Company Approved Contractor / Pipeline Integrity Group follows the steps below to evaluate corrosion, general metal loss, and wall thickness deviations.

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Step	Activity
1	CHARACTERIZE a defect with the single characteristic of a measurable reduction in wall thickness as “corrosion or general metal loss.”
2	EVALUATE external corrosion and general metal loss defects in the pipe wall, girth welds, and longitudinal seams in accordance with <i>SOP HLD.47 Evaluation of Remaining Strength of Pipe with Metal Loss</i> .
3	CONFIRM defect characterization and evaluation with Corrosion Specialist.
4	REPAIR external corrosion and general metal loss if required per <i>SOP HLI.05 Pipeline Repair</i> .



NOTE: For pre-1970 Electric Resistance Welded (ERW) pipe confirm that the corrosion is not in the seam, use Ammonium Persulfate to identify the seam if necessary. Pre-1970 ERW and Electric Flash Welded (EFW) pipe with corrosion damage interacting with the seam or HAZ and penetrating deeper than the pipe wall cannot be assessed using remaining strength calculations and must be repaired.

7.3 Gouges and Other Metal Loss

Operations Personnel or Company Approved Contractor / Pipeline Integrity Group follows the steps below to evaluate gouges and other metal loss.

Step	Activity
1	INSPECT and EVALUATE metal loss defects in the pipe (i.e., scratches, gouges, mill pits, grinding marks, etc.) to determine the extent of damage.
2	If the extent of the damage is limited to a general reduction in wall thickness, CHARACTERIZE the defect as “corrosion or general metal loss,” and EVALUATE the defect per <i>SOP HLD.47 Evaluation of Remaining Strength of Pipe with Metal Loss</i> .
3	If any of the following characteristics exist that may impair the serviceability of the pipe, CHARACTERIZE the defect as a “gouge or other metal loss defect”: <ul style="list-style-type: none"> • Sharp defect edges • Stress concentrators • Hard spots • Cracking • Plastically deformed material
4	CONSIDER using Ammonium Persulfate to INSPECT for a hard spot.
5	USE magnetic particle inspection (MPI) to inspect for linear indications according to <i>SOP HLD.45 Wet Magnetic Particle Inspection</i> . Dye penetrant inspection (DPI) or other NDE Methods may be permitted as directed by Corrosion Specialist or Pipeline Integrity Group.

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Step	Activity
6	CONFIRM defect characterization and evaluation with company Corrosion Specialist.
7	REPAIR defect per <i>SOP HLI.05 Pipeline Repair</i> .



NOTE: If mechanical damage involving a dent or gouge is suspected, take a pressure reduction according to *SOP HLI.11 Pipeline Pressure Limit Criteria*.

7.4 Plain Dents

Operations Personnel or Company Approved Contractor follows the steps below to evaluate plain dents.

Step	Activity
1	CHARACTERIZE a depression that produces a disturbance in the curvature of the pipe wall without reducing the pipe wall thickness as a “dent with no metal loss.”
2	MEASURE the depth of a dent from the lowest point of the depression to a straight line representing the original contour of the pipe.



CAUTION: Do not use MFL data to determine the depth of a dent.

Step	Activity
3	INSPECT for hard spots using Ammonia Persulfate or other acid etching method.
4	INSPECT and EVALUATE all excavated dents with magnetic particle inspection (MPI) for the presence of linear indications. Dye penetrant inspection (DPI) or other NDE Methods may be permitted as directed by Corrosion Specialist or Pipeline Integrity Group. If linear indications are evident or if there is a concern that the dent has been prestrained or has “re-rounded,” REPAIR the section of pipe containing the dent per <i>SOP HLI.05 Pipeline Repair</i> .
5	For all dents in pipe containing a dent that measures more than ¼ inch deep in pipe less than or equal to 12 inches diameter, or which measures more than 2% of the nominal pipe diameter in pipe over 12 inches diameter, REPAIR pipe per <i>SOP HLI.05 Pipeline Repair</i> .
6	DETERMINE if the dent was constrained prior to excavation. REPAIR all constrained dents per <i>SOP HLI.05 Pipeline Repair</i> regardless of depth.
7	DOCUMENT characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

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NOTE: If mechanical damage involving a dent or gauge is suspected, take a pressure reduction according to *SOP HLI.11 Pipeline Pressure Limit Criteria*.

7.5 Dents with Metal Loss

Operations Personnel or Company Approved Contractor follows the steps below to evaluate dents with metal loss.



NOTE: Dents containing metal loss include those that are scratched, gouged, grooved, or corroded.

Step	Activity
1	MEASURE the depth of a dent from the lowest point of the depression to a straight line representing the original contour of the pipe.
2	EVALUATE metal loss in accordance with <i>SOP HLD.47 Evaluation of Remaining Strength of Pipe with Metal Loss</i>
3	CHARACTERIZE a depression that produces a disturbance in the curvature of the pipe wall and has reduction the pipe wall thickness as a “dent with metal loss.”
4	INSPECT for hard spots using Ammonia Persulfate or other acid etching method.
5	INSPECT and EVALUATE all excavated dents with magnetic particle inspection (MPI) for the presence of linear indications. Dye penetrant inspection (DPI) or other NDE Methods may be permitted as directed by Corrosion Specialist or Pipeline Integrity Group.
6	DOCUMENT characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.
7	REPAIR defect per <i>SOP HLI.05 Pipeline Repair</i> .

7.6 Dents Involving Welds

Operations Personnel or Company Approved Contractor follows the steps below to evaluate dents involving welds.

Step	Activity
1	MEASURE the depth of a dent from the lowest point of the depression to a straight line representing the original contour of the pipe.
2	INSPECT for hard spots using Ammonia Persulfate or other acid etching method.
3	INSPECT and EVALUATE all excavated dents with magnetic particle inspection (MPI) for the presence of linear indications. Dye penetrant inspection (DPI) or other NDE Methods may be permitted as directed by Corrosion Specialist or Pipeline Integrity Group.
4	REPAIR any pipe with a dent involving a longitudinal seam or girth weld,

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Step	Activity
	per <i>SOP HLI.05 Pipeline Repair</i> .
5	Each weld that is repaired must have the defect removed down to sound metal and the segment to be repaired must be preheated if conditions exist which would adversely affect the quality of the weld repair. After repair, the segment of the weld that was repaired must be inspected to ensure its acceptability.
6	DOCUMENT characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

7.6.1 Dents with Linear Indications

Operations Personnel or Company Approved Contractor follow the steps below to evaluate dents that have been further characterized as dents with linear indications.

Step	Activity
1	INSPECT and EVALUATE all excavated dents with magnetic particle inspection (MPI) for the presence of linear indications. Dye penetrant inspection (DPI) or other NDE Methods may be permitted as directed by Corrosion Specialist or Pipeline Integrity Group.
2	CHARACTERIZE a depression that produces a disturbance in the curvature of the pipe wall and that has a linear indication (as found with Magnetic Particle Inspection) as a “dent with linear indication.”
3	EVALUATE and CONFIRM if the linear indication can be removed by grinding in accordance with <i>SOP HLI.05 Pipeline Repair</i> . If removed, TREAT the remaining dent as a dent with metal loss.
4	REPAIR , per <i>SOP HLI.05 Pipeline Repair</i> , any pipe with dents containing a linear indication (that cannot be removed by grinding).
5	DOCUMENT characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

7.7 Inclusions

Operations Personnel or Company Approved Contractor follows the steps below to determine and evaluate inclusions.



WARNING: An inclusion does not normally affect the integrity of the material. However, do not perform welding on an area of material with known inclusion defects.

Step	Activity
1	CHARACTERIZE a metallic or non-metallic solid material trapped within the wall of the pipe or weld metal as an inclusion
2	EVALUATE inclusions thoroughly using ultrasonic inspection or other methods.

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Step	Activity
3	COORDINATE the determination of the evaluation method with the QA/QC Group.
4	DOCUMENT characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

7.8 Laminations

Operations Personnel or Company Approved Contractor / Pipeline Integrity Department follows the steps below to determine, evaluate and repair laminations.

Step	Activity
1	CHARACTERIZE an internal metal separation creating layers generally parallel to the pipe surface as a lamination.
2	EVALUATE material adjacent to a lamination to verify that no additional defects exist. MEASURE the dimensions of the lamination using <i>SOP HLI.34 Use of Ultrasonic Thickness Equipment for Measurement of Wall Thickness</i> .
3	CHARACTERIZE a lamination that is greater than 12 square inches in total area as potentially impairing the serviceability of the pipeline. CONTACT the Pipeline Integrity Group if this criteria is met.
4	REPAIR laminations that may impair the serviceability of the pipeline per <i>SOP HLI.05 Pipeline Repair</i> .
5	DOCUMENT characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.



CAUTION: Welding and flame cutting should not be performed on areas of material with known laminations.

7.9 Surface Breaking Linear Indications

Operations Personnel or Company Approved Contractor follows the steps below to determine, evaluate, and repair linear indications.

Step	Activity
1	CHARACTERIZE a fracture type discontinuity with sharp tips as cracking linear indication.
2	MEASURE and EVALUATE the length of cracks with wet magnetic particle inspection (MPI) or dye penetrant inspection (DPI) as directed by Corrosion Specialist or Pipeline Integrity Group.
3	REPAIR cracks that threaten the serviceability of the pipeline per <i>SOP HLI.05 Pipeline Repair</i> .
4	DOCUMENT characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

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NOTE: A crack in an existing girth weld can be repaired provided the length of the crack is less than 8% of the weld length.

7.10
Stress
Corrosion
Cracks (SCC)

Operations Personnel or Company Approved Contractor / Pipeline Integrity Group follows the steps below to determine, evaluate, and repair stress corrosion cracks.

Step	Activity
1	IDENTIFY a group of linear indications as suspected Stress Corrosion Cracking (SCC).
2	CONTACT Pipeline Integrity Group when evidence of Stress Corrosion Cracking (SCC) is discovered.
3	EVALUATE stress corrosion cracks with a wet magnetic particle inspection (MPI) or dye penetrant inspection (DPI) as directed by Corrosion Specialist or Pipeline Integrity Group.
4	REPAIR stress corrosion cracks per <i>SOP HLI.05 Pipeline Repair</i> .
5	DOCUMENT characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

7.11
Longitudinal
Seam Weld
Defects

Operations Personnel or Company Approved Contractor / Pipeline Integrity Group follows the steps below to characterize and evaluate longitudinal seam weld defects.

Step	Activity
1	CHARACTERIZE and evaluate weld defects with appropriate visual and Non-Destructive Testing (NDT) inspection. REFER to Appendix C for seam type clarification. For girth weld indications REFER to the welding manual.
2	EVALUATE long seam indication in accordance with API5L.
3	CONTACT the Pipeline Integrity Group for acceptance criteria and repair methods for weld defects found in specific types of longitudinal welds.
4	REPAIR in accordance with <i>SOP HLI.05 Pipeline Repair</i> .
5	DOCUMENT characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

7.12
Wrinkles

Operations Personnel or Company Approved Contractor / Pipeline Integrity Group follows the steps below to characterize and evaluate wrinkles.

Step	Activity
1	CHARACTERIZE an irregular waiver in the pipe with a ripple height (d) to

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Step	Activity
	pipe diameter (D) ratio ≤ 0.01 when measured with a 6" long straight edge oriented longitudinally, as a wrinkle.
2	NOTIFY the Pipeline Integrity Group
3	REPAIR defect in accordance with <i>SOP HLI.05 Pipeline Repair</i> .
4	DOCUMENT characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

**7.13
Internal Metal
Loss**

Operations Personnel or Company Approved Contractor / Pipeline Integrity Department characterizes the location where internal metal loss is discovered or an anomaly is indicated by inline inspection tool.

Step	Activity
1	EVALUATE the defect in accordance with <i>SOP HLD.47 Evaluation of Remaining Strength of Pipe with Metal Loss</i> as directed by Pipeline Integrity Department.
2	REPAIR defect in accordance with <i>SOP HLI.05 Pipeline Repair</i> .
3	DOCUMENT characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

**7.14
Obsolete
Materials or
Installations &
Other Defects**

Operations Personnel or Company Approved Contractor follows the steps below to evaluate obsolete materials or installations, or other defects that do not fall under a standard category.



NOTE:	
<ul style="list-style-type: none"> Examples may include miter welds greater than 3 degrees, branch tees with weld pads, patches, and orange peel. An existing facility that was constructed using materials or methods that are no longer considered acceptable practice may need to be replaced. 	

Step	Activity
1	CONTACT the Pipeline Integrity Group or QA/QC Group
2	DEVELOP repair plan in accordance with <i>SOP HLI.05 Pipeline Repair</i> .
3	DOCUMENT characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

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7.15
Arc Burns

Operations Personnel or Company Approved Contractor / Pipeline Integrity Group follows the steps below to evaluate arc burns.

Step	Activity
1	CHARACTERIZE a hard spot or a hard spot and gouge caused by the arc of a welding tool or any unknown source as an “arc burn.”
2	INSPECT and EVALUATE the area visually for metal damage and signs of significant metallurgical changes at the location of the arc burn.
3	CONTACT Corrosion Specialist or Pipeline Integrity Group for an Ammonium Persulfate etch procedure and criterion for arc burn assessment if needed. If necessary, USE a 20% Ammonium Persulfate etch to assess the metallurgical effects of an arc burn.
4	As directed by Corrosion Specialist or Pipeline Integrity Group, EVALUATE an arc burn with magnetic particle (MP) in order to inspect for cracking. USE wet magnetic particle inspection (MPI) to verify the presence of potential cracking due to hardness. Dye penetrant inspection (DPI) or other NDE Methods may be permitted as directed by Corrosion Specialist or Pipeline Integrity Group.
5	If visual and magnetic particle inspection determines the arc burn to be non-injurious, CONSULT with the Pipeline Integrity Group to determine if the defect can be removed by grinding or filing.
6	If an arc burn has caused apparent damage that could be detrimental to the integrity of the pipe, REPAIR the arc burn per <i>SOP HLI.05 Pipeline Repair</i> .



NOTE: Arc burn damage that may be detrimental to the integrity of the pipe includes but is not limited to:

- Cracking
- Metal loss
- Hardness levels
- Stress concentrators

7.16
Ovality

Operations Personnel or Company Approved Contractor / Pipeline Integrity Group follows the steps below to evaluate ovalities.

Step	Activity
1	CHARACTERIZE ovality as any flattening of the pipe that occurs on opposite sides of the circumference in a relatively uniform manner over a long distance. (I.e. The pipe is flattened at 12:00 and 6:00, and expanded at 3:00 and 9:00, for an entire joint.)
2	CONTACT the Pipeline Integrity Group to determine if it needs to be repaired in accordance with <i>SOP HLI.05 Pipeline Repair</i> .
3	DOCUMENT characterizations and evaluations in the Pipe Inspection Report

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	or Maintenance Record.
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**8.0
Documentation
Requirements**

Record data in electronic database or utilize the following forms as applicable:

Pipe Inspection Report or Maintenance Record; retain on location for the life of the facility.

**9.0
References**

HLD.47 Evaluation of Remaining Strength of Pipe with Metal Loss
HLD.45 Wet Magnetic Particle Inspection
HLI.05 Pipeline Repair
HLI.10 Excavation and Backfill
HLI.11 Pipeline Pressure Limit Criteria
HLI.34 Use of Ultrasonic Thickness Equipment for Measurement of Wall Thickness

**Appendix A:
OQ Task
Requirements**

The table below identifies the Operator Qualification (OQ) task requirements for this SOP.

Task Description	OQ Task
Measure and evaluate pipeline defects.	PLOQ418A
Demonstrate proper use of Pipe Thickness Gauge (Ultrasonic)	PLOQ008
Visual Inspection of Welding and Welds	PLOQ203
Utilize Wet Mag Particle Inspection to identify cracks	PLOQ205
Visual Inspection for Internal Corrosion	PLOQ401
Visual Inspection for Atmospheric Corrosion	PLOQ414
Demonstrate the use of a pit gauge	PLOQ421

Evaluating Pipeline Defects

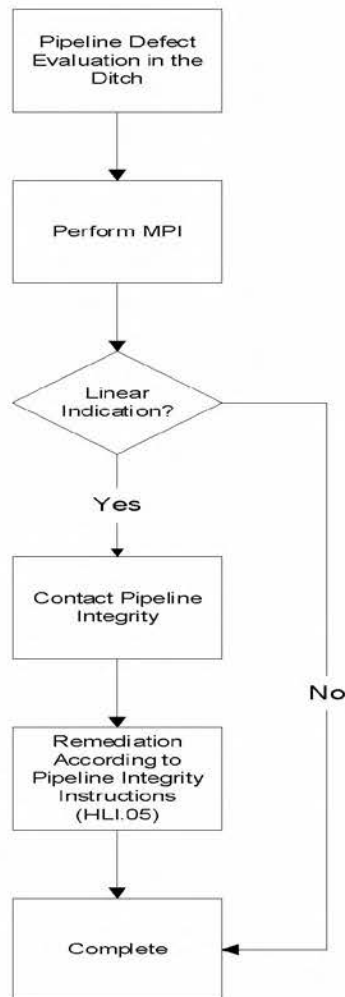
Standard Operating Procedures

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Appendix B: The figure below identifies the process for evaluating linear indications in the Ditch.
Flow Chart for
Linear
Indications in
the Ditch

Field SOP (HLI.06)
Evaluation in the ditch



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Appendix C: This appendix should be used to identify longitudinal welds in the field and determine anomalies specific to each type of weld.
Longitudinal Seam Identification

Double Submerged Arc Welding (DSAW) – formed through the deposition of a weld metal on both the outside and inside surface. Single Submerged Arc Welding (SSAW), where the pipe is only welded from the outside surface, is almost never used for longitudinal seams. Typical anomalies include (but are not limited to) lack of fusion, toe cracks, HAZ cracks, porosity, inclusions, and lack of fill.



Figure 1. Actual DSAW Long Seam

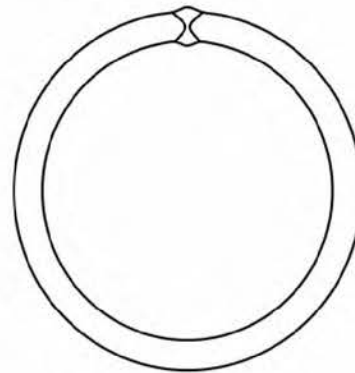
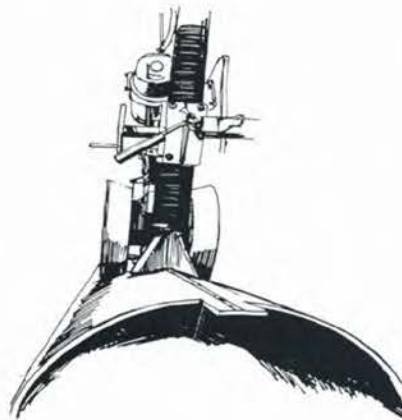


Figure 2. DSAW Profile



Outside Welding



Inside Welding

Figure 3. Manufacturing Process for Lap Weld
(Image from History of Line Pipe Manufacturing in North America)

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Electric Resistance Welding (ERW) – formed by passing a current through the pipe effectively melting the two sides together without the use of any additional weld material. Any cap or excess metal resulting from the process is trimmed flush with the pipe making identification difficult in the field. Typical anomalies include (but are not limited to) lack of fusion, HAZ cracks, and contact marks.



Figure 4. Actual ERW Long Seams

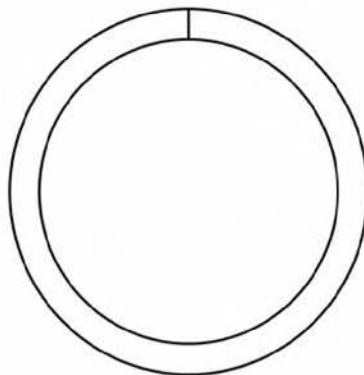


Figure 5. ERW Profile

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Electric Flash Welding (EFW) – formed similarly to ERW by passing a current through the pipe effectively melting the two sides together without the use of any additional weld material. This was only produced by the A.O. Smith Company and is characterized by a cap that is trimmed squarely. Typical anomalies include (but are not limited to) lack of fusion, HAZ cracks, and selective seam corrosion.



Figure 4. Actual EFW Long Seams

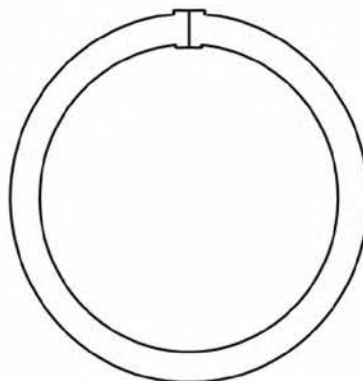


Figure 5. EFW Profile

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Lap Welding – formed by trimming the edges of the plate at an angle and then overlaying them, this provides for a larger surface area to be welded. No additional weld material is used and the weld is formed by heating the entire plate and forcing it between rollers that press it together. Typical anomalies include (but are not limited to) lack of fusion.



Figure 6. Manufacturing Process for Lap Weld

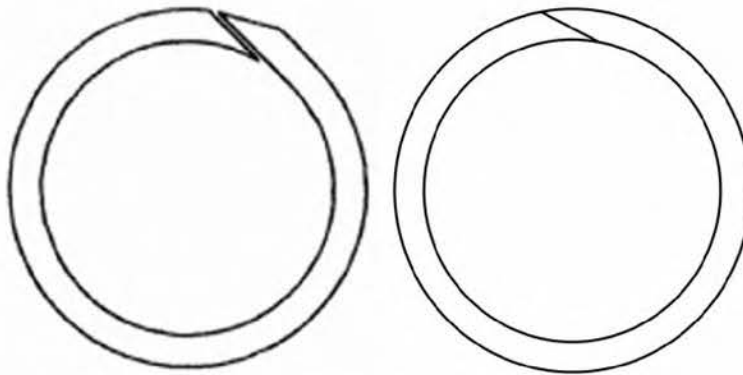


Figure 7. Lap Weld Profile Before and After Forming

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Hammer Welding – formed by heating and overlaying the ends of the plate and then beating them down to the wall thickness of the pipe. This provided for a larger surface area to be welded. No additional weld material is used. Typical anomalies include (but are not limited to) lack of fusion.

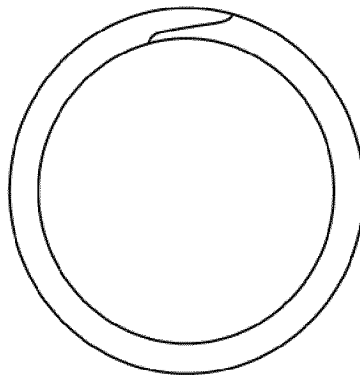


Figure 8. Hammer Weld Profile

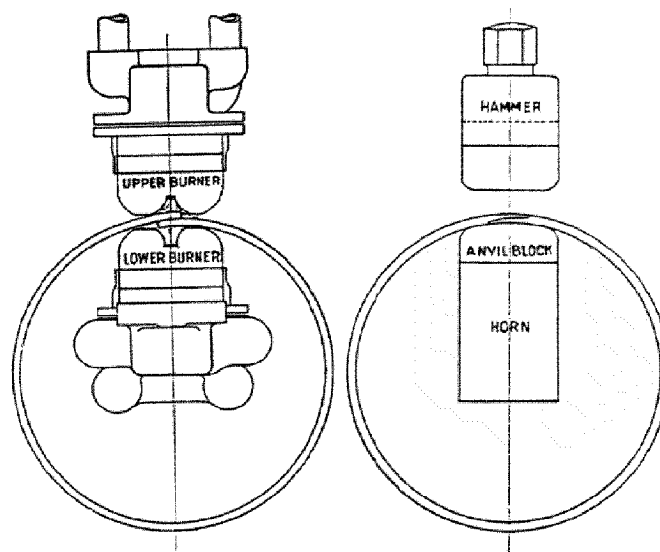


Figure 9. Manufacturing Process for Hammer Weld

(Image from History of Line Pipe Manufacturing in North America)

***Lowering or Raising
In-Service Pipelines******Standard Operating Procedures****Applicable to Hazardous Liquids Pipelines and Related Facilities*

Code Reference :	Procedure No.: HLI.08	
49 CFR 195.424, API 1117	Effective Date: 04/01/18	Page 1 of 25

**1.0
Procedure
Description** This Standard Operating Procedure (SOP) describes how to lower or raise, a liquids pipeline due to soil erosion, road crossings, cultivation, shorted casings, subsidence, or other reasons. This SOP also establishes guidelines to prevent over-stressing operating pipelines when lifting.

**2.0
Scope** This procedure satisfies the requirement for lowering and raising in-service pipelines in a safe manner.

**3.0
Applicability** This SOP is utilized during pipeline lowering or raising operations to minimize stresses and protect pipe and coating from damage.

**4.0
Frequency** As required for lowering and/or raising in-service pipelines.

**5.0
Governance** The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Operations Manager	Area Director

**6.0
Terms and
Definitions** Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

Terms	Definitions
Strain Gauge	Instrument used to monitor stress induced by pipeline movement.

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7.0

Lowering or Raising In-Service Pipelines

The following procedures are described in this section:

- Evaluating the Potential for Lowering a Pipeline
- Developing a Lowering Plan and Profile
- Excavation of the Pipeline
- Inspecting the Exposed Pipeline
- Final Preparations for Lowering the Pipeline
- Performing the Lowering Operation
- Lifting Pressurized Pipelines Using Air Bags

7.1

Evaluating the Potential for Lowering a Pipeline

Operations Personnel use the following procedure to evaluate the potential for lowering a pipeline.



CAUTION:

- A. No movement of any line pipe may be performed unless the pressure in the line is reduced to not more than 50% of the MOP.
- B. No operator may move any pipeline containing highly volatile liquids where materials in the line section involved are joined by welding unless:
 1. Movement when the pipeline does not contain highly volatile liquids is impractical
 2. The procedures of the operator under 195.402 contain precautions to protect the public against the hazard in moving pipelines containing highly volatile liquids, including the use of warnings, where necessary, to evacuate the area close to the pipeline; and
 3. The pressure in that line section is reduced to the lower of the following:
(Note: If this requirement cannot be achieved the line shall be removed from service)
 - i. 50% or less of the MOP; or
 - ii. The lowest practical level that will maintain the highly volatile liquid in a state with continuous flow but not less than 50 psig above the vapor pressure of the commodity
- C. No operator may move any pipeline containing highly volatile liquids where materials in the line section involved are not joined by welding unless:
 1. The operator complies with the paragraph B 1 & 2 above.
 2. The line section is isolated to prevent the flow of highly volatile liquid

Step	Activity
1	ANALYZE various considerations carefully to determine whether this type of modification is appropriate.
2	UNDERSTAND the special considerations for coupled pipelines, including allowable length of line where overburden may be removed and sleeving unreinforced couplings U/S and D/S of the work location.
3	If the stress levels are expected to exceed the allowable stresses, CUT and

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Step	Activity
	LOWER the pipeline, or REPLACE the pipe section in accordance with <i>SOP HLI.01 Pipeline Shutdown and Startup</i> .



NOTE: By cutting the pipe, the elongation stress and possibly some of the thermal stress is removed; however, the bending and other remaining stresses should still be analyzed.

Step	Activity
4	CONSULT Pipeline Integrity, Liquid Technical Operations, or Engineering Department to PERFORM a structural evaluation of the section to be lowered as outlined Section 7.2 below or other literature on lowering pipelines such as API 1117.
5	If the pipeline is located in hilly terrain, CONDUCT a survey of the existing profile.



NOTE: In flat areas, a USGS quadrangle map is sufficient with field verification.

Step	Activity
6	LOCATE skids, pre-tested repair pipe, river weights, and other materials. VERIFY that these are available for the lowering project.
7	CONSULT Pipeline Integrity, Liquid Technical Operations, or Engineering to determine a safe operating pressure for the lowering or raising or horizontal adjustment of the pipeline.

7.2 Developing a Lowering Plan and Profile

The Operations Personnel uses the following procedure to develop a lowering plan and profile.

Step	Activity
1	DEVELOP a final “Lowering Profile” and “Lowering Plan” after the proposed lowering is evaluated and a decision is made to lower the pipeline while in service.
2	DETERMINE the strain levels in the “Lowering Plan” for lowering associated with mining subsidence or for other lowering projects where strain gauges are installed.
3	REVIEW anomaly data for any anomalies that would be adversely affected if not repaired and/or removed.
4	OBTAIN written approval of these plans prior to any lowering related activities from an Engineer from Pipeline Integrity, Engineering, or Liquid Technical Operations.

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7.3 Excavation of the Pipeline

Operations Personnel use the following procedure to excavate the pipeline for the purpose of lowering or raising in-service pipelines.

Step	Activity
1	EXCAVATE the full length of pipe to be lowered, plus a minimum of 25 feet on either end in accordance with <i>SOP HLI.10 Excavation and Backfill</i> with the ditch sloped properly for personnel working in the ditch.
2	CONSIDER the support of heavy equipment working on the ditch bank.

CAUTION: Do not lower an in-service coupled pipelines without a detailed work plan considering pressure reduction and reinforcing mechanical couplings

Step	Activity
3	EXCAVATE the trench to at least the ditch depth required for the “Lowering Profile.”
4	PERFORM additional excavation beyond the “Lowering Profile” to allow for the following: <ul style="list-style-type: none"> • Placement of sandbags per “Supporting the Final Lowered Profile” below to obtain the final profile elevation • A pad dirt allowance in rocky areas • Room for the soil from beneath the pipeline to be cleared out after the cribbing supports are installed
5	PLAN the initial excavation to permit the line to be lowered with no further digging.

7.3.1 Cribbing

Operations Personnel use the following procedure to perform cribbing while excavating the pipeline.

Step	Activity
1	SUPPORT the pipeline firmly as it is excavated by cribbing in such a way that the pipeline stays at its original elevation.
2	PLACE tires, carpet, sandbags, or other padding between the pipe and cribbing to prevent coating damage.
3	SPACE the cribbing supports at maximum intervals of 25 feet unless otherwise specified in the “Lowering Plan.”
4	INSTALL the supports as far as practical from, and never directly beneath any girth welds since bending stresses can be much higher at the support points than at mid-span and girth welds have additional residual stresses and variable material properties.
5	MONITOR the cribbing daily and REPLACE or REPAIR as necessary.
6	SUPPORT the pipeline so that settlement or thermal expansion and

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Step	Activity
	contraction will not force the pipeline off of the cribbing.
7	When pipe operating temperatures are known to be changing or the pipeline is taken out of service for lowering, CHECK the cribbing to verify that it remains stable or is adjusted accordingly.



CAUTION: Personnel working in the ditch should be especially alert to possible side movement of the pipe due to thermal expansion or contraction.

Step	Activity
8	MAINTAIN the cribbing to prevent the pipe from shifting during the lowering operation.



WARNING: If the pipe were to slip off of one of the cribbing supports, the entire section could jump the supports and fall into the ditch.

7.3.2 Drainage Ditches

Operations Personnel use the following procedure to create drainage ditches.

Step	Activity
1	PROVIDE adequate drainage so that the pipeline ditch will not fill with water causing the pipe to float.
2	If this is not possible, OPERATE pumps which have adequate flow capacity to keep the pipeline from floating.

7.3.3 Initial Elevation Profile

Operations Personnel use the following procedure to create an initial elevation profile when excavating the pipeline.

Step	Activity
1	TAKE an initial elevation profile of the top of the pipe at maximum intervals of 25 feet after the excavation is complete.
2	IDENTIFY the midpoint of the section to be lowered.
3	VERIFY the accuracy of the original "Lowering Profile."

7.4 Inspecting the Exposed Pipeline

Operations Personnel use the following procedure to inspect the exposed pipeline.

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Step	Activity
1	INSPECT the pipeline visually for coating damage, gouges, corrosion, dents, arc burns, and wrinkles per <i>SOP HLD.35 Buried Pipe Inspection and Evaluations</i> .
2	CONSIDER the possibility of any anomalies causing complications, stress concentrations, or buckling in the lowered pipeline.
3	REPORT pipe defects to the Pipeline Integrity Department for consideration in the lowering plan.
4	If anomalies are found which are not acceptable by company standards, REPAIR them per <i>SOP HLI.06 Evaluating Pipeline Defects</i> before the line is lowered, and CONSIDER the need to continue with this procedure.
5	DOCUMENT pipe inspection on Pipe Inspection Report or Maintenance Record.

7.4.1 Evaluation of Circumferential Defects

Operations Personnel uses the following procedure to evaluate circumferential defects.

Step	Activity
1	EVALUATE the circumferential extent of corrosion or other defects in addition to the conventional evaluation of longitudinal defects.



NOTE: This is required because the lowering section will be subjected to axial bending stresses.

Step	Activity
2	If a defect is found that could reduce the bending strength of the pipe, EVALUATE the defect in developing the lowering plan.
3	If necessary, MOVE the lowering bend location to position the defect in an area of straight pipe.



NOTE: The bending, which occurs during the lowering operation, must still be considered.

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7.4.2 Operations Personnel use the following procedure for inspecting and repairing welds.
Inspecting and Repairing Welds

Step	Activity
1	Visually INSPECT all circumferential welds in the lowering section. Acetylene welded lines require particular attention to ensure lowering stresses to do not affect integrity of the weld. Acetylene welds shall be reinforced prior to initiating lowering activities.
2	VERIFY that they are 100% NDE inspected by radiography or other approved NDE methodology such as MPT and/or LPT, unless weld inspection records are available or as noted under “Welds Which Do Not Require NDE” below.
3	USE the applicable form(s) for <i>NDE Inspection Report of Field Girth Welds</i> .
4	REMOVE the pipe coating (except FBE coating) from the weld area prior to inspection.
5	INSPECT the welds visually for cracks, arc burns, or external undercutting that may be detrimental to the integrity of the weld or pipe.
6	PERFORM the radiographic inspection, INTERPRET the radiographs per API 1104, and DETERMINE if any welds do not meet the current code limitations.
7	BE AWARE that the bending of the pipe, which results from the lowering operations, is more likely to affect certain types of weld defects.
8	If any welds are interpreted as having cracks, BLOW DOWN the section and REPLACE the pipe containing the cracked weld.



NOTE Do not perform radiographic inspection for welds that are not located in the area of the final lowering bends if the longitudinal stresses from bending and axial tension during the lowering operations are calculated to be less than the Poisson effect of the hoop stress under normal operating conditions. This applies where approved by Pipeline Integrity.

Step	Activity
9	CONSIDER the need to continue with this procedure.
10	HANDLE welds that fail to meet the code limitations regarding “Inadequate Penetration,” “Inadequate Penetration Due to High-Low,” or “Incomplete Fusion” (in the bead or cap) as follows: <ul style="list-style-type: none"> REPAIR defects in the top or bottom quadrant of the pipe except as allowed for in company lowering guidelines. EVALUATE defects in the side quadrants of the weld that are in the neutral axis of the lowering bends per “Analysis of All Other Weld Defects” immediately below.
11	PERFORM an analysis of the remaining defects.

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NOTE: This analysis establishes whether the discontinuities are excessive to the extent that they could be adversely affected by the movement of the pipe during the lowering or subsidence.

Step	Activity
12	DETERMINE the action required for each weld.
13	DOCUMENT the justification for the action planned for each weld.
14	If the length of a defect or the accumulation of defects is only a moderate amount in excess of the API 1104 limitation, EVALUATE the defect per the alternate criteria in the Appendix to API 1104.
15	CONSULT Pipeline Integrity Department regarding defects accepted based upon the alternate criteria.
16	If the size of defect or length of accumulation is significant, and/or the overall appearance of the weld is questionable, REPAIR or CUT OUT the weld unless sufficient justification can be made to leave the weld as is.
17	PAY special attention to the evaluation of welds in areas where the highest stresses are anticipated (e.g., the edge of mining panels, areas where bends will be induced, areas where deflections will be the greatest, bends in existing pipe, etc.).
18	If the pipeline must be removed from service to make a repair, CONSIDER cutting the pipe and performing the lowering at the same time to eliminate the elongation stress component.
19	CONSIDER the final stress produced by bending, temperature differences, and other factors if permanent lowering bends are not installed as part of the lowering plan.

7.5 Final Preparations for Lowering the Pipeline

Operations Personnel use the following procedure to make final preparations for lowering a pipeline.

Step	Activity
1	TAKE the following final preparations prior to commencing the lowering operation.
2	ADVISE Pipeline Integrity or Liquid Tech Ops Department of any circumstances, which should be considered in establishing the need for an additional pressure reduction during the lowering operation.



NOTE:

- It may be necessary to reduce the operating pressure when excavating a section of pipe with known defects. Refer to *SOP HLI.05 Pipeline Repair*.
- A reduced operating pressure may also be required during the lowering operation based upon the calculations performed in developing the lowering plan.

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Step	Activity
3	ADVISE Liquid Control to reduce the pipeline operating pressure at the location to the pressure approved by Management.
4	CONSIDER evacuating the area near the pipeline when necessary unless conditions from the analysis in the Lowering Plan indicate that there is no need for concern.
5	If feasible MAN the mainline valves immediately upstream and downstream of the excavation while the lowering operations are in progress.
6	POST an observer for the purpose of maintaining communication with people manning valves and with Liquid Control

7.6 Performing the Lowering Operation

Operations Personnel use the following procedure to perform the lowering operation.

Step	Activity
1	ADHERE to the following guidelines and the site specific “Lowering Plan” strictly.



CAUTION: Adherence to the following is critical to the safety of the pipeline lowering since a considerable amount of the allowable axial and bending stresses can be consumed by the handling of the pipe during the lowering operation.

Step	Activity
2	HOLD a pre-job safety meeting to discuss the sequence of events for the lowering operation.
3	COMPLETE the applicable form(s) for <i>Pre-job Safety Meeting</i> .
4	VERIFY that the pipeline lowering is supervised by a person knowledgeable of the procedures and methods necessary to successfully perform the work, and that the personnel performing the work are properly trained and are familiar with the requirements.
5	ALIGN the lifting equipment directly above/below the pipe to minimize any lateral movement.
6	LIFT the pipe the minimum amount necessary to remove skids. DO this slowly and to no more than a few inches.
7	REMOVE the first layer of skids from the first cribbing support and REBUILD the support if necessary. REFER to “Using Shims” below.
8	LOWER the pipe slowly back down to the shortened cribbing support.



NOTE: The lowered distance will be approximately one skid thickness.

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Step	Activity
9	REPEAT the above four steps at the second cribbing support.
10	CONTINUE from one end of the lowering section to the other until the first row of skids has been removed from each crib support for the entire lowering length.
11	REPEAT the above sequence one layer at a time until the pipeline meets the final elevation profile.
12	MINIMIZE any bouncing or other movement of the pipe.
13	ALLOW any pipe movement to stop between each lifting and lowering step during the lowering operation.



CAUTION:

- Handle the pipe carefully to maintain control of the lowering activities and to verify that the pipe is not dropped or left unsupported.
- Do not lower the pipeline to an elevation below that established in the “Lowering Profile.”

Step	Activity
14	USE shims or other support methods at crib supports where the final required elevation falls between two successive layers of skids.
15	PERFORM the lowering operation by one of the following methods, or as approved by Pipeline Integrity or Liquid Tech Ops Department: <ul style="list-style-type: none"> • USE conventional pipeline equipment. • USE pressurized air bags to support and lower the pipe. REFER to Section 7.8, Lifting Pressurized Pipelines Using Air Bags, and Appendix B. • PLACE beams across the ditch and LOWER the pipe using a winch. VERIFY the beams are adequately designed to carry the weight of the pipe.
16	If a valve or other heavy component is included in the lowering section, SUPPORT it directly.



CAUTION: Do not lift the pipe on both sides of the ditch.

Step	Activity
17	MAINTAIN adequate support beneath the pipe as it is lifted to remove skids and as it is lowered back down to the shortened crib support during each successive pass to remove another layer of skids.



NOTE: A pipeline larger than 4 inches in diameter will probably not sag down far enough under its own weight to rest on the next skid using the cribbing spacing under the “Spacing of Cribbing” subsection above until the skids have been removed from several consecutive supports.

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Step	Activity
18	REFER to Appendix C for the initial unsupported span length required to lower the pipe down to the elevation required by the “Lowering Profile” or down to the shortened cribbing support (whichever comes first).



NOTE: As the lowering progresses, the required span length is reduced. Support requirements are illustrated in Appendix D.

Step	Activity
19	VERIFY that equipment supporting the pipe during the lowering operation is not spaced more than 50 feet apart.
20	REFER to the company lowering guidelines for the stresses induced by the above span lengths.
21	If a span fails to reach one of the cribbing supports after the specified span length is achieved, SUPPORT the pipe and CONTACT Pipeline Integrity Department.



NOTE: This may be a result of wall thickness variations or higher than anticipated axial stresses being present in the pipe prior to the start of the lowering operation.

Step	Activity
22	REDUCE the operating pressure temporarily, or REDUCE the axial stress from other sources to offset the lowering stresses until the work can be completed, if necessary.



CAUTION: Do not place the lifting and support points for lowering the pipe beneath or near the pipeline girth welds. This is the same as for cribbing placements as described above.

Step	Activity
23	LOWER the pipeline under its own weight.



CAUTION: If the pipeline does not readily lower to the intended elevation, do not force it.

Step	Activity
24	NOTIFY Pipeline Integrity Department to analyze the original and current profiles to determine the required action.



CAUTION: Do not change the configuration of any original pipe bends except as indicated in the lowering plan. This applies during the lowering process and in the final placement of the pipe.

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Step	Activity
25	REMOVE the remaining skids.
26	DETERMINE the final lowered elevation and CHECK it against the "Lowering Profile."
27	MAKE adjustments as necessary to match the lowering profile.



CAUTION: Do not allow final strain levels to exceed the maximum allowable value provided by Pipeline Integrity or Liquid Tech Ops Department where strain gauges have been installed.

Step	Activity
28	REPORT excessive strain values to Pipeline Integrity Department, who will analyze the profile and provide instructions to correct the problem.
29	DOCUMENT the evaluations under <i>Section 7.1, Evaluating the Potential for Lowering a Pipeline; Section 7.4.2, Inspecting and Repairing Welds; and Section 7.6, Performing the Lowering Operation;</i> as well as the initial profile, profile calculations supporting the final profile, the final profile, and the final stress levels per <i>Section 7.2, Developing a Lowering Plan and Profile.</i>
30	DOCUMENT all work, and KEEP the records in the project file and RETAIN for the life of the facility. SUBMIT project file to Engineering Records Group per requirements of <i>SOP HLB.11 Project Documentation and As-built Process</i>
31	BACKFILL the pipeline per <i>SOP HLI.10 Excavation and Backfill.</i>

7.8 Lifting Pressurized Pipelines Using Air Bags

Operations Personnel use the following procedure to lift or move pressurized pipelines using air bags. This method helps prevent over-stressing operating pipelines.



NOTE:

- Pipe of any size, other than at casings, can be lifted by this method. However, for the tables in Appendix B to apply, it must be unrestrained for approximately 80 feet in length, and the lifting should take place within 15 feet of the midpoint.
- For pipeline diameters less than 20" or greater than 36", create a work plan to determine appropriate number of bags, bag size and maximum bag pressure.
- For use of airbag other than this, a specific study must be made. Contact Pipeline Integrity Department to determine the applicability of the raising criteria if a bend is present.

Step	Activity
1	EQUIP air bags with 125-150 psig gauges that are accurate to the nearest one

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	pound.
2	VERIFY that there is a solid base under the air bag to determine the actual lifting force.
3	ESTABLISH a fixed reference point for measuring the deflection of the pipe.



NOTE: Do not use pipe casing as a reference since it may move along with the pipe.

Step	Activity
4	If there are different wall thicknesses of pipe inside the casing and in the excavated area, USE the values in the tables in Appendix B for the lighter wall pipe to determine the allowable lifting force and deflection.
5	POSITION air bag(s) under the pipe as close together as possible so the center of the lifting area is approximately 6 feet from the end of the casing.
6	PROVIDE a smooth, flat surface for the air bag(s) to rest on, such as $\frac{3}{4}$ inch or 1 inch plywood.
7	PLACE a piece of heavy canvas or rock shield between the pipe and the air bag to help protect the bag from any sharp protrusions in the coating.
8	CONNECT the air source to the bags and slowly INFLATE while watching the pipe deflection and bag pressure.



CAUTION: Do not exceed the elevation change specified by the pipeline raising plan developed by Pipeline Integrity Department.

Step	Activity
9	MONITOR the shorted casing to the pipe potential and when the shorted condition is eliminated and there is clearance enough between the bottom of the pipe and the casing, STOP pressuring the air bag(s).
10	INSTALL insulating material between the pipe and casings.
11	RELEASE pressure and CHECK that the shorted condition does not recur.
12	If an adequate pipe deflection is not obtained with the force listed in the tables in Appendix B for existing conditions, or the conditions do not match model conditions outlined in the Note following Step 13 below, CONTACT Pipeline Integrity Department.



NOTE: Pipeline Integrity Department calculates a safe lifting force and maximum deflection from the existing conditions.

Step	Activity
13	REFER to the following for a discussion of this method and a description of model conditions.

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NOTE:

- A typical shorted casing repair was used as a model for making the pipe stress calculations. This model consists of 40 feet of straight pipe excavated from the end of the casing, 40 feet of free pipe inside the casing and the air bag lifting the pipe at a point approximately 6 feet from the end of the casing. The maximum stress level used in the calculations was 75% of Specified Minimum Yield Strength (SMYS).
- For Appendix B, the bag pressure to be used was determined by dividing the force on the pipe by the area of the “foot print” on the bag for each diameter of pipe 20” through 36”. In all cases, the primary air bag used was the larger size bag of 30” x 30” nominal size. Those situations where the tables in Appendix B indicate a second or third bag is to be used, the bag sizes are footnoted as to size, either the 24” x 24” or 30” x 30” nominal size. Where more than one air bag is required, the bag pressure in the table in Appendix B is for each bag. The additional bags should be placed under the pipe as close to the first bag as possible. It is important to keep the lifting point approximately 6 feet from the end of the casing. The table values for bag pressure and pipe deflection at the end of the casing are maximum values. If a casing short can be cleared using lower values, use only the bag pressure or deflection necessary to accomplish the task. For pipeline diameters less than 20” or greater than 36”, create a work plan to determine appropriate number of bags, bag size and maximum bag pressure.
- Possible existing conditions that have not been considered in the stress calculations are:
 - Corrosion (internal or external)
 - Acetylene welds
 - Condition of un-x-rayed welds
 - Unreinforced couplings
 - Stresses (resulting from tie-ins, settlement, bends, construction damage, lamination, etc.)
 - If it is determined that any of these conditions exist, consult Pipeline Integrity Department.
- In the event an adequate pipe deflection cannot be obtained with the force listed for the conditions, contact Pipeline Integrity Department. Be prepared to give the details of the situation, i.e. length of excavation, pipe size, wall thickness, grade, heavy and light wall lengths in the excavated area, existing line pressure, area of contact between bag and pipe, deflection obtained at the listed pressure, obstructions in casing, or any other condition that could affect the situation. From this information, a recalculation can be made that will better fit the conditions and possibly result in the attainment of the required deflection.

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- 8.0 Documentation Requirements**
- Record data in electronic database or utilize the following forms as applicable:
- Pipe Lowering Profile
 - Pipe Lowering Plan
 - I.05.A NDT Report of Field Girth Welds (or Equivalent Contractor Form)
 - I.05.B NDT Report of Field Girth Welds – Overflow (or Equivalent Contractor Form)
 - I.05.D Pre-Job Safety Meeting Form
 - Pipe Inspection Database

- 9.0 References**
- HLI.01 Pipeline Shutdown and Startup
HLI.05 Pipeline Repair
HLI.06 Evaluating Pipeline Defects
HLI.10 Excavation and Backfill
HLI.26 Mining, Subsidence, and Soil Slippage
HLB.11 Project Documentation and As-built Process

- Appendix A: OQ Task Requirements**
- The table below identifies the Operator Qualification (OQ) task requirements.

Task Description	OQ Task
Visual Inspection of Buried Pipe and Components When Exposed	PLOQ401
Measure and Evaluate Pipeline Defects	PLOQ418A
Backfilling – Pipe and Coating Protection	PLOQ404
Damage Prevention During Excavation/Encroachment Activities	PLOQ607
Visual Inspection of Welding and Welds	PLOQ203

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Appendix B: The tables below define the maximum allowable bag pressures, pipe deflections and
Air Bag Tables force on pipe for each diameter 20” through 36”, wall thickness, SMYS and line pressures.

**20 INCH PIPE
LARGE BAG - 303 SQ. IN.**

Pipe Diameter (Inches)	Wall Thickness (Inches)	SMYS	Line Pressure (psig)	Maximum Allowable		
				Bag Pressure (psig)	Pipe Deflection (Inches)	Force on Pipe (Lbs.)
20	0.281	4200	200	59.5	3.05	18020
20	0.281	4200	400	44.7	2.30	13554
20	0.281	4200	600	30.0	1.54	9089
20	0.281	4200	400	51.4	2.64	15566
20	0.281	4200	600	36.6	1.88	11101
20	0.281	4200	800	21.9	1.12	6636
20	0.281	4400	400	54.5	2.80	16507
20	0.281	4400	600	39.7	2.04	12042
20	0.281	4400	800	25.0	1.28	7577
20	0.312	2500	200	38.2	1.78	11573
20	0.312	2500	400	23.5	1.09	7129
20	0.312	26900	200	41.5	1.93	12561
20	0.312	26900	400	26.8	1.25	8117
20	0.312	26900	600	12.1	0.56	3672
20	0.312	28200	200	43.7	2.03	13237
20	0.312	28200	400	29.0	1.35	8793
20	0.312	28200	600	14.4	0.67	4348
20	0.5	24000	200	65.7	1.96	19911
20	0.5	24000	400	51.5	1.54	15591
20	0.5	24000	600	37.2	1.11	11270

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AIR BAG TABLES
22 INCH PIPE
LARGE BAG - 374 SQ. IN.

Pipe Diameter (Inches)	Wall Thickness (Inches)	SMYS	Line Pressure (psig)	Maximum Allowable		
				Bag Pressure (psig)	Pipe Deflection (Inches)	Force on Pipe (Lbs.)
22	0.281	43600	400	48.7	2.31	18201
22	0.281	43600	600	32.7	1.55	12235
22	0.281	43600	800	16.8	0.80	6269
22	0.281	46700	400	53.4	2.53	19973
22	0.281	46700	600	37.5	1.78	14007
22	0.281	46700	800	21.5	1.02	8040
22	0.312	31300	200	52.5	2.25	19619
22	0.312	31300	400	36.6	1.57	13678
22	0.312	31300	600	20.7	0.89	7737
22	0.312	32200	200	54.0	2.32	20188
22	0.312	32200	400	38.1	1.63	14247
22	0.312	32200	600	22.2	0.95	8306
22	0.312	40000	200	67.2	2.88	25117
22	0.312	40000	400	51.3	2.20	19176
22	0.312	40000	600	35.4	1.52	13235
22	0.312	40800	200	68.5	2.94	25623
22	0.312	40800	400	52.6	2.26	19682
22	0.312	40800	600	36.7	1.58	13740
22	0.312	52000	200	87.4	3.75	32700
22	0.312	52000	400	71.5	3.07	26759
22	0.312	52000	600	55.7	2.39	20818
22	0.375	32200	200	67.6	2.43	25285
22	0.375	32200	400	51.9	1.87	19395
22	0.375	32200	600	36.1	1.30	13505
22	0.375	42000	200	87.3	3.15	32664
22	0.375	42000	400	71.6	2.58	26774
22	0.375	42000	600	55.8	2.01	20884

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Pipe Diameter (Inches)	Wall Thickness (Inches)	SMYS	Line Pressure (psig)	Maximum Allowable		
				Bag Pressure (psig)	Pipe Deflection (Inches)	Force on Pipe (Lbs.)
22	0.375	46000	400	79.6	2.87	29786
22	0.375	46000	600	63.9	2.30	23896
22	0.375	46000	800	48.1	1.73	18006
22	0.375	52000	200	60.7	3.87	40194
22	0.375	52000	400	51.8	3.30	34304
22	0.375	52000	600	42.9	2.74	28414
22	0.375	60000	200	69.8	4.45	46218
22	0.375	60000	400	60.9	3.88	40328
22	0.375	60000	600	52.0	3.32	34438
22	0.5	42000	200	67.7	3.29	44845
22	0.5	42000	400	59.0	2.87	39055
22	0.5	42000	600	50.2	2.44	33265
22*	0.5	46000	400	65.0	3.16	43003
22*	0.5	46000	600	56.2	2.73	37213
22*	0.5	46000	800	47.5	2.31	31423

* Use two (2) air bags, one (1) 30" x 30" and one (1) 24" x 24" (662 sq. in.)

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AIR BAG TABLES
24 INCH PIPE
LARGE BAG - 428 SQ. IN.

Pipe Diameter (Inches)	Wall Thickness (Inches)	SMYS	Line Pressure (psig)	Maximum Allowable		
				Bag Pressure (psig)	Pipe Deflection (Inches)	Force on Pipe (Lbs.)
24	0.281	45000	400	48.7	2.03	20860
24	0.281	45000	600	30.6	1.27	13089
24	0.281	45200	400	49.1	2.05	20996
24	0.281	45200	600	30.9	1.29	13225
24	0.281	47400	400	52.6	2.19	22497
24	0.281	47400	600	34.4	1.43	14727
24	0.281	47400	800	16.3	0.68	6956
24	0.281	60000	400	72.7	3.03	31095
24	0.281	60000	600	54.5	2.27	23324
24	0.281	60000	800	36.3	1.52	15554
24	0.312	43700	400	55.6	2.10	23814
24	0.312	43700	600	37.6	1.42	16073
24	0.312	43700	800	19.5	0.73	8333
24	0.375	43700	400	73.7	2.33	31539
24	0.375	43700	600	55.7	1.76	23859
24	0.375	43700	800	37.8	1.19	16179
24*	0.5	46000	400	65.7	2.77	49256
24*	0.5	46000	600	55.6	2.35	41696
24*	0.5	46000	800	45.5	1.92	34136
24*	0.5	52000	400	75.1	3.17	56344
24*	0.5	52000	600	65.0	2.75	48784
24*	0.5	52000	800	55.0	2.32	41224

* Use two (2) air bags, one (1) 30" x 30" and one (1) 24" x 24" (750 sq. in.)

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AIR BAG TABLES

26 INCH PIPE

1 LARGE BAG & 1 SMALL BAG - 737 SQ. IN.

Pipe Diameter (Inches)	Wall Thickness (Inches)	SMYS	Line Pressure (psig)	Maximum Allowable		
				Bag Pressure (psig)	Pipe Deflection (Inches)	Force on Pipe (Lbs.)
26	0.271	60000	500	37.5	2.19	27629
26	0.271	60000	700	24.0	1.40	17711
26	0.271	60000	900	10.6	0.62	7792
26	0.281	57830	500	37.8	2.13	27846
26	0.281	57830	700	24.3	1.37	17939
26	0.281	57830	900	10.9	0.61	8033
26	0.312	52000	400	45.2	2.30	33303
26	0.312	52000	500	38.5	1.96	28367
26	0.312	52000	600	31.8	1.62	23432
26	0.312	52000	700	25.1	1.28	18496
26	0.312	52000	800	18.4	0.94	13560
26	0.312	52000	900	11.7	0.60	8625
26	0.375	52000	500	52.7	2.25	38834
26	0.375	52000	700	39.4	1.68	29034
26	0.375	52000	900	26.1	1.11	19235
26	0.375	60000	400	70.8	3.02	52214
26	0.375	60000	600	57.5	2.46	42414
26	0.375	60000	800	44.3	1.89	32615
26	0.375	65000	500	71.4	3.05	52614
26	0.375	65000	700	58.1	2.48	42815
26	0.375	65000	900	44.8	1.91	33015
26	0.5	40000	500	57.6	1.87	42469
26	0.5	40000	700	44.5	1.45	32811
26	0.5	40000	900	31.4	1.02	23152
26	0.5	42000	400	68.0	2.21	50084
26	0.5	42000	600	54.9	1.78	40426
26	0.5	42000	800	41.7	1.36	30768

Lowering or Raising In-Service Pipelines

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Pipe Diameter (Inches)	Wall Thickness (Inches)	SMYS	Line Pressure (psig)	Maximum Allowable		
				Bag Pressure (psig)	Pipe Deflection (Inches)	Force on Pipe (Lbs.)
26	0.5	45000	500	67.1	2.18	49434
26	0.5	45000	700	54.0	1.75	39776
26	0.5	45000	900	40.9	1.33	30118
26	0.5	47000	400	77.4	2.51	57050
26	0.5	47000	600	64.3	2.09	47391
26	0.5	47000	800	51.2	1.66	37733
26	0.5	52000	500	80.3	2.61	59186
26	0.5	52000	700	67.2	2.18	49527
26	0.5	52000	900	54.1	1.76	39869

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AIR BAG TABLES

30 INCH PIPE

1 LARGE BAG & 1 SMALL BAG - 768 SQ. IN.

Pipe Diameter (Inches)	Wall Thickness (Inches)	SMYS	Line Pressure (psig)	Maximum Allowable		
				Bag Pressure (psig)	Pipe Deflection (Inches)	Force on Pipe (Lbs.)
30	0.312	52000	500	41.2	1.41	31624
30	0.312	52000	700	21.3	0.73	16386
30	0.312	60000	500	53.6	1.84	41132
30	0.312	60000	700	33.7	1.16	25894
30	0.312	60000	900	13.9	0.48	10657
30	0.325	42000	500	28.7	0.95	22077
30	0.325	52000	500	44.8	1.48	34441
30	0.325	52000	700	25.0	0.83	19224
30	0.344	60000	500	64.0	2.00	49117
30	0.344	60000	700	44.2	1.38	33929
30	0.344	60000	900	24.4	0.76	18740
30	0.361	52000	500	55.1	1.65	42350
30	0.361	52000	700	35.4	1.06	27187
30	0.361	52000	900	15.7	0.47	12025
30	0.375	52000	500	59.2	1.70	45452
30	0.375	52000	700	39.5	1.14	30311
30	0.375	52000	900	19.8	0.57	15170
30	0.406	52000	500	68.0	1.81	52197
30	0.406	52000	700	48.3	1.29	37103
30	0.406	52000	900	28.7	0.76	22009
30	0.406	60000	500	83.9	2.24	64454
30	0.406	60000	700	64.3	1.71	49360
30	0.406	60000	900	44.6	1.19	34265
30	0.5	42000	500	69.9	1.53	53721
30	0.5	42000	700	50.5	1.10	38769
30	0.5	42000	900	31.0	0.68	23817

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Pipe Diameter (Inches)	Wall Thickness (Inches)	SMYS	Line Pressure (psig)	Maximum Allowable		
				Bag Pressure (psig)	Pipe Deflection (Inches)	Force on Pipe (Lbs.)
30	0.5	47000	500	82.1	1.79	63066
30	0.5	47000	700	62.6	1.37	48114
30	0.5	47000	900	43.2	0.94	33162
30	0.5	52000	500	94.3	2.06	72412
30	0.5	52000	700	74.8	1.63	57459
30	0.5	52000	900	55.3	1.21	42507

AIR BAG TABLES

30 INCH PIPE

2 LARGE BAGS - 884 SQ. IN.

Pipe Diameter (Inches)	Wall Thickness (Inches)	SMYS	Line Pressure (psig)	Maximum Allowable		
				Bag Pressure (psig)	Pipe Deflection (Inches)	Force on Pipe (Lbs.)
30.125	0.375	60000	500	64.7	2.11	57091
30.125	0.375	60000	700	47.3	1.54	41757
30.125	0.375	60000	900	29.9	0.98	26424
30.175	0.375	60000	500	64.8	2.11	57204
30.175	0.375	60000	700	47.3	1.54	41793
30.175	0.375	60000	900	29.9	0.97	26382
30.313	0.469	60000	500	91.8	2.37	81062
30.313	0.469	60000	700	74.3	1.92	65581
30.313	0.469	60000	900	56.7	1.47	50100
30.375	0.5	46000	500	70.4	1.70	62129
30.375	0.5	46000	700	52.8	1.28	46599
30.375	0.5	46000	900	35.2	0.85	31070
30.375	0.5	60000	500	100.8	2.44	88970
30.375	0.5	60000	700	83.2	2.01	73441
30.375	0.5	60000	900	65.6	1.59	57911

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AIR BAG TABLES

36 INCH PIPE

2 LARGE BAGS - 968 SQ. IN.

Pipe Diameter (Inches)	Wall Thickness (Inches)	SMYS	Line Pressure (psig)	Maximum Allowable		
				Bag Pressure (psig)	Pipe Deflection (Inches)	Force on Pipe (Lbs.)
36	0.375	60000	500	71.3	1.49	69008
36	0.375	60000	700	44.1	0.92	42680
36	0.375	60000	900	16.9	0.35	16351
36	0.5	60000	500	116.6	1.84	112871
36	0.5	60000	700	89.7	1.42	86816
36	0.5	60000	900	62.8	0.99	60762
36.25*	0.5	60000	500	78.4	1.82	113908
36.25*	0.5	60000	700	90.2	1.40	87298
36.25*	0.5	60000	900	62.7	0.97	60698
36.25*	0.562	65000	500	104.8	2.15	152209
36.25*	0.562	65000	700	86.3	1.77	125458
36.25*	0.562	65000	900	102.0	1.40	98707

* Use three (3) air bags - 30" x 30" (1453 sq. in.)

Appendix C: The table defines the maximum span length of unloaded pipelines prior to lowering the pipe down to the elevation required by the Lowering Profile or down to the shortened cribbing support, whichever comes first.

Pipe Diameter	Maximum Span Length
4"	50'
6"	60'
8"	70'
10"	78'
12"	85'
14"	92'
16"	99'
18"	105'
20"	112'
24"	125'
26"	132'

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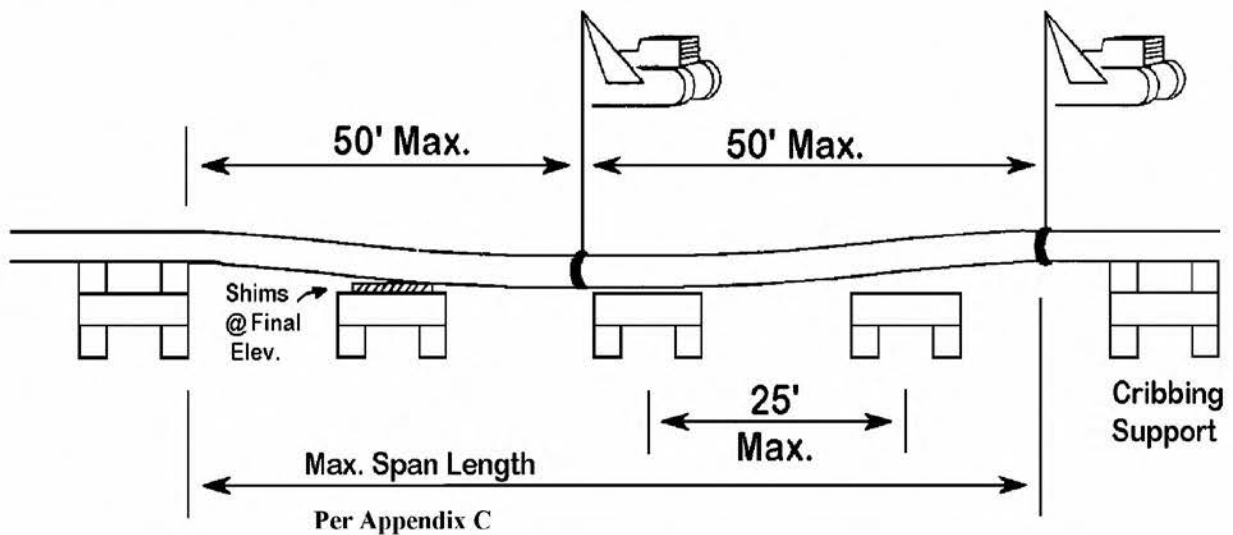
30"	145°
36"	160°



NOTE: These lengths vary slightly with pipe wall thickness and are not applicable for pipe with weight coating, liquids, or other heavy components.

**Appendix D:
Figure 1**

The figure below defines the maximum span length for cribbing at the final lowering profile elevation.



**Excavation and Backfill****Standard Operating Procedures***Applicable to Hazardous Liquids Pipelines and Related Facilities*

Code Reference :	Procedure No.: HLI.10	
49 CFR 195.402, 195.248, 195.252	Effective Date: 04/01/18	Page 1 of 15

1.0 Procedure Description This Standard Operating Procedure (SOP) describes how to provide adequate support and protection of company pipeline facilities during excavation and backfilling activities.

2.0 Scope This SOP establishes requirements to be followed prior to, during and post any excavation and backfilling activities on or around company pipeline facilities. This SOP also protects company personnel who are required to work in or around excavations and trenches by establishing excavation procedures to help prevent the hazards of cave-in or asphyxiation in trenches, under embankments, and in holes.

3.0 Applicability This SOP applies to any excavation and backfilling activities on or around company pipeline facilities performed by Company employees or authorized contractors.

4.0 Frequency As required: All excavations and backfilling on or around company pipeline facilities.

5.0 Governance The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Operations Manager	Director of Operations

6.0 Terms and Definitions Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

Terms	Definitions
Bell-Hole	An excavation where the width is typically greater than the depth and access routes are cut along the sides of the excavation to form an approximate bell shape.
Competent Person	One who is qualified, capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.
Trench	A long, narrow excavation where the width of the excavation is less than the depth.

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7.0 Excavation and Backfill

The following procedures are described in this section:

- Prior to Excavation
- Requirements for New Pipeline Installation
- Excavation of Existing Company Pipeline Facilities
- Safety Precautions
 - Hazardous Atmospheres
- Using Explosives
- Excavation of Company Pipelines by a Contractor
- Sloping and Shoring
 - Sloping Requirements
 - Shoring Requirements
- Inspecting Excavations
- Backfilling
 - Erosion Control

7.1 Prior to Excavation

Operation Personnel perform the following procedures prior to excavation.

Step	Activity
1	DESIGNATE and VERIFY a qualified competent person will be on site to supervise all excavation work performed by company personnel.
2	REVIEW the terms of the easement for the tract(s) of land where the excavation is to be conducted.
3	LOCATE and MARK company pipeline facilities per <i>SOP HLB.04 Pipe Location and Marking</i> . VERIFY the proposed excavation limits are marked to assist local One-Call responders in identifying the limits of excavation activities.



NOTE: Indicate the depth of cover of company pipeline facilities on each marking when the excavation limits will be 75 ft. or greater.



CAUTION: When excavating existing company pipeline facilities for maintenance, where shallow cover is discovered, **DEVELOP** an excavation and backfill plan prior to excavation to confirm the safety and integrity of the company pipeline facility. Methods include but are not limited to:

- Additional soil combined with grading and contouring to re-establish adequate cover.
- Installation of erosion control and mechanical protection (e.g., revetment mats, concrete slabs, and rip-rap).
- Pipeline lowering
- Installation of box sag bends
- Installation of warning tape to alert future excavators

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4	CONTACT the local One-Call system and REQUEST a notification be sent out for the proposed excavation. NOTIFY all utilities not participating in the One-Call system in the area of the proposed excavation.
5	If necessary, REQUIRE utilities to move any overhead hazards. If below-ground utilities present a hazard, DISCUSS work with the utility representative.
6	ENCOURAGE affected utility owners to have a representative at the site during excavation and backfilling operations.
7	CONSIDER traffic and/or any material, structures, or equipment which could be present near the edge of the excavation.
8	DEPLOY barricading, signal guards, stop logs, or other warning systems needed when mobile equipment is used around the excavation.
9	DEPLOY proper barricading, plating and other warnings on excavations left open after working hours or left unattended.



NOTE: Secure all necessary permits and observe barricading/signage rules of the local governing authorities when excavations cross or affect roads.

10	CONSULT with Pipeline Integrity Department to review the anomaly data to determine whether smart tool indications will be exposed during the excavation.
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11	CONFIRM if any additional pressure reductions are required prior to starting excavation activities. Refer to <i>SOP HLI.11 Pipeline Pressure Limit Criteria</i>
12	NOTIFY Liquids Control.

7.2 Requirements for New Pipeline Installation

Operation Personnel perform the following procedure when excavating for new company pipeline facility installation.

Step	Activity
1	DETERMINE the dimensions of the ditch for new company pipeline facility installations based on the size of the pipeline.
2	REFER to the following table for: <ul style="list-style-type: none"> The minimum width at the bottom of the ditch Minimum cover as measured from the top of the pipe to the average level of the ground on both sides of the ditch.

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Nominal Pipe Size (Inches)	Minimum Ditch Width (Inches)		
4	22		
6	26		
8	26		
10	26		
12	30		
14	32		
16	36		
18	38		
20	40		
22	42		
24	44		
26	46		
30	50		
36	52		
42 & Larger	56		

Location	For Normal Excavation (inches)	For Rock Excavation (Inches)
Industrial, Commerical, and residential areas	36	30
Crossing of inland bodies of water with a width of at least 100 feet from high water mark to high water mark	48	18
Drainage ditches at public roads and railroads	36	36
Deepwater port safety zones	48	24
Any other area	30	18



NOTE:

- These depths of cover are applicable for new installations in soil.
- Rock excavation is any excavation that requires blasting or removal by equivalent means.

**7.3
Excavation of
Existing
Company
Pipeline
Facilities**

Operation Personnel performs the following procedure to excavate existing company pipeline facilities.

Step	Activity
1	CLASSIFY the soil in each section of the excavation. DETERMINE appropriate sloping, shoring, or shielding per <i>Section 7.7 below</i> .

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CAUTION: When conditions change, reclassify soil and modify sloping, shoring, or shielding requirements as necessary before entry.

2	VERIFY excavation equipment (e.g., backhoe, track hoe) has the side cutters detached with a plate welded over the teeth or the bucket teeth removed unless otherwise permitted by Operations Management.
3	POSITION a spotter to watch for unmarked lines, probe company facilities when required, and to stop the excavation equipment (e.g., backhoe, track hoe) operator if a foreign object is observed.
4	EXCAVATE on both sides parallel to the marked location of the company pipeline facility to minimize the danger of contact.



CAUTION: A minimum of 24" of separation between company pipeline facilities and any mechanized excavating equipment will be maintained unless otherwise permitted by Operations Management. At no time shall the separation be less than 12".

5	CONTINUE the excavation adjacent to the company pipeline facility with a hand shovel until the side wall of the company pipeline facility is exposed.
6	PUSH the dirt directly above the company pipeline facility into the adjacent ditch with hand shovels.
7	PLACE the excavated material at least two (2) feet from the edge of the excavation. SEPARATE the topsoil and fill material for later use in the backfill operation.
8	<p>When excavation is to take place within the specified tolerance zone of company pipeline facilities, an excavator must exercise such reasonable care as may be necessary for the protection of any underground pipeline in or near the excavation area (Sections A. through C. shall be exercised in Texas).</p> <p>A. "Tolerance zone" is defined as half the width of the underground pipeline plus a minimum of eighteen inches (18") on either side of the outside edge of the underground pipeline on a horizontal plane. The tolerance zone shall not be less than twenty-four inches (24") on either side of the pipe.</p> <p>B. Unless approved by the underground utility operator, excavation within the "Tolerance Zone" shall only be performed by non-mechanical means. Certain climate or geographical conditions may require a specific method of excavation such as hand digging, soft digging, vacuum excavation, or pneumatic hand tools. Other mechanical or technical methods developed may be used with the approval of the underground pipeline operator.</p> <p>C. Hand digging and non-invasive methods are not required for pavement removal.</p>

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NOTE: When excavation activity occurs on company pipeline facilities and is complete by Operations Personnel, or Company Contractors, sections A. through C. above are not required, but should be considered.

9	IF it becomes necessary to operate excavation equipment over company pipeline facilities, VERIFY there is adequate stable cover and DETERMINE per <i>SOP HLI.27 Abnormal Loading External Loads Hwy_RR</i> if external loading from excavation equipment is within acceptable limits.
10	COMPLETE a Pipe Inspection Report upon exposing company pipeline facilities designed for below grade service. Refer to <i>SOP HLD.35 Buried Pipe Inspection and Evaluations</i> .

7.4 Safety Precautions

Operation Personnel follow the safety procedures below when working in a trench, ditch, or hole.



CAUTION: Reference *Safety Procedure S-130 Excavation and Trenching* for additional requirements.

Step	Activity
1	VERIFY all personnel who are exposed to public vehicular traffic during excavation activities are provided and wear suitable warning vests or garments.
2	EXCAVATE the area in a careful and controlled manner.
3	PLACE excavated material at least two (2) feet from the edge of the ditch to avoid impeding the use of ramps, ladders, or steps. ADHERE to OSHA Subpart P guidelines for the placement of the soil.



WARNING: Prohibit any entrance into the excavation until approval of all sloping, shoring, shielding, and means of egress has been granted by the designated excavation competent person.

4	PROVIDE ramps, ladders, or steps on both sides of the company pipeline facility to provide escape routes for personnel in the event of an emergency.
5	VERIFY the area of exit from ramps, ladders, or steps is not obstructed.
6	VERIFY ladders are in good condition, extend from the floor of the excavation to three (3) feet above the top of the excavation, and are secured at the top.
7	For excavations of greater than four (4) feet in depth: <ul style="list-style-type: none"> PROVIDE means of egress/exit so no more than 25 feet of lateral travel is necessary from any point in the ditch. VERIFY the slope of exit runways does not exceed a one (1) foot rise over a three (3) feet run, or PROVIDE cut in steps.. REFER to <i>Section 7.8</i> below for sloping and shoring requirements. PROVIDE walkways with standard guardrails when employees are required to cross over excavations where the walkways are four feet or more above the lower levels.

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4	PROVIDE ramps, ladders, or steps on both sides of the company pipeline facility to provide escape routes for personnel in the event of an emergency.
8	INSPECT the work area daily before work, during each shift, and under any circumstance making the work area unsafe.
9	COMPLETE a hot work permit/hazardous operations plan when performing welding, cutting, heating, or other maintenance activities where liquid or vapors might be present in the trench.
10	TEST excavations for any possible accumulation of dangerous fumes or oxygen deficient atmospheres. DIRECT employees to report any signs of fume accumulation or oxygen depletion.



NOTE:

- Hazardous liquids or vapors are not generally expected in the excavation of company liquid pipeline facilities. However, when hazardous liquids or vapors are expected or known to be present adequate precautions shall be taken to protect personnel.
- Direct reading instruments will be utilized to determine whether hazardous, vapors or inadequate oxygen levels exist prior to personnel entering excavation, or a confined space. Personnel will not enter excavation where hazardous vapors, or insufficient oxygen levels are found without appropriate personal protective equipment and training.
- Training in the use of hazardous vapor detection devices will be in accordance with manufacturer's recommended procedures.

11	MONITOR water control and removal equipment. DIRECT employees to report accumulations of water or other material that might weaken the excavation or make escape difficult. DISCONTINUE work if water in the trench impedes safe egress.
12	DIRECT employees to watch for evidence of cracks, slumping, slides, caving in soil, and signs of stress or failure in shoring or shielding.
13	STORE any materials at least two (2) feet from the edge of the excavation.
14	IF a welder or other worker is required to lie down in a trench over 3½ feet deep, WIDEN and SLOPE OUT the trench at the elevation the worker is present.
15	VERIFY bell-holes are large enough in all dimensions for safe and easy working conditions.

**7.4.1
Hazardous
Atmospheres**

Operation Personnel are responsible for the following procedures when individuals work in the trench and there is an unsafe accumulation of vapor or gas.



WARNING: No personnel will be allowed to enter any excavation, regardless of depth, until the area is made safe from the presence of a hazardous atmosphere.

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Step	Activity
1	TAKE adequate precautions to prevent employee exposure to hazardous atmospheres and atmospheres containing less than 19.5% oxygen. PROVIDE respiratory protection or ventilation, if appropriate.
2	IF hazardous vapors are being vented in trench excavations out of a company pipeline facility during maintenance functions, INSTRUCT employees working in close proximity to venting vapors to position themselves in such a way to not be inhaling fumes. USE approved monitors to verify air quality.



CAUTION: Hazardous vapors accumulate in low lying areas and do not dissipate quickly and have a tendency to accumulate in the trench.

Step	Activity
3	MONITOR trenches and bell-holes where vapors are venting for any unsafe accumulation of vapors using portable gas detection.
4	If distillate or some other condition causes an unsafe accumulation of vapor in the trench or bell-hole, PROVIDE the appropriate emergency rescue equipment, including a breathing apparatus and a rescue harness and line.



NOTE: Excavations may be considered confined spaces and require permit entry. Refer to *Safety Procedure S-370 Work Permits*.

7.5 Using Explosives

Operation Personnel perform the following procedure where explosives are used to assist in excavations near existing company pipeline facilities.



WARNING: Reference *SOP HLI.23 Protection of Pipeline Facilities From Blasting Operations* for the requirements of a blasting plan, the evaluation of the plan, and any actions to be taken.



CAUTION: When the use of explosives is necessary and approved for assisting in excavations, the utmost care must be taken to not endanger life or adjacent property and maintain the safety and integrity of company pipeline facilities. In addition, all use of explosives must be witnessed by a company representative

Step	Activity
1	SECURE all necessary permits required for the transportation, storage, and use of explosives.
2	FOLLOW all laws, rules, and regulations governing the storing, handling, and use of such explosives.

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CAUTION: Do not permit blasting within or near stream channels without prior consultation with federal or state conservation authorities to determine what protective measures to take to minimize damage to fish and other aquatic life.

Step	Activity
3	PROVIDE a blasting plan the Pipeline Integrity Department, who will evaluate and approve the plan prior to blasting.
4	NOTIFY building owners prior to blasting and PERFORM a pre-blast survey, including photos.
5	If buildings or other structures are located within 200 ft. of company pipeline facilities, USE seismic equipment and MONITOR each of these locations during blasting.



NOTE: Seismographic monitoring criteria, such as peak particle velocity, give a very poor correlation with the stress imposed on pipelines from blasting. Where the company's guidelines for blasting near pipelines are used to evaluate blasting plans, seismographic equipment is not necessary and is not used for monitoring the pipeline.

Step	Activity
6	USE mats and/or backfill over the blast area and TAKE all other possible precautions to prevent damage to livestock and other property and to avoid inconvenience to the property owner or tenant during blasting operation.
7	HAUL any rock scattered outside the right-of-way by blasting operations to the right-of-way.

7.6 Excavation of Company Pipeline Facilities by a Contractor

In addition to the requirements set forth in this SOP, Operation Personnel or a qualified Company Inspector follow the procedures below and are responsible for overseeing the excavation of company pipeline facilities when performed by a contractor or other parties.

Step	Activity
1	VERIFY a Operation Personnel or Company Inspector is on site at all times while the contractor is excavating within company right-of-way to watch for unmarked lines, probe company facilities when required, and to stop the excavation equipment (e.g., backhoe, track hoe) operator if a foreign object is observed.



WARNING: Operation Personnel or Company Inspector has full authority to stop the work if he/she determines the work is being performed unsafely, if a foreign object is spotted, or if the guidelines set forth in this procedure are not properly followed.

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2	VERIFY excavation equipment (e.g., backhoe, track hoe) is maintained, serviced, and in good working order allowing it to be operated safely and having the ability to maintain depth and offset specifications.
3	VERIFY the excavation equipment (e.g., backhoe, track hoe) is operated by a skilled and experienced operator.
4	COMPLETE work permits as necessary considering scope of work.

7.7 Sloping and Shoring

All Sloping and Shoring should be done when directed by and in accordance with the current *Safety Procedure S-130 Excavation and Trenching*.

Step	Task
1	CONSULT Operations Manager or Project Manager of proposed excavations which may require sloping and shoring.
2	INSPECT all sloping, shoring, or shielding as required.

7.7.1 Sloping Requirements

Operation Personnel equipment operator uses the following procedure when required by the current *Safety Procedure S-130 Excavation and Trenching*.

Step	Activity
1	DETERMINE the angle of repose for the walls of the excavation per <i>Safety Procedure S-130 Excavation and Trenching</i> based on the type of soil, water conditions, and previous soil disturbances.
2	SLOPE the ditch by stair-stepping/benching or cutting back the ditch walls to an appropriate angle of repose.
3	FLATTEN the angle of repose when the excavation has water conditions, silty material, loose boulders, and areas where erosion, deep frost action, or slide planes appear.

7.7.2 Shoring Requirements

Operation Personnel qualified as an OSHA competent person uses the following procedure when the appropriate angle of repose cannot be achieved and required by the current *Safety Procedure S-130 Excavation and Trenching*.

Step	Activity
1	SHORE the trench for additional protection using timbers and trench jacks, sheet piling, or manufactured hydraulic shoring systems. INSTALL shoring from the top down.
2	REMOVE shoring from the bottom up after work has been completed on excavations.
3	TAKE precautions in the release of shoring jacks and braces. In unstable soil, USE ropes to remove jacks and braces.

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**7.8
Inspecting
Excavations**

Operation Personnel Competent Person uses the following procedure to inspect an excavation.

Step	Activity
1	INSPECT the shoring system, soil conditions, and construction methods daily to detect unsafe conditions.
2	NOTE the condition of the soil and shoring materials.
3	IDENTIFY existing and potential hazards in the surrounding working conditions. TAKE prompt corrective action to eliminate hazards.
4	INSPECT excavations after rain storms or other hazard-increasing occurrences.
5	COMPLETE the applicable form(s) for <i>Safety Procedure S-130A Excavation Report</i>
6	PROVIDE additional protection against slides or cave-ins, if necessary.
7	ADHERE to local highway department requirements while on a highway right-of-way.

**7.9
Backfilling**

Operation Personnel or a qualified Company Inspector follow the procedures below when backfilling company pipeline facilities or are responsible for overseeing backfilling operations of company pipeline facilities when performed by a contractor or other parties.



NOTE: The backfilling operation is critical for providing support around and beneath company pipeline facilities.

Step	Activity
1	REPAIR probe marks and damaged coating in accordance with <i>Engineering Standard HL6.0306 Coating of Field Joints, Valves, Tie-Ins, Girth Welds and Short Sections of Pipe Using Two Part Epoxy or HL6.0306 Wax Coating for Buried or Submerged Fittings, Valves, Tie-Ins, & Repairs to Linepipe Coating.</i>
2	FOLLOW the coating manufacturer's recommended cure time prior to backfilling.
3	VERIFY the company pipeline facility rests on the bottom of the ditch/trench.
4	PREPARE a dirt cushion of at least six (6) inches prior to laying company pipeline facility in solid or loose rock. CONSIDER using approved rock shield.
5	REMOVE bottom trench supports first. RELEASE trench jacks slowly.
6	PLACE additional pad dirt around the company pipeline facility to a minimum elevation of six (6) inches above the top of the pipeline.



NOTE: Rock, two (2) inches in diameter and larger, or like materials shall not be backfilled directly onto company pipeline facilities. Where such materials are encountered, sufficient earth or sand shall be used to backfill around and over company pipeline facilities to form a protective padding or cushion as

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specified in step 6 above.

Large rock or boulders shall not be backfilled into the ditch and shall be disposed of properly.



CAUTION: Exercise care when backfilling to assure rocks of significant size (rocks large enough to penetrate the padding and damage the coating and/or the pipeline) are not backfilled immediately on top of the padding.

Step	Activity
7	IF backfilling in cultivated lands, REPLACE the original depth of surface soil.
8	VERIFY no foreign or refuse material is included in the backfill. DO NOT USE contaminated fill. These materials include, but are not limited to: <ul style="list-style-type: none"> • Skids • Welding rods • Pipe rings • Trash • Tree and shrubbery limbs REMOVE all such materials from the job site.



CAUTION:

- Do not stand in excavation when mechanical back filling is underway.
- In unstable soil, clear all employees from trench and use ropes to remove the trench jacks.

Step	Activity
9	RESTORE any fences, culverts, or markers.
10	SPREAD soil which has been excavated during construction and not used evenly onto the cleared areas or REMOVE it from the site.
11	GRADE the topsoil to conform to the adjacent terrain. MAKE an allowance, such as a crown over the ditch, for the natural settlement of the soil.
12	IF excavating existing company pipeline facilities, RETURN the grade to its original condition.
13	COMPLETE the applicable form(s) for inadequate cover or ENTER data in electronic database for all company pipeline facilities excavated with less than 24 inches of cover. Refer to <i>SOP HLI.24 Management of Depth of Cover and Evaluation</i> .
14	REMOVE excess construction material and other debris from the right-of-way.
15	REMOVE rock brought to the surface by excavation and remaining after backfilling from the property unless approved by management.
16	SEED and FERTILIZE the right-of-way or otherwise return it to approximately the original condition.
17	VERIFY the replacement of earth adjacent to water crossings is at slopes equal to or less than the normal angle of repose for the soil type involved.
18	ACCOMPLISH sandbagging, seeding, or other methods of soil stabilization without undue delay.

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Step	Activity
19	FOLLOW any special and reasonable considerations requested by the landowner and approved by the company Right-of-Way Representative and Operations Management regarding the clearing and restorations activities.
20	VERIFY that the depth of cover is in accordance with the permit or easement requirements, the latest revision of the company drawing standards and the requirements of applicable jurisdictional government agencies.

**7.9.1
Erosion
Control**

During the backfill operation, Operations Personnel follow this procedure to prevent subsurface soil movement and subsequent erosion in hilly or mountainous terrain.

Step	Activity										
1	CONSTRUCT an interceptor dike with compacted earth or earth filled burlap bags extending completely across company right-of-way at a minimum height and width of 18" x 36".										
2	POSITION each dike to divert water downhill at a 2% slope toward a well vegetated area, if possible.										
3	INSTALL permanent interceptor dikes after the final grading and prior to reseeding. As a general rule, interceptor dikes are not used in cultivated lands (except as a field boundary) or in residential or landscaped areas.										
4	SPACE interceptor dikes as follows: <table border="1"> <thead> <tr> <th><u>Right-of-Way Slope</u></th><th><u>Interceptor Dike Spacing</u></th></tr> </thead> <tbody> <tr> <td>< 5%</td><td>No structure</td></tr> <tr> <td>5 to 15%</td><td>150 ft.</td></tr> <tr> <td>15 to 30%</td><td>100 ft.</td></tr> <tr> <td>30%</td><td>50 ft.</td></tr> </tbody> </table>	<u>Right-of-Way Slope</u>	<u>Interceptor Dike Spacing</u>	< 5%	No structure	5 to 15%	150 ft.	15 to 30%	100 ft.	30%	50 ft.
<u>Right-of-Way Slope</u>	<u>Interceptor Dike Spacing</u>										
< 5%	No structure										
5 to 15%	150 ft.										
15 to 30%	100 ft.										
30%	50 ft.										
5	INSTALL trench plugs after the company pipeline facility has been laid in the ditch and prior to backfilling.										



NOTE: Trench plugs are composed of earth filled sacks packed tightly around company pipeline facilities.

Step	Activity										
6	SPACE trench plugs as follows: <table border="1"> <thead> <tr> <th><u>Right-of-Way Slope</u></th><th><u>Trench Plug Spacing</u></th></tr> </thead> <tbody> <tr> <td>< 5%</td><td>No plugs required</td></tr> <tr> <td>5 to 15%</td><td>300 ft. (150 ft.)</td></tr> <tr> <td>15 to 30%</td><td>200 ft. (100 ft.)</td></tr> <tr> <td>30%</td><td>50 ft.</td></tr> </tbody> </table>	<u>Right-of-Way Slope</u>	<u>Trench Plug Spacing</u>	< 5%	No plugs required	5 to 15%	300 ft. (150 ft.)	15 to 30%	200 ft. (100 ft.)	30%	50 ft.
<u>Right-of-Way Slope</u>	<u>Trench Plug Spacing</u>										
< 5%	No plugs required										
5 to 15%	300 ft. (150 ft.)										
15 to 30%	200 ft. (100 ft.)										
30%	50 ft.										



NOTE: Values in parentheses indicate required spacing on slopes with highly erodible soils.

Step	Activity
7	DETERMINE whether trench plugs or interceptor dikes are appropriate for

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Step	Activity
	company pipeline facility replacements and installations less than 50 feet in length.

8.0 Documentation Requirements

Record data in the electronic database or utilize the following form(s) as applicable:

- S-130A Excavation Report
- I.10.C Pipeline Inadequate Cover Notification
- I.10.D Rights-of-Way and Other Property Damage Reports
- Shallow Cover Database
- Pipe Inspection Database

The following table describes the documentation reporting requirements of this SOP.

Activity	Reporting
Acknowledge the requirements as outlined in the SOP have been completed. Record exceptions, if any, in the comments section.	EAM Unplanned Pipeline Work Order or appropriate maintenance record; retain for the life of the facility.

9.0 References

- E.S. HL6.0306 Wax Coating for Buried or Submerged Fittings, Valves, Tie-Ins, & Repairs to Linepipe Coating
- E.S. HL6.0306 Coating of Field Joints, Valves, Tie-Ins, Girth Welds and Short Sections of Pipe Using Two Part Epoxy
- HLA.01 Glossary and Acronyms
- HLB.04 Pipe Location and Marking
- HLD.35 Buried Pipe Inspection and Evaluations
- HLI.11 Pipeline Pressure Limit Criteria
- HLI.23 Protection of Pipelines Facilities from Blasting Operations
- HLI.24 Management of Depth of Cover and Evaluation
- HLI.27 Abnormal Loading of External Loads / Highway and Railroad Crossings
- Safety Procedure S-370 Work Permits
- Safety Procedure S-130 Excavation & Trenching

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Appendix A: The table below identifies the Operator Qualification (OQ) task requirements.
OQ Task Requirements

Task Description	OQ Task
Backfilling Pipe and Coating Protection	PLOQ404
Underground Pipeline – locate and temporarily mark	PLOQ605
Damage Prevention During Excavation/Encroachment Activities	PLOQ607

**Pipeline Pressure Limit
Criteria****Standard Operating Procedures***Applicable to Hazardous Liquids Pipelines and Related Facilities*

Code Reference :	Procedure No.: HLI.11	
49 CFR: 195.406, 195.424	Effective Date: 04/01/18	Page 1 of 7

**1.0
Procedure
Description** This Standard Operating Procedure (SOP) describes the scenarios and guidelines used when a pressure reduction is required prior to excavating a pipeline or prior to making a repair. This SOP establishes maximum pressures at which a pipeline is operated during maintenance and repair projects.

**2.0
Scope** This SOP establishes maximum pressures at which a pipeline is operated during maintenance and repair projects.

**3.0
Applicability** This SOP applies to pressure limits for damaged pipe at company facilities. The operating pressure limits for excavation activity apply when using powered equipment. Refer to *Appendix B: Operating Pressure Limitations*.

**4.0
Frequency** As required: During damage assessment, excavation, maintenance, and repairs.

**5.0
Governance** The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Operations Manager	Director of Operations

**6.0
Terms and
Definitions** Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

Terms	Definitions
Damaged Pipeline	Pipe with a defect, which requires an evaluation and repair according to <i>SOP HLI.06 Evaluating Pipeline Defects</i> . If a damaged pipeline is identified, it retains this classification until it is repaired per <i>SOP HLI.05 Pipeline Repair</i> .
Pipeline Anomaly	An unexamined and unevaluated deviation from the norm in pipe material identified through ILI data.
Pipeline Defect	A physically examined and evaluated deviation from the norm in pipe material with dimensions or characteristics that exceed

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Terms	Definitions
	acceptable limits.
Operating Pressure	For the purpose of this specification, the operating pressure is defined as the highest pressure experienced in the pipeline at the excavation location during the 60 days prior to discovery.
Pipeline Condition	The condition of the segment of the line in the immediate surroundings where the activities are taking place or are expected to take place. (Refer to Table 1 in Appendix B)
Undamaged Pipeline	No defect exceeding the limits of <i>SOP HLI.06 Evaluating Pipeline Defects</i> is found or after all known defects are repaired.
Unknown Damage	Damage identified through ILI data or third party notification that has not been measured or cannot be accurately measured using approved methods and that represents a possible safety and integrity hazard.

7.0 Pipeline Pressure Limit Criteria

The pressure criteria in this SOP are based upon company and industry experience as opposed to mathematical analysis or empirical expressions predicting pipeline behavior. Pressure reduction decreases the stress in the pipe and lowers the probability of failure. Consequently, performing activities at the lowest practical operating pressure maximizes the reduction of risk.

The following procedures are described in this section:

- Pressure reduction assessment
- Notification of pressure reduction
- Pressure reduction
- Durations of pressure reductions for defects
- Pressure reduction exception



WARNING: Verify HVLs remain at the appropriate pressure to ensure liquid state. If this cannot be accomplished the line shall be removed from service per *SOP HLI.01 Hazardous Liquid Pipeline Shutdown and Startup*

7.1 Pressure Reduction Assessment

Operations Personnel follow the steps below to determine if a pressure reduction is required during or prior to damage assessment, repair, construction, or maintenance activities

Pressure reduction is not necessary if there are no known defects and no additional factors regarding the pipeline section to be excavated.

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Step	Activity
1	<p>DETERMINE if one of the following is required during or prior to damage assessment, repair, construction, or maintenance activities:</p> <ul style="list-style-type: none"> • Pressure reduction not required • Pressure reductions corresponding to metal loss defect • Pressure reductions corresponding to a leaking defect, unknown damage, alternative factors • Pressure reductions prior to pipeline repair
2	<p>IDENTIFY if any of the following factors or conditions exist influencing the decision to restrict the pipeline pressure. Factors and or pipeline conditions include but are not limited to:</p> <ul style="list-style-type: none"> • Operating and construction history of the pipeline: <ul style="list-style-type: none"> ○ Type of girth weld/coupling ○ Type of seam weld ○ Pipe vintage ○ Expected manufacturing, construction, or operation defects ○ History of stress corrosion cracking • Type of work to be done: <ul style="list-style-type: none"> ○ Lowering/raising of the pipeline ○ Inducing pipeline stresses ○ Welding for Sleeve or Appurtenance Installation • Anomaly/defect characteristics: <ul style="list-style-type: none"> ○ Known - Defect ○ Unknown - Anomaly • Percentage of specified minimum yield strength (SMYS) at which the pipeline operates • Poor site conditions • Characteristics of the product



WARNING: Any one or combination of factors or conditions may warrant a more severe pressure reduction than outlined in this SOP at the discretion of the Qualified Operations Personnel, including a complete reduction in line pressure if it is deemed at any time necessary in order to maintain safety and integrity of the pipeline.

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7.1.1
Prior to
Excavation

When a pipeline with a leaking defect, known or unknown damage, or pipeline anomaly will be exposed by excavation, Operations Personnel perform these steps to reduce the operating pressure.

Step	Activity
3	When excavating a damaged pipeline due to a leaking defect or unknown damage from second or third parties, REDUCE the operating pressure to 80% of the operating pressure from the last 60 days at a minimum (see Definitions in <i>Section 6.0</i> , Terms and Definitions)
4	When excavating a pipeline due to a pipeline anomaly, CONSIDER reducing the operating pressure to the one of the following: <ul style="list-style-type: none"> The safe pressure determined by Engineering Analysis from Technical Operations or Pipeline Integrity Department considering anomaly location and distance from pressure source, or 80% of the operating pressure (see Definitions in <i>Section 6.0</i>, Terms and Definitions) <p>The Pipeline Integrity Department will determine necessary pressure reductions for Immediate Conditions.</p>
5	If there are alternative factors that warrant pressure reduction, REDUCE the operating pressure to a safe pressure determined by Engineering Analysis from Technical Operations or Pipeline Integrity Department.
6	MAINTAIN pressure reductions per Section 7.4 requirements.



NOTE: Consider a pressure reduction when excavating on any section with a history of stress corrosion cracking until it is verified that no crack-like defects are present. Consult the Pipeline Integrity Department to determine the appropriate pressure reduction if necessary.

7.1.2
During
Evaluation of
Pipeline Defects

During the evaluation of pipeline defects (metal loss or damage) the Qualified Operations Personnel performs the steps below. Refer to Section 6.0 for a definition of unknown defect and suspected damage.

Step	Activity
1	EVALUATE external corrosion and general metal loss defects detected during any damage assessment, repair, construction, or maintenance activities per <i>SOP D.47 Evaluation of Remaining Strength of Pipe with Metal Loss</i> .

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2	VERIFY pressure is below the “Max Safe Pressure” results determined by <i>SOP D.47 Evaluation of Remaining Strength of Pipe with Metal Loss</i> and ADJUST pressure reduction accordingly.
3	After characterization of an unknown or newly discovered defect, if this pressure is less than 80% of the most recent operating pressure or highest known pressure from the last 60 days, ADJUST the pressure reduction to the safe operating pressure as defined in <i>SOP HLD.47 Evaluation of Remaining Strength of Pipe with Metal Loss</i> .
4	Accordingly, upon characterization of the defect, if the safe operating pressure as defined in <i>SOP HLD.47 Evaluation of Remaining Strength of Pipe with Metal Loss</i> is greater than 80% of the most recent operating pressure, OBTAIN approval from the Director of Operations to ADJUST the pressure reduction to the higher pressure.
5	EVALUATE other metal loss or damage defects (i.e. scratches, gouges, mill pits, grinding marks, etc.) per <i>SOP HLI.06 Evaluating Pipeline Defects</i> .
6	ADJUST the pressure reduction if there are defect characteristics identified that may impair serviceability of the pipeline. REDUCE the pressure to a safe pressure determined by Engineering Analysis from Technical Operations or Pipeline Integrity Department. Defect characteristics that may impair serviceability include but are not limited to: <ul style="list-style-type: none"> • Sharp defect edges • Stress concentrators • Cracking • Hard spots • Arc burns
7	MAINTAIN pressure reductions per Section 7.4 requirements.

**7.1.3
Pipeline Repair
by Grinding**

Pipeline repairs made by grinding often requires a pressure reduction. Operations Personnel perform the following activities.

Step	Activity
1	REDUCE the pressure to the one of the following: <ul style="list-style-type: none"> • The safe operating pressure determined via <i>SOP HLD.47 Evaluation of Remaining Strength of Pipe with Metal Loss</i>, based upon the expected remaining wall thickness after the repair • 80% of the operating pressure from the last 60 days • Or a safe pressure determined by Engineering Analysis from Technical Operations or Pipeline Integrity Department considering defect location and distance from pressure source.
2	CONSIDER the following attributes/defects when determining a pressure reduction prior to grinding:

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Step	Activity
	<ul style="list-style-type: none"> Stress Corrosion Cracks (SCC) ERW or EFW Girth weld Crack-like defect remaining in pipe body after initial 10% nominal wall thickness removal per <i>SOP I.05 Pipeline Repair</i> Defect with unknown effects to the serviceability of the pipeline

7.2
Notification of
Pressure
Reduction

The following notifications of pressure reduction should occur as soon as possible, prior to excavation.

- Operations Personnel **NOTIFY** the Operations Manager or Director of Operations when a pressure reduction is required.
- Operations Manager or Area Director **NOTIFY** Liquids Control.

7.3
Pressure
Reduction

Operations Personnel use the following steps to reduce operating pressures in pipelines before excavation and repairs.

Step	Activity
1	CONDUCT a pressure reduction assessment per Section 7.1.
2	REDUCE pressure.



WARNING: For cases when a pressure reduction assessment results in a pressure below a critical delivery pressure, a more detailed analysis of the planned work must be completed. Safety of Operations Personnel and the safety and integrity of the pipeline shall not be compromised. Any deviation from the required pressure reduction shall be obtained through the waiver process per *SOP HLA.03 Management of Change*.

Step	Activity
3	REDUCE the pressure to zero (atmospheric) in situations where pipe damage is from equipment impacting the pipe and that equipment remains in place or where the integrity of the pipeline is jeopardized.
4	Upon characterization of a defect, DETERMINE if the current pressure reduction is adequate or requires adjustment.

7.4
Durations of
Pressure
Reductions for
Defects

An Operations Manager uses the following steps to determine duration of pressure reductions for defects.

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Step	Activity
1	CONTINUE and MAINTAIN any pressure reduction until after the visual inspection and evaluation of the defect are complete and it is determined that a pressure reduction is not required or a repair is completed per <i>SOP HLI.05 Pipeline Repair</i> .
2	If the evaluation determines that a pressure reduction is no longer necessary, LIFT the pressure restriction.
3	For pressure reductions of a pipeline in a high consequence area (HCA) exceeding 365 days NOTIFY Regulatory Compliance Group for notification to PHMSA.

8.0
Documentation
Requirements

There are no documentation requirements in this SOP.

9.0
References

HLA.03 Management of Change
HLD.47 Evaluation of Remaining Strength of Pipe with Metal Loss
HLI.01 Hazardous Liquid Pipeline Shutdown and Startup
HLI.05 Pipeline Repair
HLI.06 Evaluating Pipeline Defects

Appendix A:
OQ Task
Requirements

There are no Operator Qualification (OQ) tasks required for this procedure.

**Pipeline Facilities
Identification****Standard Operating Procedures***Applicable to Hazardous Liquids Pipelines and Related Facilities*

Code Reference :	Procedure No.: HLI.12	
49CFR 195.434, 195.410, 195.438	Effective Date: 04/01/18	Page 1 of 6

1.0 Purpose This Standard Operating Procedure (SOP) describes the various methods used to identify company pipelines and related facilities, as well as the activities involved with the placement and maintenance of the different types of identification markers.

2.0 Scope This procedure describes the requirements for the type and placement of signs along the pipeline ROW as well as fenced or otherwise enclosed boundaries of company facilities to aid in their identification and alert the general public of potential hazards.

3.0 Applicability This SOP applies to all regulated pipelines and facilities.

4.0 Frequency As required: Install and maintain signs and markers.

5.0 Governance The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Operations Manager	Director of Operations

6.0 Terms and Definitions For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

7.0 Pipeline Facilities Identification The following procedures are described in this section:

- Placement of Pipeline Markers
- Aerial Markers
- Road and Blacktop Stencils and Decals
- Temporary Markers
- Painted Fence Posts
- Facility Signs
- Maintenance

Code Reference :	Procedure No.: HLL12	
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7.1 Placement of Pipeline Markers

Operations Personnel follows the steps below for the placement of pipeline markers at the following locations:

- Stream crossings
- Both sides of public road crossings
- Other utility's right-of-way
- Both sides of railroad crossings
- Aboveground pipelines in areas accessible to the public
- Any other location where it is necessary to identify the pipeline location

Step	Activity
1	PROVIDE pipeline identification and warning information on casing vents or pipeline markers.
2	Markers MUST include the following written legibly on a background of sharply contrasting color: <ul style="list-style-type: none"> • OPERATING COMPANY NAME, • The words "WARNING", "CAUTION" or "DANGER", followed by the type of PRODUCT TRANSPORTED, (ei "HAZARDOUS LIQUIDS") "PIPELINE", all of which (except for markers in heavily developed urban areas) must be in letters 1" high by ¼" stroke • The appropriate 24-hour, toll free or emergency phone number, including area code.
3	CONSIDER placing markers at LINE-OF-SIGHT intervals where practical
4	REFER to alignment sheets for installation details.

7.2 Aerial Markers

Operations Personnel follows the steps below for installing aerial markers where applicable.



NOTE: Aerial markers may include mileposts, valve numbers, and other pipeline information visible by aerial patrol.

Step	Activity
1	INSTALL aerial patrol markers at frequent intervals and at all industrial sites only where necessary to assist the aerial patrol pilot in identifying locations along the pipeline ROW.
2	VERIFY that aerial patrol markers are maintained in good condition and are clearly visible from the air.
3	VERIFY that all aerial markers have clear bold letters and/or numbers.
4	REFER to appropriate company standard drawings for aerial markers.



NOTE: In lieu of aerial markers, GPS waypoints may be established at frequent intervals to enable the aerial patrol operator and Operations Personnel to locate the pipeline and associated facilities along the ROW. A master list of waypoints should be maintained for quick reference.

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7.3
Road and
Parking-lot
Stencils and
Decals

Operations Personnel follows the steps below to use stencils and decals to mark pipeline locations.

Step	Activity
1	USE decals, stencils or other appropriate markers to MARK the location of the pipeline where it is impractical to install a marker on company facilities, such as areas where the pipeline is located longitudinally within a road, and where the pipeline is located within parking areas.
2	VERIFY that the decals identify the company name, the appropriate signage (i.e. "Hazardous Liquid" or "Petroleum Pipeline") that identifies the pipeline the 24 hour telephone number, and the orientation of the pipeline.

7.4
Waterway
Warning Signs

Operations Personnel installs warning signs for waterway crossings.

Step	Activity
1	POST waterway warning signs at navigable inland waterway crossings where anchor damage to the pipeline is possible.
2	VERIFY that the decals identify the company name, the appropriate signage (ei "Hazardous Liquid" or "Petroleum Pipeline") that identifies the pipeline the 24 hour telephone number, and the orientation of the pipeline.



NOTE: Consider boat traffic, flood zones, and high water areas when placing pipeline markers and water crossing signs.

7.5
Temporary
Markers

Operations Personnel follows the steps below for installing temporary markers.

Step	Activity
1	INSTALL temporary markers where necessary to aid in preventing damage caused by short-term construction activities. Refer to <i>SOP HLI.28 ROW Encroachments</i> and <i>SOP HLI.30 Third Party Damage</i> .



NOTE: Temporary markers include stakes, flags, marker posts, signs, painted markings on paved surfaces.

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- 7.6 Painted Fence Posts** Operations Personnel follows the steps below for painting fence posts if directed by the area Operations Management.

Step	Activity
1	PAINT the fence posts located within the pipeline ROW with high visibility paint, after NOTIFYING the landowner.
2	If the pipeline easement does not have a defined width, EXTEND the painted fence posts 25 feet out from the centerline of the outermost pipeline.
3	PAINT the fence posts unless forbidden by the landowner.
4	If the landowner forbids the painting, NOTIFY the ROW Representative.
5	DOCUMENT in <i>ROW Tract Files</i> that the landowner has forbidden the painting of fence posts.

- 7.7 Facility Signs** Operations Personnel places the following signs at the appropriate locations for the listed company facilities.

- 7.7.1 Pump Stations and Breakout Tanks** Smoking or an Open Flame is prohibited where there is a potential or presence of flammable vapors or liquids. Follow the steps below for the placement of signs at pump stations, breakout tank and DOT regulated sphere facilities, junctions and delivery facilities where there is a potential for the presences of flammable vapors or liquid.

Step	Activity
1	PLACE “No Trespassing” “Authorized Personnel Only” signs at or near each walk-in or drive-in gate.
2	CONSIDER placing “No Trespassing” “Authorized Personnel Only” signs at 100-foot intervals along the fence where appropriate.
3	PLACE line markers where liquid pipelines enter and exit the facility.
4	PLACE “Smoking in Designated Areas Only” signs at or near each walk-in or drive-in gate.
5	PLACE “Smoking in Designated Areas Only” signs between any smoking and non-smoking areas on the property. Add “No Open Flames” signs where smoking is prohibited.
6	PLACE signs including the company name, facility name and appropriate emergency telephone numbers at the main entrance to the facility or the entrance facing the public and around the facility fence.

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7.7.2
Measuring
Stations

Follow the steps below for the placement of signs at measuring stations.

Step	Activity
1	PLACE "No Trespassing" signs at or near each walk-in or drive-in gate, "Authorized Personnel Only".
2	PLACE company and facility name, and appropriate emergency telephone numbers at the main entrance to the facility or the entrance facing the public roadway.
3	PLACE line markers where liquid pipelines enter and exit the facility.
4	PLACE "No Smoking or Open Flames Signs" at or near each walk-in or drive-in gate.

7.7.3
Main/Lateral
Line Valve
Settings

Follow the steps below for the placement of signs at main/lateral line valve settings.

Step	Activity
1	PLACE "No Trespassing" signs at or near each walk-in or drive-in gate.
2	PLACE "No Smoking Signs" at or near each walk-in or drive-in gate.
3	PLACE sign on the facility fence including the name of the operator and the 24 hour emergency call number
4	PLACE line markers where liquid pipelines enter and exit the enclosed boundary.



NOTE:

- On facilities south of the Colorado River (in Texas) and at other locations where English may not be the predominant language, signs must be printed in English and the locally predominant language, or two signs must be used, one in English and the other in the locally predominant language.
- For small meter stations, especially in the gathering area, where there may be only a tap valve and Electronic Gas Measurement (EGM) (where the producer owns the meter run), or where there is a skid-mounted metering facility that may be on others' property, there may not be sufficient surface area or fence to install signs as on larger facilities.

Step	Activity
5	INSTALL an approved pipeline warning sign on the meter house door and/or at the tap valve in areas where the cases in the previous note are present.
6	For main/lateral line valve settings or measurement facilities where there is only a pipe-fence and no woven fence, PLACE signs inside the area as long as they are clearly visible at the property boundary and do not interfere with operations and maintenance activities.

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NOTE: It is not the intent to install fencing in order to post signs.

7.8 Maintenance

Operations Personnel follows the steps below for maintenance.

Step	Activity
1	REPAIR or REPLACE damaged or missing markers in a timely manner.

8.0 Documentation Requirements

There are no documentation requirements for this SOP.

9.0 References

HLI.28 ROW Encroachments
HLI.30 Third Party Damage

Appendix A: OQ Task Requirements

The table below identifies the Operator Qualification (OQ) task requirements.

Task Description	OQ Task
Install and Maintain Pipeline Markers	PLOQ703

**Standard Operating Procedures***Applicable to Hazardous Liquids Pipelines and Related Facilities***Inspection of Rights-of-Way & Crossings Under Navigable Waters**

Code Reference :	Procedure No.: HLI.21	
49 CFR: 195.412	Effective Date: 04/01/18	Page 1 of 6

**1.0
Purpose**

This Standard Operating Procedure (SOP) establishes the requirements inspection of rights-of-way (ROW) and crossings under navigable waters. Methods of inspection include walking, driving, flying or other appropriate means of traversing the right-of-way.

**2.0
Scope**

This SOP describes the criteria for conducting and documenting pipeline inspections to verify the safety of the pipeline.

**3.0
Applicability**

This SOP applies to all regulated hazardous liquid facilities that are operated by the company.

**4.0
Frequency**

At intervals not exceeding 3 weeks, but at least 26 times each calendar year: Inspect the surface conditions on or adjacent to each pipeline right-of-way, including off-shore rights-of-way.

At intervals not exceeding 5 years: Inspect each crossing under a navigable waterway to determine the condition of the crossing, except for offshore pipelines.

**5.0
Governance**

The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
Patrol Observations & Reporting	Contractor / Operator Performing Patrol / Inspection	Operations Manager	Director of Operations

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6.0 Terms and Definitions

Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

Terms	Definitions
Navigable Waterway	As defined in Subpart 2.10-5 of 33 CFR where it states that "...navigable waters of the United States shall be construed to mean those waters of the United States, including the territorial seas adjacent thereto, the general character of which is navigable, and which, either by themselves or by uniting with other waters, form a continuous waterway on which boats or vessels may navigate or travel between two or more States, or to or from foreign nations...."

7.0 Inspection of Rights-of-Way & Crossings under Navigable Waters

Operations Personnel develop an inspection program to observe surface conditions on and adjacent to the facilities and/or pipeline right-of-way for indications of leaks, construction activity, and other factors affecting safety and operations.

Methods of inspection include walking, driving, flying, or other appropriate means of traversing the right-of-way.

The following procedures are described in this section:

- Aerial surveillance
- Observations during Inspection
- Inspection methods for crossings under navigable waterways
- Notification of encroachment problems
- Reporting and Investigating Patrol Observations
- Crossings Under Navigable Waterways Inspection Summary

7.1 Aerial Surveillance

Operations Personnel schedule aerial inspections.

In the event of a cancellation, the pilot documents the cancellation of a scheduled aerial inspection due to weather conditions, mechanical readiness of the aircraft or other conditions and notifies Operations Personnel. Consideration of alternative methods of inspection should be initiated to insure compliance with frequency requirements in Section 3.0.

Step	Activity
1	VERIFY personnel performing the inspections have adequate training and experience.
2	CONSIDER accompanying the pilot on the aerial inspections periodically.
3	EVALUATE construction activity to determine if more frequent flights are warranted.

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**7.2
Observations
during
Inspections**

The operator performing an inspection keeps a log of the inspection, observing and documenting the following items:

- General conditions of the right-of-way.
- Indications of sink holes, sunken trenches, or exposed pipelines.
- Water erosion, bank erosion, soil slippage, or landslide areas.
- Indications of leakage such as blowing liquids / vapors, displaced backfill, discolored or wilted vegetation, oil sheen on water crossing areas or rights-of-way, bubbles in water puddles or water crossing areas, and/or ice formations over the pipeline.
- Fires on or adjacent to the right-of-way.
- The condition of pipeline markers. If they are found not to meet the requirements of SOP HLI.12 *Pipeline Facilities Identification*, correct that condition at this time.
- Damage to existing company facilities such as valves, pump stations and junctions, delivery facilities, loop terminals, or communications facilities.
- Construction or logging activity on, in the vicinity of, or progressing toward the pipeline right-of-way (including evidence of possible construction such as the presence of excavation equipment or evidence of disturbed earth that crosses the ROW.)
- Land leveling or grading activities.
- Excavation near the pipelines, including routine activities occurring within industrial properties.
- Installation of houses, mobile homes, businesses, churches, schools or other structures.
- Installation of parks, recreation areas, play grounds or other places of assembly on or adjacent to the right-of-way.
- Construction of irrigation or drainage canals, ponds, or swimming pools.
- Installation of irrigation piping systems, sprinkler systems, sewers, utilities, or other underground facilities or structures.
- Installation of telephone or power poles, fence posts, or guy wire anchors.
- Deep plowing operations
- Seismic geological survey activities, well logging operations, well drilling activities, or quarry and blasting work.
- Any unusual conditions or activities, which may have an effect on the pipelines.

**7.3
Inspection
Methods for
Crossings
under
Navigable
Waterways**

Operations Personnel may use or select a Third Party to employ one of the following methods for inspection of crossings under navigable waterways:

- Sonar
- Physical Probing
- Acoustic Systems
- Magnetic Systems

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7.4
Notification of
Encroachment
Problems

The patrol operator performs the following procedure when potential encroachments are identified during a patrol survey. Notify Operations Personnel in accordance with HLI.28 *Right-of-Way Encroachment*.

7.5
Reporting and
Investigating
Patrol
Observations

Operations Personnel uses the following procedure for conditions identified by patrols.

Step	Activity
1	DOCUMENT the results of the Area's investigation and any other conditions found or reported that could adversely affect the safety, operation, or maintenance of the pipeline system on the applicable form(s) for <i>Encroachment, Foreign Line Crossing and Class Location HCA Report</i> . INCLUDE a description of conditions found and any remedial action required or taken.
2	COMPLETE the applicable form(s) for <i>Aerial Patrol Trouble Report</i> when the flight is completed. Include sketches, photos, or additional data to supplement reports where necessary.
3	INCLUDE on the applicable form(s) for <i>Aerial Patrol Trouble Report</i> a description of each activity on or adjacent to the pipeline right-of-way.



NOTE: Provide a distinct number for each individual report of activity documented on the applicable form(s) for *Aerial Patrol Trouble Report*.

Step	Activity
4	INVESTIGATE each activity reported using the applicable form(s) for <i>Aerial Patrol Trouble Report</i>
5	Operations Personnel TAKE immediate action if a condition is detected which could be a hazard to persons, environment or property in the area.
6	Operations Personnel ADVISE Director of Operations and/or Operations Manager and Integrity Department of the conditions, immediate actions taken and proposed future actions to resolve the condition. Integrity Department will inform the Director of Regulatory Compliance of these activities.
7	Operations Personnel DOCUMENT findings and actions taken on the applicable form(s) for <i>Line Patrol</i> .
8	Operations Personnel COMPLETE the process flow for an Abnormal Operation or Safety Related Condition, if applicable. REFER to SOP HLA.12 <i>Safety-Related Condition</i> , SOP HLA.15 <i>PHMSA / State Incident Reporting</i> and SOP HLA.13 <i>Response to Abnormal Operations</i> .
9	The Pipeline Integrity Department INITIATES through routine actions a program to recondition, replace, or abandon any line segment found to be in

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Step	Activity
	unsatisfactory condition. Pipeline Integrity Department, Director of Regulatory Compliance, and Director of Operations shall approve this program prior to initiation.
10	If required, INSPECT the pipeline visually for coating damage, gouges, corrosion, dents per <i>SOP HLD.35 Buried Pipe Inspection and Evaluations</i> .
11	If anomalies are found which are not acceptable by company standards, REPAIR them per <i>SOP HLI.06 Evaluating Pipeline Defects</i> .
12	Operations Personnel MAINTAIN records for 2 years as required by the activity resolving an unsatisfactory condition.

7.6
Crossings
under
Navigable
Waterways
Inspection
Summary

Operations Personnel uses the following for inspections of crossing under navigable waterways.

Step	Task
1	For Crossings Under Navigable Waterways, OBTAIN information pertaining to the current profile of the pipeline in relation to the bottom of the navigable waterway. ADJUST frequency of inspection based on the condition of the crossing to ensure integrity of pipe, prevent hazards to navigation and continuity of safe operations. SCHEDULE repairs as necessary.
2	DOCUMENT results of the inspection and RETAIN at the field office for at least 2 years or until the next inspection is performed, whichever is longer.

8.0
Documentation
Requirements

Record data in electronic database or utilize the following form(s) as applicable:

- A.12.A Safety Related Conditions Report
- A.13.A Abnormal Operations
- B.13.A Encroachment, Foreign Line Crossing and Class Location HCA Report
- I.21.A Line Patrol
- I.21.B Aerial Patrol Report
- I.21.C Aerial Patrol Trouble Report

The following table describes the reporting requirements of this SOP for the electronic database.

Activity	Reporting
Acknowledge the requirements as outlined in the SOP have been completed. Record exceptions in	Electronic Maintenance Database

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the description tab. Records of Patrols must be maintained for a minimum of 2 years. Inspections of Crossing under navigable waterways must be maintained for a minimum of 2 years or until the next inspection is performed, whichever is longer.



NOTE: For Third Party Operators not using G-Forms, they should provide the applicable forms and be retained on file for the life of the facility.

**9.0
References**

HLD.35 Buried Pipe Inspection and Evaluations
HLI.06 Evaluating Pipeline Defects
HLI.12 Pipeline Facilities Identification
HLI.28 Right-of Way Encroachments

**Appendix A:
OQ Task
Requirements**

The table below identifies the Operator Qualification (OQ) task requirements.

Task Description	OQ Task
Pipeline Patrol	PLOQ701B
Install and Maintain Pipeline Markers	PLOQ703

**Standard Operating Procedures***Applicable to Hazardous Liquids Pipelines and Related Facilities***Protection of Pipeline
Facilities from Blasting
Operations**

Code Reference:	Procedure No.: HLI.23	
49 CFR: 195.442	Effective Date: 04/01/18	Page 1 of 6

**1.0
Procedure
Description** This Standard Operating Procedure (SOP) describes the steps and necessary precautions to be taken when blasting operations are to be conducted within 300 feet of the company's facilities.

**2.0
Scope** The SOP provides the guidance necessary to perform adequate analysis of blasting plans for blasting near company facilities.

**3.0
Applicability** This SOP applies when blasting operations occur within 300 feet of regulated company facilities.

**4.0
Frequency** As required: When Blasting activity takes place near company facilities.

**5.0
Governance** The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel / Engineering	Operations Manager	Director of Operations

**6.0
Terms and
Definitions** For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

**7.0
Protection of
Pipeline
Facilities from
Blasting
Operations** This SOP contains the following sections:

- Identify Potential Threats To Company Facilities
- Obtain Needed Information from the Parties Involved
- Analysis of the Proposed Blasting Plan
- Communicate Blasting Plan Requirements

Protection of Pipeline Facilities from Blasting Operations

Code Reference:	Procedure No.: HLI.23	
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- 7.1** Operations Personnel follow these steps to identify potential threats to company facilities.
- Identify Potential Threats to Company Facilities**

Step	Activity
1	INVESTIGATE any activity related to blasting or seismic operations that occur in the vicinity of the pipeline.
2	CONFIRM the limits of the blasting operation with the party performing the blasting.
3	DOCUMENT the results of the investigation on the applicable form(s) for <i>Encroachment, Foreign Line Crossing and Class Location HCA Reports</i> .

- 7.2** Operations Personnel follow these steps for obtaining needed information from the parties involved.
- Obtain Needed Information from the Parties Involved**

Step	Task
1	<p>OBTAIN a detailed blasting plan from the party performing the blasting operations. The following information is required:</p> <ul style="list-style-type: none"> • Date and time of proposed blasting operations • Location of blasting operations and distance from the nearest company facility • Rock configuration-degree of confinement, presence of free faces for rock to move toward, and relative elevations of pipe and blast holes • Hole size, spacing, burden, depth, and layout within drawing • Type of explosive, Energy Release Ratio (EER), and specific energy (calories per gram) • Total number of holes (charges) • Delay interval between charges • Maximum charge weight per delay • Drawing of the location depicting the relationship of the charges to company facilities (this drawing shall be provided by the party performing the blasting operations). • The blasting plan shall be provided by the party performing the blasting operations sufficiently in advance to allow for evaluation and to make arrangements for witnessing the operation. • Blasting permit and blaster license

Protection of Pipeline Facilities from Blasting Operations

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Step	Task
	<ul style="list-style-type: none"> Advise the company ROW Representative of the planned blasting operation
2	DETERMINE the characteristics of the pipeline in the area where blasting operations are planned. Information to be gathered includes the following: <ul style="list-style-type: none"> MOP of the pipeline(s) Pipe diameters Pipe wall thickness Pipe grade Pipe depth Type of joint (coupled, acetylene welded, etc.) Type of longitudinal joint Distance from the pipeline to the proposed blasting operations Known defects in the pipeline (this information can be gathered from recent In-line inspection runs – discuss with the Pipeline Integrity Engineer). Historical data such as leak history Operational data (local knowledge of the pipeline)
3	ADVISE the party performing the blasting operation that no blasting may occur until the company has had an opportunity to review and approve the blasting operations plan.
4	PROVIDE a copy of the proposed blasting plan, and the pipeline characteristics to the Engineering Department, Liquid Technical Operations Group, and / or Geology Department for analysis and review.

7.3 Analysis of the Proposed Blasting Plan

Engineering Department, Liquid Technical Operations Group, and / or Geology Department performs the following steps for analysis of the proposed blasting plan

Step	Activity
1	REVIEW the characteristics of the pipeline facilities that may be affected.
2	REVIEW the blasting plan to determine the variables to be used in the evaluation.
3	UTILIZE a computer modeling program specifically designed to evaluate the effects of blasting on a pipeline (such as Pipeline ToolBox or other equivalent).



NOTE: The pipeline ToolBox program does not take delay between charges into account.

Protection of Pipeline Facilities from Blasting Operations

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Step	Activity
4	To perform a proper evaluation of the blasting operation with delays between charges of 8 to 15 milliseconds, CONSIDER the charges as single individual point charges utilizing the nearest off-set distance from the pipeline as the off-set variable.
5	<p>If adjustments are needed in the blasting plan regarding types of explosives, burden, hole spacing, hole size, charge weight per hole, number of charges in front row, number of rows in grid, stand-off distance, etc., WORK with the blasting operator to arrive at a mutually agreed-upon plan that will allow for blasting without compromise of pipeline integrity or safety of personnel. The approved blasting plan conveys the following information:</p> <ul style="list-style-type: none"> • Acceptability of operating conditions for the approved blasting plan • Maximum allowable charge weight permitted if the pipeline operating pressure is to be maintained at its current level during blasting operations • Test blast requirements, number of seismographs required, and placement • Minimum required separation from blast source to the pipeline or facility • Highest safe operating pressure at which the pipeline may operate with the proposed blasting plan • What, if any, additional safety measures must be taken during or after blasting operations which may include manning of valves, reducing operating pressure, reinforcing couplings or acetylene welds, conducting post blast leakage surveys • Any other action felt to be prudent by the evaluator



CAUTION: Blasting operations within the confines of the pipeline ROW will not be allowed unless it is being conducted for the benefit of the company and under the direct supervision of a company representative, unless otherwise approved by the Director of Operations / Engineering.

7.4 Communicate Blasting Plan Requirements

Engineering Department, Liquid Technical Operations Group, and / or Geology Department follow the steps below once an approved blasting plan has been agreed upon to communicate requirements to the parties involved.

Step	Task
1	COMMUNICATE the requirements of the plan to Operations Personnel, Director of Operations, Operations Manager and the company ROW Representative.

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Step	Task
2	COMMUNICATE the requirements of the blasting plan to the blasting company, and CLARIFY to the blasting operator that any changes to any variable in the blasting plan MUST BE APPROVED by the company approved representative prior to blasting operations.
3	OBSERVE blasting operations. If the approved blasting plan requires that a company representative be present during initial blasting operations, MAKE arrangements for Company personnel to be on-site prior to commencement of blasting.

7.5 Post-Blast Requirements

Operations Personnel follow these steps for observing and monitoring the pipeline following individual blasts or blasting activities.

Step	Task
1	PERFORM a post-blast leakage survey following blasting in the vicinity of the pipeline. This survey shall include: use of gas detection equipment to monitor the pipeline ROW for indications of leaking petroleum or crude oil, surveillance of the ROW for indications of surface cracks, liquid sounds, hydrocarbon odors and leaking hazardous liquids. USE a probing bar to create holes in the ground surface to assist with identifying subsurface conditions.
2	If there are indications of ROW surface cracks, blast craters or if seismograph readings have significantly exceeded limits, EXPOSE the pipeline to inspect for damage. Evaluate the pipeline for any defects per <i>SOP HLI.06 Evaluating Pipeline Defects</i> and repair any defects per <i>SOP HLI.05 Pipeline Repair</i> .
3	MONITOR the pipeline for pressure loss or leak conditions. Report any pressure loss or leak conditions to Operations Management per <i>SOP HLA.04 Initial Reporting and Investigating Events</i> .

8.0 Documentation Requirements

Record data in electronic database or utilize the following form(s) as applicable:

B.13.A Encroachment, Facility Crossing and Class Location HCA Reports
Copy of the approved blasting plan
Pipe Inspection Report or Maintenance Record

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Facilities from Blasting
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9.0 Pipeline Toolbox – PipeBLAST
References HLI.05 Pipeline Repair
HLI.06 Evaluating Pipeline Defects
HLA.04 Initial Reporting and Investigating Events

Appendix A: There are no Operator Qualification (OQ) tasks required for this SOP.
OQ Task
Requirements

**Management of Depth of Cover and Evaluation****Standard Operating Procedures***Applicable to Hazardous Liquids Pipelines and Related Facilities*

Code Reference :	Procedure No.: HLI.24	
49 CFR: 195.248, 195.401	Effective Date: 05/01/17	Page 1 of 15

1.0 Procedure Description This Standard Operating Procedure (SOP) outlines activities directed at the management of depth of cover for the purpose of minimizing the possibility of damage to pipelines as a result of shallow cover or exposure.

2.0 Scope This SOP establishes depth of cover guidelines with minimum requirements for the inspection, remediation, and monitoring of shallow and exposed pipe conditions, including unintended spans.



NOTE: For additional guidance and inspection requirements of river/waterway approaches and river/waterway crossings requiring Contract Assisted River Crossing Survey (CARCS), refer to SOP HLI.21 Inspection of ROW – Crossings Under Navigable Waters.

3.0 Applicability This SOP applies to any regulated pipe segment where shallow cover and pipeline exposures can potentially occur.

4.0 Frequency

As required: Perform depth of cover surveys on regulated pipeline segments to determine pipe segments with existing shallow cover, exposures, or areas suspected of becoming shallow or exposed due to a threat from a weather, natural, or outside force.

As required at least once each calendar year at intervals not to exceed 15 months: Inspect all pipeline segments classified as **exposed**.

As required at least once every two calendar years, not to exceed 27 months: Inspect all pipeline segments classified as **elevated**.

As required at least once every three calendar years, not to exceed 39 months: Inspect pipeline segments classified as **monitored**.

As required: Develop a remediation action plan for pipeline segments classified as **immediate**.

As required: Inspect pipeline segments classified as **remediated**.

5.0 Governance The table below identifies responsibility, accountability, and authority for this SOP.

Function	Responsibility	Accountability	Authority
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Buried Pipeline Cover

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Managing Depth of Cover	Operations Personnel	Operations Manager	Director of Operations
Locating Shallow and Exposed Company Pipelines	Operations Personnel	Operations Manager	Director of Operations
Site Evaluations	Operations Personnel	Operations Manager	Director of Operations
Pipe Inspections	Operations Personnel	Corrosion Specialist	Director of Operations
Develop Remedial Action Plans	Operations Personnel and Pipeline Operations Specialist	Operations Manager	Director of Operations
Implement Remedial Action Plan	Operations Personnel and Pipeline Operations Specialist	Operations Manager	Director of Operations
Aerial Patrol Observations & Reporting	Operator Performing Patrol	Operations Manager	Director of Operations
Legal Action and Right-of-Way	Right-of-Way Representative	Right-of-Way Representative	Manager Right-of-Way

6.0 Terms & Definitions

Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

Terms	Definitions
Exposed Pipeline	A pipe segment which was designed and constructed according to the pipeline safety regulations in place at the time of construction, with sufficient cover to minimize damage by outside or natural forces, but which has experienced deterioration in the amount of cover originally provided, resulting in exposure of the pipe to the atmosphere.
Shallow Pipeline	A pipe segment which was designed and constructed according to the pipeline safety regulations in place at the time of construction, with sufficient cover to minimize damage by outside or natural forces, but which has experienced deterioration in the amount of cover originally provided.
Unintended Span	A pipe segment classified as Exposed and due to additional loss of surrounding soil has resulted in an unsupported span. (360° exposure)
Immediate Classification	A Shallow or Exposed Pipeline Segment such that without further intervention, damage to the pipeline is likely and

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Terms	Definitions
	remediation is warranted.
Elevated Classification	A Shallow pipeline segment in which an evaluation indicates a threat of becoming Exposed and due to the additional loss of cover, damage from outside or natural forces IS possible. Such a condition requires continued monitoring with no immediate action required.
Monitored Classification	A Shallow Pipeline Segment in which an evaluation indicates that the loss of cover does NOT increase the potential for damage or require remedial action to re-cover the pipe segment. Such a condition requires continued monitoring with no immediate action required.
Remediated	A Shallow or Exposed pipeline segment in which a remediation plan has been completed and the threat of a natural or outside force has been removed by either line lowering, additional soil, or structural protection.
Remediation Plan	A repair or mitigation activity used to reduce the likelihood of failure of the component being examined.

7.0 Management of Depth of Cover and Evaluation

This SOP contains the following sections:

- Depth of Cover Assessment – 7.1
- Location Description with Public Notification – 7.2
- Evaluation of Depth of Cover – 7.3
- Evaluation of Shallow Cover – 7.4
- Evaluation of Cultivated Lands with Shallow Cover – 7.5
- Evaluation of Exposed Pipeline Segments – 7.6
- Evaluation of Unintended Span – 7.7
- Monitored Conditions – 7.8
- Elevated Conditions – 7.9
- Immediate Conditions – 7.10
- Remedial Action Plans – 7.11
- Remediated Conditions – 7.12
- Reporting Requirements – 7.13

7.1 Depth of Cover Assessment

Operations Personnel, **REVIEWS** depth of cover information from multiple sources, **DETERMINES** additional areas needing depth of cover surveys to identify pipe segments with shallow cover and exposed conditions following the steps below.

Step	Activity
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1	REVIEW collected depth of cover data. Data sources should include but not limited to the following: <ul style="list-style-type: none"> • 3rd Party Depth of Cover Survey • Construction As-Built • Pipe Inspections • Line locates/probing • Line Crossings • Right-of-Way Reclamation • Encroachments • CARC Survey • River Approach Inspection • Coupling locating
2	DETERMINE areas needing a depth of cover survey performed.
3	IDENTIFY and DOCUMENT pipe segments with shallow cover and exposed conditions from collected data and depth of cover surveys.

7.2 Location Description with Public Notification

Operations Personnel, upon initial investigation of pipe segments with shallow cover and or exposures will follow the steps below.

Step	Activity
1	COLLECT the following data on shallow and exposed pipe segments and document in the electronic Shallow Cover Database <ul style="list-style-type: none"> • Pipeline name • Begin Station and End Station Range • GPS coordinates from Pipeline Mapping System or approved handheld device • Upstream and Downstream Road Crossings • Area Pictures (Facing North, East, South, West) • Land Owner name, address, phone number • If applicable, Farmer/Tenant name, address, phone number • Legal Land Description (e.g. Section/Township/Range/Survey) • County
2	WORK with Right-of-way and make NOTIFICATION attempts to the Affect Public concerning shallow and exposed pipe segments. Refer to <i>SOP HLI.40 Public Awareness Plan</i> .
3	RECORD and DOCUMENT on form I.40A Public Awareness Contact Data
4	ATTACH a copy of form I.40A Public Awareness Contact Data to the electronic Shallow Cover Database Record

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- 7.3 Evaluation of Depth of Cover** Operations Personnel, will evaluate pipe segments with depth of cover deficiencies by collecting data on the pipe segments affected and the surrounding area. To evaluate and classify pipe segments, use the steps below.

Step	Activity
1	<p>COLLECT data on shallow and exposed pipe segments to allow for a potential damage evaluation. Dats should include the following:</p> <ul style="list-style-type: none"> • Land use • Potential for third party damage • Potential for loading • Potential for additional loss of cover/erosion • Inadequate pipe support • Forces – Outside and Natural • Interacting threats (anomalies, low potentials, etc..) • Pipe properties (MOP, seam type, SMYS, w.t., O.D., etc..) • Water turbidity • Coating condition, if applicable • Soil Type • Slope Angle • Within an Identified HCA limit • Distance from structures or roadways • Extent of inadequate cover <p>NOTE: UTILIZE information from a variety of sources, including:</p> <ul style="list-style-type: none"> • Construction activities • Landowner notifications • Depth of cover surveys • ILI data • GReporter Database • O&M Review • Encroachments • Corrosion surveys • Leakage surveys <p>Make note of any pipe segments with shallow cover and exposures located on cultivated land, and in addition, follow Section 7.5 – Evaluatoin of Cultivated Lands with Shallow Cover.</p>
2	In creeks, rivers, waterways, drainage ditches, wet-lands, and bar ditches associated with shallow or exposed pipe segments NOT listed in SOP

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	HL.I.21 DETERMINE the minimum amount of cover between the top of the pipeline and the water to soil interface.
	WARNING: If a condition is encountered that results in doubt as to the safety of proceeding with obtaining depths for a creek, river, waterway, drainage ditch, wet-land, or bar ditch, consult the Operations Manager.
3	DETERMINE the expected maximum depth of the water level. CONSIDER future changes in the waterway bottom or route (migrating head-cut, severe stream bank erosion, reefs, etc.), allowing for further erosion and scour.
4	RECORD all information above using the electronic Shallow Cover Database Record
5	COMPLETE an electronic Pipe Inspection Report upon initial discovery of pipeline segments designed for below grade service exposed to the atmosphere. Refer to <i>SOP HL.D.35 Pipe Inspections and Evaluations</i> . Exclude pipeline segments under flowing turbid (cloudy, opaque, or thick with suspended matter) water, and where the water cannot be diverted safely.

7.4 Evaluation of Shallow Cover

Operations Personnel, will evaluate Shallow Cover as follows:

Step	Activity
1	USE the data collected in Section 7.3 - Evaluation of Depth of Cover and DETERMINE the classification.
2	If DETERMINED Immediate, DEVELOP a remediation action plan.
3	ATTACH a copy of the remediation plan to the electronic Shallow Cover Database Record.
4	COMPLETE remediation plan promptly.
5	If immediate remediation is NOT necessary, schedule next inspection in Electronic Maintenance System per classification definition.
6	SUBMIT electronic Shallow Cover Database Record for approval.

7.5 Evaluation of Cultivated Lands with Shallow Cover

Operations Personnel will evaluate cultivated lands with shallow cover as follows.

Step	Activity
1	In cultivated lands INCORPORATE the information below into the evaluation:

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Step	Activity
	<ul style="list-style-type: none"> • VERIFY external loading farming equipment does NOT exceed the safe limits. Refer to <i>SOP HLI.1.27 Abnormal Loading_External Loads_Hwy_RR</i>. • ADVISE the entity responsible for operation and maintenance of the land of the company's damage prevention program. • DISCUSS farming methods and equipment utilized with the landowner/tenant/farmer. <p>DETERMINE maximum anticipated plow depth.</p>
	NOTE: See Appendix B for typical farm data regarding cultivated fields.
2	PROVIDE a minimum of 12 inches of cover between the maximum planned plow depth and the top of the pipeline in cultivated areas.
3	If DETERMINED the minimum distance between plow depth and the top of the pipeline cannot be provided, Classify as Immediate and DEVELOP a remediation action plan.
4	NOTIFY the Right-of-Way Department to advise them of the condition and involve them as necessary in the remediation plan.
5	ATTACH a copy of the remediation plan to the electronic Shallow Cover Database Record.
6	COMPLETE remediation plan promptly
7	If immediate remediation is NOT necessary, schedule next inspection in Electronic Maintenance System per classification definition.
8	SUBMIT electronic Shallow Cover Database Record for approval.

7.6 Evaluation of Exposed Pipeline Segments

Operations Personnel, will evaluate exposed pipe segments as follows:

Step	Activity
1	USE the data collected in Section 7.3 - Evaluation of Depth of Cover and DETERMINE the classification.
2	PERFORM an initial Atmospheric Pipe Inspection. Refer to <i>SOP HL.D.44 Atmospheric Pipe Inspection</i> . Reschedule pipeline segments under flowing turbid (cloudy, opaque, or thick with suspended matter) water, and where the water cannot be diverted safely to a time when water levels are lower.
3	If DETERMINED the pipe segment will remain exposed for any length of time, consider and implement one or more of the following:

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	<ul style="list-style-type: none"> Install a compatible and approved atmospheric coating over the existing underground coating. Recoat the pipe segment with an approved coating system. Consider the conditions and the need to install both a below ground and above ground system. Replace the underground coating systems with an atmospheric coating system. <p>Refer to <i>Engineering Standard Volume HL6 – Corrosion Control</i> for the current procedure regarding above and below ground coating systems.</p>
4	If DETERMINED Immediate, DEVELOP a remediation action plan.
5	DOCUMENT and RECORD remediation plan on form D.40.A Corrosion Control Remedial Action Report. Refer to <i>SOP D.40 Corrosion Control Remedial Action</i> .
6	ATTACH a copy of D.40.A Corrosion Control Remedial Action Report to the electronic Shallow Cover Database Record.
7	COMPLETE remediation plan promptly
8	If immediate remediation is NOT necessary, schedule next inspection in Electronic Maintenance System per classification definition.
9	SUBMIT electronic Shallow Cover Database Record for approval.
NOTE: In addition to inspections and documentation requirements of this SOP, exposed pipe segments with an atmospheric coating systems are subject to inspection and documentation in accordance with <i>SOP HL.D.44 Atmospheric Pipe Inspections</i>	

7.7 Evaluation of Unintended Span

- Operations Personnel, will evaluate Unintended Span pipe segments as follows:

Step	Activity
1	If an exposed pipe segment has become an Unintended Span, DETERMINE if the spanned pipe segment has adequate support upstream and downstream of affected area.
2	CONSULT with the Pipeline Operations Specialist to DETERMINE if pipe segment can remain a span.
3	If evaluation allows being left a span REFERENCE <i>SOP HL.I.25 Aboveground Component – Overhead Crossings</i> for inspection requirements.
4	If DETERMINED Immediate, DEVELOP a remediation action plan.
5	DOCUMENT and RECORD remediation plan on form D.40.A Corrosion Control Remedial Action Report. Refer to <i>SOP D.40 Corrosion Control Remedial Action</i> .
6	ATTACH a copy of the D.40.A Corrosion Control Remedial Action Report

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	to the electronic Shallow Cover Database Record.
7	COMPLETE remediation plan promptly
8	SUBMIT electronic Shallow Cover Database Record for approval.

7.8 Monitored Conditions

Operations Personnel, performs the following actions for each monitored condition identified. No remediation is required unless subsequent evaluation determines it to be an immediate condition.

Step	Activity
1	DETERMINE locations for shallow cover or exposed markers based on site specific conditions.
2	VERIFY pipeline identification/location markers are present. MAINTAIN markers and signs until shallow pipeline segment is remediated.
3	CONSIDER installation of warning style pipeline markers at the beginning and end of the shallow or exposed areas on land.
4	INSPECT per Section 4.0 Frequencies or as directed by the Pipeline Operations Specialist to verify the integrity of the segment and evaluate for changes in condition.

7.9 Elevated Conditions

Operations Personnel, performs the following actions for each elevated condition identified. No remediation is required unless subsequent evaluation determines it to be an immediate condition.

Step	Activity
1	DETERMINE locations for shallow cover or exposed markers based on site specific conditions.
2	VERIFY pipeline identification/location markers are present. MAINTAIN markers and signs until shallow pipeline segment is remediated.
3	CONSIDER installation of warning style pipeline markers at the beginning and end of the shallow or exposed areas on land.
4	DETERMINE and form a remedial action plan and SUBMIT into the budget process.
5	ATTACH a copy of the remediation plan to the electronic Shallow Cover Database Record.
6	INSPECT per Section 4.0 Frequencies or as directed by the Pipeline Operations Specialist to verify the integrity of the segment and evaluate for changes in condition until remediate through the budget process.

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7.10 Immediate Conditions For each identified Immediate Condition, Operations Personnel, performs the following actions in Section 7.11 Remedial Action Plan. Operations Personnel must consider and implement one or more of the remedial actions described, with the assistance of the Pipeline Operations Specialist. Appropriate remedial measures others than those listed, if required, are subject to company approval.

7.11 Remedial Action Plans Operations Personnel, considers one or more of the remedial actions described in the following sub procedures for each pipeline segment with an Immediate or Elevated condition. Information documented in the remedial plan and in the shallow cover database include:

- Description of the situation
- Inadequate cover evaluation, such as a profile survey
- Remedial Action Plan
- Proposed schedule of submitting into budget
- Inspection interval

7.11.1 Remediation Priorities Operations Personnel, prioritizes plans for remedial action for each shallow or exposed pipeline segment according to the following:

REMEDIAL ACTION PRIORITIZATION (AMAOP)

- Exposed pipe that operates at AMAOP
- Pipe that operates at AMAOP with less than 30” of cover
- Pipe that operates at AMAOP with 30” to 36” of cover (remediated by signage)

REMEDIAL ACTION PRIORITIZATION

1. Non-reinforced coupled pipe with unintended spans (360° exposure) with shallow cover extending over over-bends
2. Exposed pipe in cultivated lands
3. Non-reinforced coupled pipe with less than 24 inches of cover extending over over-bends
4. Exposed pipe in bar ditches parallel to roads
5. Pipe with less than 24 inches of cover in cultivated land
6. Pipe with 1 inch to 12 inches of cover in bar ditches parallel to roads (dirt and gravel roads)
7. Exposed pipe in creeks and river crossings
8. Exposed pipe in waterways, drainage ditches and wet-lands
9. Exposed pipe in non-cultivated land
10. Pipe with 1 to 12 inches of cover in creeks, rivers, waterways, drainage ditches

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and wet-lands.

11. Pipe with less than 24 inches of cover in non-cultivated land
12. Pipe with 12 to 24 inches of cover in creeks, rivers, waterways, drainage ditches, wet-lands, and bar ditches
13. Offshore pipelines with less than 3 feet of cover in water less than 200 feet deep

7.11.2 Negotiation of Plowing Risks

Operations Personnel is responsible for communications of the potential problems associated with plowing.



Step	Activity
1	MEET with the farmer and EXPLAIN the potential problems associated with damage to the pipeline.
2	NEGOTIATE with the farmer to plow at lesser depths.
3	CONTACT Right-of-Way Department and CONSIDER an agreement with the farmer for not cultivating above the pipeline.
4	CONSIDER lowering the pipeline. Refer to <i>SOP HLI.08 Lowering or Raising In-Service Pipelines</i>
5	CONSIDER placing additional cover over the pipelines.
NOTE: If future erosion, other plans to re-contour the field or field drainage is a concern, additional cover may not be a long term solution.	

7.11.3 Pipeline Lowering

Operations Personnel is responsible for providing recommendation on lowering the pipeline, if required, to a depth that provides adequate depth of cover, or to a depth that provides sufficient cover in waterways and ditches. Future erosion and scour must be considered. Refer to *SOP HLI.08 Lowering or Raising In-Service Pipelines*.

7.11.4 Additional Cover



Operations Personnel, can place additional cover over the pipeline segments. If future erosion, drainage etc. is a concern, additional cover may not be a long term solution.

NOTE: Consider effects of addition weight on certain pipe seams and girth weld types.

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7.11.5 Structural Protection Operations Personnel provides recommendation on installing concrete slabs, mats, or blocks over the pipeline, if required, to achieve a barrier and protection from damage of outside or natural forces.

7.12 Remediated Conditions Operations Personnel, will evaluate Remediated Conditions as follows:

Step	Activity
1	CONSULT with the Pipeline Operations Specialist to DETERMINE if continued inspections to verify the integrity of the depth of cover and evaluate for changes in condition are needed.
2	INSPECT per Section 4.0 Frequencies or as directed by the Pipeline Operations Specialist.
3	CONSIDER Aerial Patrol to DOCUMENT and RECORD inspections.
4	IF Aerial Patrol is used, ATTACH a copy of the Aerial Patrol report to the electronic Shallow Cover Database Record.

7.13 Reporting Requirements To fulfill reporting requirements for this SOP, Operations Personnel uses the following steps:

Step	Activity
1	TRACK , at a minimum, the following items in the electronic Shallow Cover database: <ul style="list-style-type: none"> • Location Information • Depth of Cover evaluation • Changes from previous inspections • Dates of previous surveys • Who performed the previous surveys • Any problems discovered during previous surveys • Remedial actions taken • Remedial actions proposed
2	USE an electronic maintenance system for scheduling and permanently recording each inspection or survey to be done on a uniform recurring basis.
3	RETAIN the results of all surveys and outside consultant investigations for the life of the facility involved.
4	RECORD remediation information in the electronic Shallow Cover database.
5	If applicable, RECORD in electronic Pipe Inspection database.
6	If applicable, RECORD in electronic Corrosion Database

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8.0 Record data in electronic database or utilize the following form(s) as applicable:
Documentation Electronic maintenance system
Requirements Electronic Corrosion Database
Pipeline Inspection Database
Shallow Cover Database Record
I.40A Public Awareness Contact Data Form

9.0 HL.A.01 Glossary and Acronyms
References HL.I.40 Public Awareness Plan
HL.D.35 Buried Pipe Inspection
Engineering Standard Volume HL6 – Corrosion Control
HL.I.27 Determination of Abnormal Loading
HL.D.44 Atmospheric Pipe Inspections
HL.D.40 Corrosion Control Remedial Action
HL.I.25 Aboveground Components – Overhead Crossings
HL.I.08 Lowering or Raising In-Service Pipelines

Appendix A: The table below identifies the Operator Qualification (OQ) task requirements.
OQ Task
Requirements

Function	OQ Task
Underground Pipeline – Locate and Temporary Mark	PLOQ605
Pipeline Patrol	PLOQ701B
Install and Maintain Pipeline Markers	PLOQ703
Visual Inspection for Atmospheric Corrosion	PLOQ417
Visual Inspection of Buried Pipe and Components When Exposed	PLOQ401

Appendix B: Reference this appendix for typical farm data regarding cultivated fields.
Cultivated
Fields

Erosion, leveling, terracing, changes in grade, or changes in land use can reduce the depth of cover above pipelines in cultivated areas where farm equipment could damage the pipeline.

TYPICAL PLOW DEPTHS

The following typical plow depths are based upon discussions with agricultural

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agencies and farmers and are provided as a general guideline. However, actual depths may vary depending on the type of equipment used, soil conditions, type of crop, and individual farmer preferences. These depths are by no means an absolute limit on plow penetration.

CROP VARIATIONS

Some general differences in plow depth exist based upon the type of crops being planted. For instance, a rice farmer may not want to plow too deep so as to avoid breaking up the impervious soil layer that holds the water in the field; whereas, a cotton farmer may want to plow deep enough to break up a water holding layer. The following list of typical plow depths may be useful:

<u>Crop</u>	<u>Typical Maximum Plow Depth</u>
Cotton	18"
Wheat	12"
Peanuts	12"
Rice	10"
Soybeans	8"
Potatoes	8"
Milo	6"
Corn	6"
Grass	6"

PLOW METHODS

Provided below is a general outline of the frequency of use for various plowing methods and associated plowing depths.

Plow Method	Plow Depth	Frequency
Typical Plowing	< 12"	87%
Subsoiling*	12" – 18"	10%
Deep Subsoiling*	18" – 24"	3%
Custom Equipment*	24" – 30"	< 1/4%

**NOTE:* Subsoiling equipment typically requires a heavy duty four-wheel-drive tractor, which makes it less common due to the investment required. However, this form of "no till" farming is being promoted for better productivity and is on the increase.

LIVE LOADS FROM FARM EQUIPMENT

Farm equipment is designed to exert low ground pressure to minimize soil compaction. As a result, the consideration of the live loads from farm equipment is typically not of concern in cultivated fields since the cover needed to protect the pipe from mechanical damage should also provide protection from the live loads.

However, in areas where the pipeline has less than 24 inches of cover in non-plowed

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areas that may be crossed by heavy farm equipment, review the current procedure regarding pipeline road and rail crossings for live load considerations.

Exhibit SPLP MG-12

SPLP
MG-12



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Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

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1.0 Procedure Description

This Standard Operating Procedure (SOP) outlines activities directed at the management of depth of cover for the purpose of minimizing the possibility of damage to pipelines as a result of shallow cover or exposure.

2.0 Scope

This SOP establishes depth of cover guidelines with minimum requirements for the inspection, remediation, and monitoring of shallow and exposed pipe conditions, including unintended spans.



NOTE: For additional guidance and inspection requirements of river/waterway approaches and river/waterway crossings requiring Contract Assisted River Crossing Survey (CARCS), refer to SOP [HLI.21 Inspection of ROW – & Crossings Under Navigable Waters](#).

3.0 Applicability

This SOP applies to any regulated pipe segment where shallow cover and pipeline exposures can potentially occur.

4.0 Frequency

As required: Perform depth of cover surveys on regulated pipeline segments to determine pipe segments with existing shallow cover, exposures, or areas suspected of becoming shallow or exposed due to a threat from a weather, natural, or outside force.

As required at least once each calendar year at intervals not to exceed 15 months: Inspect all pipeline segments classified as **exposed**.

As required at least once every two calendar years, not to exceed 27 months: Inspect all pipeline segments classified as **elevated**.

As required at least once every three calendar years, not to exceed 39 months: Inspect pipeline segments classified as **monitored**.

As required: Develop a remediation action plan for pipeline segments classified as **immediate**.

As required: Inspect pipeline segments classified as **remediated**.

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5.0 Governance

The table below identifies responsibility, accountability, and authority for this SOP.

Function	Responsibility	Accountability	Authority
Managing Depth of Cover	Operations Personnel	Operations Manager	Director of Operations
Locating Shallow and Exposed Company Pipelines	Operations Personnel	Operations Manager	Director of Operations
Site Evaluations	Operations Personnel	Operations Manager	Director of Operations
Pipe Inspections	Operations Personnel	Operations Manager	Director of Operations
Develop Remedial Action Plans	Operations Personnel and/or Pipeline Operations Specialist	Operations Manager	Director of Operations
Implement Remedial Action Plan	Operations Personnel and/or Pipeline Operations Specialist	Operations Manager	Director of Operations
Aerial Patrol Observations & Reporting	Operator Performing Patrol	Operations Manager	Director of Operations
Legal Action and Right-of-Way	Right-of-Way Representative	Right-of-Way Representative	Manager Right-of-Way

6.0 Terms & Definitions

Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to SOP [HLA.01 Glossary and Acronyms](#).

Terms	Definitions
Exposed Pipeline	A pipe segment which was designed and constructed according to the pipeline safety regulations in place at the time of construction, with sufficient cover to minimize damage by outside or natural forces, but which has experienced deterioration in the amount of cover originally provided, resulting in exposure of the pipe to the atmosphere.
Shallow Pipeline	A pipe segment which was designed and constructed according to the pipeline safety regulations in place at the time of construction, with sufficient cover to minimize damage by outside or natural forces, but which has experienced

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Terms	Definitions
	deterioration in the amount of cover originally provided.
Unintended Span	A pipe segment classified as Exposed and due to additional loss of surrounding soil has resulted in an unsupported span. (360° exposure)
Immediate Classification	A Shallow or Exposed Pipeline Segment such that without further intervention, damage to the pipeline is likely and remediation is warranted.
Elevated Classification	A Shallow pipeline segment in which an evaluation indicates a threat of becoming Exposed and due to the additional loss of cover, damage from outside or natural forces IS possible. Such a condition requires continued monitoring with no immediate action required.
Monitored Classification	A Shallow Pipeline Segment in which an evaluation indicates that the loss of cover does NOT increase the potential for damage or require remedial action to re-cover the pipe segment. Such a condition requires continued monitoring with no immediate action required.
Remediated	A Shallow or Exposed pipeline segment in which a remediation plan has been completed and the threat of a natural or outside force has been removed by either line lowering, additional soil, or structural protection.
Remediation Plan	A repair or mitigation activity used to reduce the likelihood of failure of the component being examined.

7.0

Management of Depth of Cover and Evaluation

This SOP contains the following sections:

- Depth of Cover Assessment – 7.1
- Location Description with Public Notification – 7.2
- Evaluation of Depth of Cover – 7.3
- Evaluation of Shallow Cover – 7.4
- Evaluation of Cultivated Lands with Shallow Cover – 7.5
- Evaluation of Exposed Pipeline Segments – 7.6
- Evaluation of Unintended Span – 7.7
- Monitored Conditions – 7.8
- Elevated Conditions – 7.9
- Immediate Conditions – 7.10
- Remedial Action Plans – 7.11
- Remediated Conditions – 7.12
- Reporting Requirements – 7.13

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7.1 Operations Personnel uses the following steps to identify pipe segments with shallow cover and exposed conditions.

Depth of Cover Assessment

Step	Activity
1	REVIEW collected depth of cover data. Data sources should include but not limited to the following: <ul style="list-style-type: none"> • 3rd Party Depth of Cover Survey • Construction As-Built • Pipe Inspections • Line locates/probing • Line Crossings • Right-of-Way Reclamation • Encroachments • CARC Survey • River Approach Inspection • Coupling locating
2	DETERMINE areas needing a depth of cover survey performed.
3	IDENTIFY and DOCUMENT pipe segments with shallow cover and exposed conditions from collected data and depth of cover surveys.

7.2 Operations Personnel, upon initial investigation of pipe segments with shallow cover and or exposures will follow the steps below.

Location Description with Public Notification

Step	Activity
1	COLLECT the following data on shallow and exposed pipe segments and document in the electronic Shallow Cover Database <ul style="list-style-type: none"> • Pipeline name • Begin Station and End Station Range • GPS coordinates from Pipeline Mapping System or approved handheld device • Upstream and Downstream Road Crossings • Area Pictures (Facing North, East, South, West) • Land Owner name, address, phone number • If applicable, Farmer/Tenant name, address, phone number • Legal Land Description (e.g. Section/Township/Range/Survey)

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Step	Activity
	<ul style="list-style-type: none"> County
2	WORK with Right-of-Way Department and make NOTIFICATION attempts to the Affected Public concerning shallow and exposed pipe segments. Refer to SOP HLI.40 Public Awareness Plan .
3	RECORD and DOCUMENT on form I.40A Public Awareness Contact Data
4	ATTACH a copy of form I.40A Public Awareness Contact Data to the electronic Shallow Cover Database Record

7.3 Evaluation of Depth of Cover

Operations Personnel, will evaluate pipe segments with depth of cover deficiencies by collecting data on the pipe segments affected and the surrounding area. To evaluate and classify pipe segments, use the steps below.

Step	Activity
1	COLLECT data on shallow and exposed pipe segments to allow for a potential damage evaluation. Data should include the following: <ul style="list-style-type: none"> Land use Potential for third party damage Potential for loading Potential for additional loss of cover/erosion Inadequate pipe support Forces – Outside and Natural Interacting threats (anomalies, low potentials, etc..) Pipe properties (MOP, seam type, SMYS, w.t., O.D., etc..) Water turbidity Coating condition, if applicable Soil Type Slope Angle Within an Identified HCA limit Distance from structures or roadways Extent of inadequate cover



NOTE: UTILIZE information from a variety of sources, including:

- Construction activities
- Landowner notifications
- Depth of cover surveys
- ILI data
- GReporter Database
- O&M Review
- Encroachments

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- Corrosion surveys
- Leakage surveys

Make note of any pipe segments with shallow cover and exposures located on cultivated land, and in addition, follow Section 7.5 – Evaluation of Cultivated Lands with Shallow Cover.

Step	Activity
2	In creeks, rivers, waterways, drainage ditches, wet-lands, and bar ditches associated with shallow or exposed pipe segments DETERMINE the minimum amount of cover between the top of the pipeline and the water to soil interface.



WARNING: If a condition is encountered that results in doubt as to the safety of proceeding with obtaining depths for a creek, river, waterway, drainage ditch, wet-land, or bar ditch, consult the Operations Manager.

Step	Activity
3	DETERMINE the expected maximum depth of the water level. CONSIDER future changes in the waterway bottom or route (migrating head-cut, severe stream bank erosion, reels, etc.), allowing for further erosion and scour.
4	RECORD all information above using the electronic Shallow Cover Database Record
5	COMPLETE an electronic Pipe Inspection Report upon initial discovery of pipeline segments designed for below grade service exposed to the atmosphere. Refer to SOP HLD.35 Pipe Inspections and Evaluations . Exclude pipeline segments under flowing turbid (cloudy, opaque, or thick with suspended matter) water, and where the water cannot be diverted safely.

7.4 Evaluation of Shallow Cover

Operations Personnel, will evaluate Shallow Cover as follows:

Step	Activity
1	USE the data collected in Section 7.3 - Evaluation of Depth of Cover and DETERMINE the classification.
2	If DETERMINED Immediate, DEVELOP a remediation action plan.
3	ATTACH a copy of the remediation plan to the electronic Shallow Cover Database Record.
4	COMPLETE remediation plan promptly.
5	If immediate remediation is NOT necessary, schedule next inspection in Electronic Maintenance System per classification definition.
6	SUBMIT electronic Shallow Cover Database Record for approval.

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7.5 Evaluation of Cultivated Lands with Shallow Cover

Operations Personnel will evaluate cultivated lands with shallow cover as follows.

Step	Activity
1	<p>In cultivated lands INCORPORATE the information below into the evaluation:</p> <ul style="list-style-type: none"> • VERIFY external loading farming equipment does NOT exceed the safe limits. Refer to SOP HLI.27 Abnormal Loading Evaluation for Equipment, Highway & Railroad Crossing Type Loads. • ADVISE the entity responsible for operation and maintenance of the land of the company's damage prevention program. • DISCUSS farming methods and equipment utilized with the landowner/tenant/farmer. • DETERMINE maximum anticipated plow depth.



NOTE: See Appendix B for typical farm data regarding cultivated fields.

Step	Activity
2	PROVIDE a minimum of 12 inches of cover between the maximum planned plow depth and the top of the pipeline in cultivated areas.
3	If DETERMINED the minimum distance between plow depth and the top of the pipeline cannot be provided, Classify as Immediate and DEVELOP a remediation action plan.
4	NOTIFY the Right-of-Way Department to advise them of the condition and involve them as necessary in the remediation plan.
5	ATTACH a copy of the remediation plan to the electronic Shallow Cover Database Record.
6	COMPLETE remediation plan promptly
7	If immediate remediation is NOT necessary, schedule next inspection in Electronic Maintenance System per classification definition.
8	SUBMIT electronic Shallow Cover Database Record for approval.

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7.6

Evaluation of Exposed Pipeline Segments

Operations Personnel, will evaluate exposed pipe segments as follows:

Step	Activity
1	USE the data collected in Section 7.3 - Evaluation of Depth of Cover and DETERMINE the classification.
2	PERFORM an initial Atmospheric Pipe Inspection. Refer to SOP HL.D.44 Atmospheric Pipe Inspection . Reschedule pipeline segments under flowing turbid (cloudy, opaque, or thick with suspended matter) water, and where the water cannot be diverted safely to a time when water levels are lower.
3	If DETERMINED the pipe segment will remain exposed for any length of time, consider and implement one or more of the following: <ul style="list-style-type: none"> • Install a compatible and approved atmospheric coating over the existing underground coating. • Recoat the pipe segment with an approved coating system. Consider the conditions and the need to install both a below ground and above ground system. • Replace the underground coating systems with an atmospheric coating system. Refer to <i>Engineering Standard Volume HL6 – Corrosion Control</i> for the current procedure regarding above and below ground coating systems.
4	If DETERMINED Immediate, DEVELOP a remediation action plan.
5	DOCUMENT and RECORD remediation plan on form D.40.A Corrosion Control Remedial Action Report. Refer to SOP HLD.40 Corrosion Control Remedial Action .
6	ATTACH a copy of D.40.A Corrosion Control Remedial Action Report to the electronic Shallow Cover Database Record.
7	COMPLETE remediation plan promptly
8	If immediate remediation is NOT necessary, schedule next inspection in Electronic Maintenance System per classification definition.
9	SUBMIT electronic Shallow Cover Database Record for approval.



NOTE: In addition to inspections and documentation requirements of this SOP, exposed pipe segments with an atmospheric coating systems are subject to inspection and documentation in accordance with SOP [HLD.44 Atmospheric Pipe Inspections](#)

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7.7

Evaluation of Unintended Span

Operations Personnel, will evaluate Unintended Span pipe segments as follows:

Step	Activity
1	If an exposed pipe segment has become an Unintended Span, DETERMINE if the spanned pipe segment has adequate support upstream and downstream of affected area.
2	CONSULT with the Pipeline Operations Specialist to DETERMINE if pipe segment can remain a span.
3	IF evaluation allows being left a span REFERENCE SOP HLI.25 Aboveground Components / Overhead Crossings for inspection requirements.
4	If DETERMINED Immediate, DEVELOP a remediation action plan.
5	DOCUMENT and RECORD remediation plan on form D.40.A Corrosion Control Remedial Action Report. Refer to SOP HLD.40 Corrosion Control Remedial Action .
6	ATTACH a copy of the D.40.A Corrosion Control Remedial Action Report to the electronic Shallow Cover Database Record.
7	COMPLETE remediation plan promptly
8	SUBMIT electronic Shallow Cover Database Record for approval.

7.8

Monitored Conditions

Operations Personnel, performs the following actions for each monitored condition identified. No remediation is required unless subsequent evaluation determines it to be an immediate condition.

Step	Activity
1	DETERMINE locations for shallow cover or exposed markers based on site specific conditions.
2	VERIFY pipeline identification/location markers are present. MAINTAIN markers and signs until shallow pipeline segment is remediated.
3	CONSIDER installation of warning style pipeline markers at the beginning and end of the shallow or exposed areas on land.
4	INSPECT per Section 4.0 Frequencies or as directed by the Pipeline Operations Specialist or Operations Management to verify the integrity of the segment and evaluate for changes in condition.

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**7.9
Elevated
Conditions** Operations Personnel, performs the following actions for each elevated condition identified. No remediation is required unless subsequent evaluation determines it to be an immediate condition.

Step	Activity
1	DETERMINE locations for shallow cover or exposed markers based on site specific conditions.
2	VERIFY pipeline identification/location markers are present. MAINTAIN markers and signs until shallow pipeline segment is remediated.
3	CONSIDER installation of warning style pipeline markers at the beginning and end of the shallow or exposed areas on land.
4	DETERMINE and form a remedial action plan and SUBMIT into the budget process.
5	ATTACH a copy of the remediation plan to the electronic Shallow Cover Database Record.
6	INSPECT per Section 4.0 Frequencies or as directed by the Pipeline Operations Specialist or Operations Management to verify the integrity of the segment and evaluate for changes in condition until remediate through the budget process.

**7.10
Immediate
Conditions** For each identified Immediate Condition, Operations Personnel, performs the following actions in Section 7.11 Remedial Action Plan. Operations Personnel must consider and implement one or more of the remedial actions described, with the assistance of the Pipeline Operations Specialist or Operations Management. Appropriate remedial measures others than those listed, if required, are subject to company approval.

**7.11
Remedial Action
Plans** Operations Personnel, considers one or more of the remedial actions described in the following sub procedures for each pipeline segment with an Immediate or Elevated condition. Information documented in the remedial plan and in the shallow cover database include:

- Description of the situation
- Inadequate cover evaluation, such as a profile survey
- Remedial Action Plan
- Proposed schedule of submitting into budget
- Inspection interval

**7.11.1
Remediation
Priorities** Operations Personnel, prioritizes plans for remedial action for each shallow or exposed pipeline segment according to the following:

REMEDIAL ACTION PRIORITIZATION

Management of Depth of Cover and Evaluation

Code Reference :	Procedure No.: HLI.24	
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1. Non-reinforced coupled pipe with unintended spans (360° exposure) with shallow cover extending over over-bends
2. Exposed pipe in cultivated lands
3. Non-reinforced coupled pipe with less than 24 inches of cover extending over over-bends
4. Exposed pipe in bar ditches parallel to roads
5. Pipe with less than 24 inches of cover in cultivated land
6. Pipe with 1 inch to 12 inches of cover in bar ditches parallel to roads (dirt and gravel roads)
7. Exposed pipe in creeks and river crossings
8. Exposed pipe in waterways, drainage ditches and wet-lands
9. Exposed pipe in non-cultivated land
10. Pipe with 1 to 12 inches of cover in creeks, rivers, waterways, drainage ditches and wet-lands.
11. Pipe with less than 24 inches of cover in non-cultivated land
12. Pipe with 12 to 24 inches of cover in creeks, rivers, waterways, drainage ditches, wet-lands, and bar ditches
13. Offshore pipelines with less than 3 feet of cover in water less than 200 feet deep

7.11.1 Negotiation of Plowing Risks

Operations Personnel is responsible for communications of the potential problems associated with plowing.

Step	Activity
1	MEET with the farmer and EXPLAIN the potential problems associated with damage to the pipeline.
2	NEGOTIATE with the farmer to plow at lesser depths.
3	CONTACT Right-of-Way Department and CONSIDER an agreement with the farmer for not cultivating above the pipeline.
4	CONSIDER lowering the pipeline. Refer to SOP HLI.08 Lowering or Raising In-Service Pipelines
5	CONSIDER placing additional cover over the pipelines.



NOTE: If future erosion, other plans to re-contour the field or field drainage is a concern, additional cover may not be a long term solution.

7.11.2 Pipeline Lowering

Operations Personnel is responsible for providing recommendation on lowering the pipeline, if required, to a depth that provides adequate depth of cover, or to a depth that provides sufficient cover in waterways and ditches. Future erosion and scour must be considered. Refer to SOP [HLI.08 Lowering or Raising In-Service Pipelines](#).

Management of Depth of Cover and Evaluation

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7.11.3 Additional Cover

Operations Personnel, can place additional cover over the pipeline segments. If future erosion, drainage etc. is a concern, additional cover may not be a long term solution.



NOTE: Consider effects of addition weight on certain pipe seams and girth weld types.

7.11.4 Structural Protection

Operations Personnel provides recommendation on installing concrete slabs, mats, or blocks over the pipeline, if required, to achieve a barrier and protection from damage of outside or natural forces.

7.12 Remediated Conditions

Operations Personnel, will evaluate Remediated Conditions as follows:

Step	Activity
1	CONSULT with the Pipeline Operations Specialist to DETERMINE if continued inspections to verify the integrity of the depth of cover and evaluate for changes in condition are needed.
2	INSPECT per Section 4.0 Frequencies or as directed by the Pipeline Operations Specialist.
3	CONSIDER Aerial Patrol to DOCUMENT and RECORD inspections.
4	IF Aerial Patrol is used, ATTACH a copy of the Aerial Patrol report to the electronic Shallow Cover Database Record.

7.13 Reporting Requirements

To fulfill reporting requirements for this SOP, Operations Personnel uses the following steps:

Step	Activity
1	TRACK , at a minimum, the following items in the electronic Shallow Cover database: <ul style="list-style-type: none">• Location Information• Depth of Cover evaluation• Changes from previous inspections• Dates of previous surveys• Who performed the previous surveys• Any problems discovered during previous surveys

Management of Depth of Cover and Evaluation

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	<ul style="list-style-type: none"> • Remedial actions taken • Remedial actions proposed
2	USE an electronic maintenance system for scheduling and permanently recording each inspection or survey to be done on a uniform recurring basis.
3	RETAIN the results of all surveys and outside consultant investigations for the life of the facility involved.
4	RECORD remediation information in the electronic Shallow Cover database.
5	If applicable, RECORD in electronic Pipe Inspection database.
6	If applicable, RECORD in electronic Corrosion Database

8.0 Documentation Requirements

Record data in electronic database or utilize the following form(s) as applicable:
Electronic maintenance system
Electronic Corrosion Database
Pipeline Inspection Database (GIS Database)
Shallow Cover Database (GIS Database)
I.40A Public Awareness Contact Data Form

9.0 References

[HLA.01 Glossary and Acronyms](#)
[HLD.35 Buried Pipe Inspection](#)
[HLD.40 Corrosion Control Remedial Action](#)
[HLD.44 Atmospheric Pipe Inspections](#)
[HLI.08 Lowering or Raising In-Service Pipelines](#)
[HLI.25 Aboveground Components / Overhead Crossings](#)
[HLI.27 Abnormal Loading Evaluation for Equipment, Highway & Railroad Crossing Type Loads](#)
[HLI.40 Public Awareness Plan](#)
Engineering Standard Volume HL6 – Corrosion Control

Appendix A: OQ Task Requirements

The table below identifies the Operator Qualification (OQ) task requirements.

Function	OQ Task
Underground Pipeline – Locate and Temporary Mark	PLOQ605
Pipeline Patrol	PLOQ701B
Install and Maintain Pipeline Markers	PLOQ703
Visual Inspection for Atmospheric Corrosion	PLOQ417
Visual Inspection of Buried Pipe and Components When Exposed	PLOQ401

Management of Depth of Cover and Evaluation

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Appendix B: Reference this appendix for typical farm data regarding cultivated fields.
**Cultivated
Fields**

Erosion, leveling, terracing, changes in grade, or changes in land use can reduce the depth of cover above pipelines in cultivated areas where farm equipment could damage the pipeline.

TYPICAL PLOW DEPTHS

The following typical plow depths are based upon discussions with agricultural agencies and farmers and are provided as a general guideline. However, actual depths may vary depending on the type of equipment used, soil conditions, type of crop, and individual farmer preferences. These depths are by no means an absolute limit on plow penetration.

CROP VARIATIONS

Some general differences in plow depth exist based upon the type of crops being planted. For instance, a rice farmer may not want to plow too deep so as to avoid breaking up the impervious soil layer that holds the water in the field; whereas, a cotton farmer may want to plow deep enough to break up a water holding layer. The following list of typical plow depths may be useful:

<u>Crop</u>	<u>Typical Maximum Plow Depth</u>
Cotton	18"
Wheat	12"
Peanuts	12"
Rice	10"
Soybeans	8"
Potatoes	8"
Milo	6"
Corn	6"
Grass	6"

PLOW METHODS

Provided below is a general outline of the frequency of use for various plowing methods and associated plowing depths.

Plow Method	Plow Depth	Frequency
Typical Plowing	< 12"	87%
Subsoiling*	12" – 18"	10%
Deep Subsoiling*	18" – 24"	3%
Custom Equipment*	24" – 30"	< ¼%

**NOTE:* Subsoiling equipment typically requires a heavy duty four-wheel-drive tractor,

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which makes it less common due to the investment required. However, this form of “no till” farming is being promoted for better productivity and is on the increase.

LIVE LOADS FROM FARM EQUIPMENT

Farm equipment is designed to exert low ground pressure to minimize soil compaction. As a result, the consideration of the live loads from farm equipment is typically not of concern in cultivated fields since the cover needed to protect the pipe from mechanical damage should also provide protection from the live loads.

However, in areas where the pipeline has less than 24 inches of cover in non-plowed areas that may be crossed by heavy farm equipment, review the current procedure regarding pipeline road and rail crossings for live load considerations.

**BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION**

MEGHAN FLYNN et al.	:	Docket Nos. C-2018-3006116 (consolidated)
	:	P-2018-3006117
MELISSA DIBERNARDINO	:	Docket No. C-2018-3005025 (consolidated)
REBECCA BRITTON	:	Docket No. C-2019-3006898 (consolidated)
LAURA OBENSKI	:	Docket No. C-2019-3006905 (consolidated)
ANDOVER HOMEOWNER'S ASSOCIATION, INC.	:	Docket No. C-2018-3003605 (consolidated)
	:	
v.	:	
	:	
SUNOCO PIPELINE L.P.	:	

**REJOINDER TESTIMONY OUTLINE
OF MATTHEW GORDON
ON BEHALF OF SUNOCO PIPELINE, L.P.**

**SPLP
N13-RJ**

1. Mr. Boyce's surrebuttal testimony, which incorporates his direct written testimony, asserts throughout that Sunoco has not provided sufficient information or training to emergency responders. Do you have a response?
 - A. My rebuttal testimony, and the other rebuttal testimony offered by Sunoco demonstrates the robust public awareness program, including training for emergency planners, that Sunoco has implemented.
 - B. I also want to provide specific additional examples that rebut Mr. Boyce's assertion. I or my team were personally present during the following public awareness outreach:
 - Sunoco conducted several tours of its facilities with government officials from both Chester and Delaware Counties as well as several table top exercises.
 - For example, in June 2017, Mr. Boyce was given a tour of Sunoco's pipeline control center located in Montello, Pennsylvania.
 - On May 29, 2018, Sunoco hosted training at the Marcus Hook Industrial Center ("MHIC") for community fire companies.
 - On June 6, 2018, the Chester County Hazmat team toured Sunoco's pipeline control center located in Montello, Pennsylvania.
 - On November 10, 2018, Sunoco conducted an emergency functional training involving a hypothetical NGL pipeline incident at the Marcus Hook Tank Farm in Upper Chichester, Delaware County. This fundamental training exercise was in partnership with Delaware County Emergency Services as a support responder. That site is a Mariner East meter site with a flare, valves and other equipment. Mr. Boyce attended that training.
 - On December 6, 2018, Sunoco hosted a tabletop exercise at MHIC regarding a diesel spill. Larry Bak from Delaware County Emergency Services attended.
 - On May 29, 2019, Sunoco hosted a Corporate Incident Management Team tabletop exercise at MHIC on a worst case crude oil spill. Tim Boyce and Larry Bak attended.
 - On June 21, 2019, Sunoco hosted the Chester County Association of Township's on a tour of the Eagle Point Pump Station. Attendees included Bill Turner and Mike Murphy from Chester County EMS, Bud Turner and police department Chief Joe Catov from West Whiteland Township, Mike Lamm from Lionville Fire Company, Rick Smith from East Goshen Township, Shanna Lodge from Upper Uwchlan Township, Rob Pinger from Westtown Township, representatives from the offices of Rep. Kristine Howard, Rep. Tim Kearney and

Rep. Carolyn Committa, and a representative from Downingtown Area School District.

- On July 25, 2019, Sunoco hosted a tabletop exercise for the Philadelphia zone on a diesel spill. Larry Bak attended.
 - On August 20, 2019, Sunoco hosted a training session at MHIC for community fire departments.
 - In September 2019, Sunoco hosted training at MHIC for community police departments.
 - On September 17, 2019, Sunoco hosted a tabletop training exercise at Twin Oaks on a diesel spill from a tank.
 - On August 5, 2020, Sunoco conducted a tour of Mariner East facilities, including a pump station, with representatives of East Goshen Township. An email from Michelle Truitt, East Goshen Township Supervisor, expressed her appreciation for the tour. Ms. Truitt described the facilities as “tremendous,” and emphasized the safety of the facilities. Ms. Truitt’s email is attached as SPLP Exhibit MG-1-RJ hereto.
 - More specifically, Ms. Truitt’s email states: “The main reason John and I were so interested in touring the pump station and an active site, was all about safety. The redundancies that are built into the system are many and gives both of us reassurance that [Sunoco] is a first-class operation with safety foremost in mind.”
 - As for the Sunoco representatives who hosted the tour, Ms. Truitt’s email states: “ALL of you are very knowledgeable and professional in how you explained everything to us.”
- C. Sunoco representatives meet frequently with Delaware County’s and Chester County’s Local Emergency Response Committees.
- D. With respect to Mr. Boyce’s surrebuttal testimony regarding lack of information on safe distances, Sunoco also performed the following training with the Counties:
- Plume modeling review at the Delaware County Department of Emergency Service building on January 27, 2017. Tim Boyce and Larry Bak participated.
 - Plume modeling review at the Chester County Department of Emergency Service building in West Chester on November 30, 2017.

- Plume Modeling Review, Integrity Management Program, Environmental Compliance Program and Security Program review at the Chester County Training Center on July 30, 2019.

SPLP Exhibit MG-1-RJ

-----Original Message-----

From: Michele Truitt <mtruitt@eastgoshen.org>

Sent: Wednesday, August 5, 2020 5:07 PM

To: Massaro, Joseph P <JOSEPH.MASSARO@energytransfer.com>; Gordon, Matthew L
<MATTHEW.GORDON@energytransfer.com>

Cc: John Hertzog <jhertzog@eastgoshen.org>; Bloom, Ronald G <RONALD.BLOOM@energytransfer.com>; Jon
Altshul <jaltshul@eastgoshen.org>

Subject: Pump station & Pipeline site tour

Gentlemen,

Please accept our gratitude for everything you had to do to set up the tours for John & I today. Ron, your thorough explanation of the operations side of the project was impressive! In fact, ALL of you are very knowledgeable & professional in how you explained everything to us.

The main reason John & I were so interested in touring the pump station & an active site, was all about the safety. The redundancies that are built into the system are many, & gives both of us reassurance that SET is a first class operation with safety foremost in mind.

While you answered so many of our questions today, we may have some follow ups. Personally, I need a little time to digest the information before deciding if I need any clarification. If I have anything, I will probably reach out to Matt.

Matt, the Eagle site is tremendous! And you have to know already, that Quita, Rahn, Ron, & Joe all represented SET exceptionally well. Jamie (Michel's) was very thorough & clear with his explanations of the active site, & seems to genuinely love his job & care that what he is doing is so important from the safety perspective as well. And I was happy to hear that so many of the people on site are from PA.

Thanks again for a terrific site tour, the thorough explanations, answering our questions, & being gracious hosts.

With Appreciation,
Michele

Private and confidential as detailed [here](#). If you cannot access hyperlink, please e-mail sender.

**BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION**

MEGHAN FLYNN et al.	:	Docket Nos.	C-2018-3006116 (consolidated)
	:		P-2018-3006117
MELISSA DIBERNARDINO	:	Docket No.	C-2018-3005025 (consolidated)
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LAURA OBENSKI	:	Docket No.	C-2019-3006905 (consolidated)
ANDOVER HOMEOWNER'S ASSOCIATION, INC.	:	Docket No.	C-2018-3003605 (consolidated)

v.

SUNOCO PIPELINE L.P.

**REBUTTAL TESTIMONY
OF PETER ANGELIDES, PH.D., AICP
ON BEHALF OF SUNOCO PIPELINE, L.P.**

Dated: June 15, 2020

**SPLP
N12**

1 **Q. What is your full name and position?**

2 **A.** My name is Peter Angelides. I am a Principal of the Econsult Solutions, Inc. located in
3 Philadelphia, Pennsylvania. We conduct economic, financial and strategic analyses for public and
4 private entities. My concentrations include real estate development, transportation, economic
5 development, economic and fiscal impacts, and financial modeling. I am also a Lecturer at the
6 University of Pennsylvania, Fels Institute of Government in the Department of City and Regional
7 Planning, and have had that position since 2004.

8

9 **Q. What is your educational background?**

10 **A.** I received a Bachelor of Arts degree with a major in Urban Studies and a Minor in
11 Mathematics in 1987 from the University of Pennsylvania. I received a Master of Science in
12 Economics in December 1996 from the University of Minnesota, and a Doctor of Philosophy in
13 Economics in February 1998 also from the University of Minnesota.

14

15 **Q. Please describe your professional employment history?**

16 **A.** While studying for my Master of City Planning at the University of Pennsylvania and after
17 receiving it in May 1988, I worked as a Planner/Intern for approximately two years for the Central
18 Philadelphia Development Corporation. While there, I supported the activities of various of the
19 organization's committees and conducted numerous analyses in support of its initiative to create
20 what became the Center City District in Philadelphia. I then worked for approximately two years
21 as an Urban and Environmental Planner for Wallace Roberts & Todd in Philadelphia, Pennsylvania
22 where I provided planning services to private developers, state and county governments, and the
23 Washington Metropolitan Area Transportation Authority. In 1993, I went back to school for my

1 Master and Ph.D. degrees and taught eleven undergraduate and master's level economics classes
2 and supervised over thirty independent-study projects while at the University of Minnesota. I then
3 worked as a Consultant for PHB Hagler Bailly/Putnam, Hayes & Bartlett in Washington, D.C. for
4 approximately two years, where I did economic and litigation consulting in the
5 telecommunications, energy, pharmaceutical, and postal industries. I then moved to Charles River
6 Associates, also in Washington, D.C., where I was a Senior Associate. There, I provided economic
7 analysis, primarily for Fortune 500 companies seeking federal regulatory approval for mergers or
8 joint ventures. I then moved back to Philadelphia where I worked for the consulting firm
9 PricewaterhouseCoopers as a Manager and then Director, where I provided economic and
10 statistical modeling and analysis in business consulting, litigation and regulatory matters. I worked
11 there until I joined my current firm in 2008 as Vice President and Director and have been a
12 Principal since 2012. As described earlier, I conduct economic, financial and strategic analyses
13 for public and private entities.

14
15 **Q. Can you describe some of your more significant projects?**

16 A. They are listed in my CV, but as examples, I performed an analysis for the Legislative
17 Budget and Finance Committee of the Commonwealth of Pennsylvania to assess the state of the
18 casino industry in Pennsylvania, to forecast future revenue for the Commonwealth in the face of
19 increasing competition from other states, and estimated the value of potential additional forms of
20 gaming. For the Philadelphia Growth Coalition, I modeled impacts on Philadelphia employment,
21 real estate values and tax revenues from proposed changes in Philadelphia's tax structure. For
22 SEPTA, I valued the economic impact of SEPTA's expenditures and its importance to the region's
23 productivity. For a mid-western state, I estimated the economic impact of a proposed coal mine,

1 including a calculation of the overall economic impact on the state, including output, wages, jobs
2 and taxes. For the Delaware Valley Regional Planning Commission, I analyzed the ability of tolls
3 on U.S. Route 422 to finance roadway upgrades and the re-establishment of commuter rail service
4 to Philadelphia. There are many others identified on my CV.

5
6 **Q. Do you have any certifications?**

7 A. I am a certified planner and a member of the American Institute of Certified Planners.

8
9 **Q. Is SPLP Exhibit No. PA-1 a copy of your CV, which generally describes your**
10 **educational background, experience, and publications in economic, strategic and financial**
11 **analysis, including for major construction and infrastructure projects?**

12 A. Yes, it does.

13
14 **Q. Have you provided expert testimony in court or administrative proceedings?**

15 A. Yes; on numerous occasions, including in a hearing before the Pennsylvania
16 Environmental Hearing Board on a previous challenge to the environmental permits issued by the
17 Pennsylvania Department of Environmental Protection for the construction of the Mariner 2 and
18 2X pipelines.

19
20 **Q. Sunoco Pipeline L.P. proffers Dr. Angelides as an expert on the economic impacts**
21 **from development and infrastructure projects.**

22

1 **Q. What is the purpose of performing a financial analysis of the economic impacts of a**
2 **major development or infrastructure project?**

3 A. The purpose of an economic-impact analysis is to measure the economic footprint of a
4 project and to determine how that investment trickles through the economy and provides direct
5 and indirect benefits to the economy.

6
7 **Q. What is the accepted practice in the field for performing such an analysis?**

8 A. There are several computer programs and standard methods. Using the Mariner East
9 pipeline project as an example, because Sunoco Pipeline is making a significant financial
10 investment to design, construct, and then operate this infrastructure project, the purpose of the
11 financial analysis is to measure the economic impact of that project, of all of those dollars spent,
12 on the Commonwealth of Pennsylvania and its citizens. So, the impact of the investment is greater
13 than the amount of the investment itself. Dollars invested will be spent again and again, and the
14 purpose is to measure all of the other spending that occurs and all of the economic benefits that
15 accrue as a result of the initial investment on the planning, construction, and operation of the
16 pipelines. Of course, the easiest financial benefit to measure is the actual dollars expended on the
17 project. But there are other financial benefits as well. In addition to the dollars expended, there is
18 an indirect impact and an induced impact from those dollars expended. An example of an indirect
19 impact is that when Sunoco Pipeline purchases steel pipe, the manufacturers of that steel pipe must
20 purchase the raw ingredients to make it. An example of the induced impact is that the employees
21 who are paid wages will then spend those wages on other things, such as food, clothing, cars and
22 other items. The dollars will be spent again by the companies that sell those products. That

1 induced spending can be projected and quantified to determine the total impact or total footprint
2 on the Commonwealth of Sunoco Pipeline's investment in this Mariner East pipeline project.

3
4 **Q. What computer program do you use to perform the economic footprint analysis and**
5 **how does it work?**

6 A. We used a standard program called IMPLAN from the Minnesota IMPLAN Group. It's
7 the program used by most persons who perform this type of financial analysis. The program
8 models the expenditure on the project, how much of that expenditure is expended in Pennsylvania
9 and how much is expended outside of Pennsylvania, and then how much leads to indirect and
10 induced expenditures in Pennsylvania. IMPLAN is the industry standard approach to assess the
11 economic and job-creation impacts of economic development projects, the creation of new
12 businesses, and public policy changes within its surrounding area. The expenditures lead to a
13 substantial amount of employment, which consists of construction and other jobs that last for the
14 length of the construction project as well as jobs to operate and maintain the pipelines after they
15 have been constructed. Approximately half of the jobs are construction jobs and the other half are
16 jobs for architectural, engineering, legal and other services, and then there are additional jobs
17 created because of the indirect and induced spending. We performed this analysis on two separate
18 occasions, for two different components of the project. We modeled the construction and
19 operation of the pipelines and the Marcus Hook Industrial Complex.

20
21 **Q. Does the IMPLAN model account for the fact that the Mariner East pipelines and**
22 **Marcus Hook Industrial Complex may attract additional businesses to the Commonwealth?**

1 A. It does not. IMPLAN is a static model, which means that it does not account for the
2 underlying change in the economy from an infrastructure investment. In this case, there is the
3 potential for additional economic impact because the pipelines and Marcus Hook Industrial
4 Complex bring substantial additional natural gas liquids supply to the Southeastern Pennsylvania
5 region. The surety of supply can and likely will attract additional industries to the region. Those
6 would be additional economic benefits that are not included with the INPLAN model.

7
8 **Q. What would be the impact of a temporary shutdown?**

9 A. Any benefit from operations would be lost forever during the period of shutdown. Any
10 benefit from additional industrial development would be lost forever during the period of the
11 shutdown. There is no opportunity to recover that lost benefit and economic activity in the future.
12 Another way to visualize that is to consider a commercial airline that departs with empty seats.
13 Those empty seats are lost forever. The same is true here. Once the day has passed, it is gone and
14 cannot be recouped in the future. There is also the possibility that ancillary industrial development
15 would be lost because of a shutdown due to the uncertainty created because that industrial
16 development could choose to locate elsewhere.

17
18 **Q. What were the benefits projected by the IMPLAN model?**

19 A. When we initially performed our analysis before construction had begun, we projected a
20 total of \$6.14 billion expenditure as the one-time construction impact and a total of 42,630 jobs,
21 meaning full-time equivalent jobs for one year. So, if one person is employed for one year, that is
22 one full-time job equivalent. If one person is employed for three years, that is three full-time job
23 equivalents. The total added to 42,630 full-time job equivalents. The magnitude of those

1 projections is still on target, and many of the benefits from the construction have, of course, been
2 realized as construction has proceeded and is nearing completion. Some of those benefits are still
3 to be realized as construction is completed.

4
5 **Q. Did you perform an analysis to project the tax revenue produced for the**
6 **Commonwealth?**

7 A. Yes. That is an analysis separate from the IMPLAN output, but it is based upon that output.
8 We developed our own model to assess the projected tax revenues to the Commonwealth. For
9 construction alone, we anticipated tax revenues to the Commonwealth of approximately \$97
10 million. Approximately two-thirds of that amount was from personal income tax and the balance
11 was from sales-and-use taxes and business taxes.

12
13 **Q. Did you also perform a valuation to project the ongoing economic impact after**
14 **construction, and what were the results of that?**

15 A. Yes, we did. We modeled the financial footprint after construction is completed, and those,
16 of course, are annual impacts for the operating life of the infrastructure project. We calculated
17 recurring annual tax revenues for the Commonwealth due to the operations of the Mariner East
18 pipelines, the fractionation facility, and associated improvements at the Marcus Hook Industrial
19 Complex between \$1.4 and \$2.1 million per year. In addition, because of increased real estate tax
20 assessments, there will be additional property taxes paid to the Chichester School District, Marcus
21 Hook Borough, and Delaware County combined of approximately \$4.8 million annually. Those
22 economic impacts will be realized on an annual basis over the operating life of the pipeline project.

1 **Q. Were any other benefits identified?**

2 A. Yes. The Mariner East pipelines make the transport of propane in Pennsylvania more
3 efficient, reduce transportation costs, and could help to stabilize the retail price of propane in
4 Pennsylvania. Additional propane delivered and produced at the Marcus Hook Industrial Complex
5 will boost the region's reserves, which will ease supply constraints during the peak heating season

6

7 **Q. Are your opinions provided to a reasonable degree of professional certainty?**

8 A. Yes, they are.

Exhibit SPLP PA-1

SPLP
PA-1

PETER A. ANGELIDES, PhD, AICP

Econsult Solutions, Inc.
1435 Walnut Street, 4th Floor
Philadelphia, PA 19102
215-717-2777
Email: angelides@econsultsolutions.com

EDUCATION

University of Minnesota

Doctor of Philosophy in Economics, February 1998
Master of Science in Economics, December 1996
Thesis topic: "Auto Ownership and Mode Choice: A Structural Approach"
Fields: Industrial Organization, Financial Economics

University of Pennsylvania

Master of City Planning, May 1988
Bachelor of Arts – Major: Urban Studies (Honors); Minor: Mathematics, May 1987

WORK EXPERIENCE

CURRENT POSITIONS

Econsult Solutions, Inc., Philadelphia, PA, *Principal*, 2013 – Present.

- Conduct economic, financial and strategic analyses for public and private entities.
- Concentrations include real estate development, transportation, economic development, economic and fiscal impacts, and financial modeling.

University of Pennsylvania, Philadelphia, PA, *Lecturer*, 2004 – Present

Delaware Valley Smart Growth Alliance – Juror, 2012, Board member, 2018, Treasurer, 2019

Design Advocacy Group – Steering Committee, 2014

Passyunk Avenue Revitalization Corporation – Vice Chair, 2019

PenTrans – Board of Directors, 2015

Racquet Club of Philadelphia—Board of Governors, 2016, Vice President, 2017, Treasurer, 2018

Urban Land Institute –Technical Assistance Program Council, 2013, Co-Chair, 2017

PAST POSITIONS

Econsult Corporation, Philadelphia, PA, *Vice President and Director*, 2008 – 2012.

PricewaterhouseCoopers, Philadelphia, PA, *Manager, Director*, 2001-2008

- Provided economic and statistical modeling and analysis in business consulting, litigation and regulatory matters.
- Major work included litigation support in a variety of industries and case-types, setting prices for intellectual property and services, and evaluating the impact of royalty licensing agreements.

Charles River Associates, *Senior Associate*, Washington, DC, 1999-2001

- Provided economic analysis, primarily for Fortune 500 companies seeking Federal regulatory approval for mergers or joint ventures. Antitrust, commercial damages.

PHB Hagler Bailly / Putnam, Hayes & Bartlett, *Consultant*, Washington, DC, 1997-1999

- Economic and litigation consulting in the telecom, energy, pharmaceutical, and postal industries

University of Minnesota, *Instructor*, 1993-1997

- Taught eleven undergraduate and master's level economics classes and supervised more than 30 independent study projects.

Wallace Roberts & Todd, Philadelphia, PA, *Urban and Environmental Planner*, 1990-1992

- Provided planning services to private developers, state and county government, and the Washington Metropolitan Area Transportation Authority.
- Projects included preparation of county level master plans, analyzing the impact of statewide zoning changes, updating municipal zoning codes, and preparation of environmental impact statements.

Central Philadelphia Development Corporation, *Planner/Intern*, 1988-1990

- Supported the activities of CPDC committees and conducted numerous analyses in support of CPDC's initiative to create what became the Center City District.

Healthy Rowhouse Project – Philadelphia, PA – Working Team, 2014-2015

Healthy Rowhouse Project – Strategic Vision Team, Philadelphia, 2016-2018

Transportation Research Board, Washington, DC – TCRP G-15 Panel Member, 2015

St. Peter's School – Finance Committee, 2010-2016

Mayor's Task Force on Historic Preservation, Philadelphia, 2017-2019

American Institute of Certified Planners – Exam question writing task force, 2012-2018

SELECTED PROJECTS

Consulting and Planning

- Economic Development and Retail Revitalization Plans
 - Chester, PA – *Revitalization Plan for the Chester Transportation Center.*
 - Coatesville, PA – Economic Development Strategy
 - City of Coatesville, PA – *Vision plan and retail study as part of Coatesville's economic development strategy*
 - City of Trenton, NJ – Analyzed the impact of the potential reconfiguration of Rt. 29.
 - Marcus Hook – *Economic Development Agenda for Marcus Hook.*
 - Media Borough, PA – Economic development, retail, and placemaking plan
 - Ohio City, Cleveland, OH – Economic development and retail analysis and strategy
 - Regional Municipality of Wood Buffalo (Alberta, Canada) – *Real Estate Solutions for the Regional Municipality.*
 - Rowan College at Gloucester County – Market feasibility analysis for several development scenarios, including student housing, retail, and an academic building.
 - Sussex County, DE – Economic development, retail, and placemaking plan
 - Williamsburg, VA – Economic development, retail, and placemaking plan
- Economic Impact Studies
 - ARIPPA – Economic and environmental impact of waste-coal fires power plants
 - Kentucky – Economic impact of a proposed coal mine on Kentucky.
 - SEPTA – *Understanding SEPTA's Statewide Economic Impact.*
 - US Squash – Evaluated the economic impact of the new US Squash headquarters in Philadelphia
 - Virtua Health – Evaluated the economic impact of a new hospital facility.
- Fiscal Impact Studies
 - Concord Township – Evaluated fiscal impact of a proposed residential development on the host municipality and school district
 - Camden – Evaluated the fiscal impact of several development projects, including two phases of a mixed use project on the waterfront and an industrial expansion
 - South Fayette Township – Evaluated fiscal impact of a proposed mixed use development. The analysis included a custom calculation of potential public school children likely to live in the development.
 - Upper Darby Township – Evaluated comminute impact of a proposed new middle school
- Market Studies
 - RAL – Market study for 1300 Fairmount Avenue
 - Camden, NJ – market studies of proposed market rate apartments

- Hoboken, NJ – North End Redevelopment Plan
- Affordable Housing
 - New Jersey Municipalities – Created a comprehensive methodology to assist municipalities calculate their “fair share” affordable housing obligations in Mt. Laurel cases in New Jersey, pursuant to the Mt. Laurel IV and Mt. Laurel V rulings in March 2015 and January 2017.
 - New Jersey League of Municipalities – Analyzed a report quantifying each municipality’s “fair share” of affordable housing under the Mt. Laurel IV court case.
 - New Jersey Council On Affordable Housing (COAH)
 - Created a general real estate development feasibility model for COAH to review development proposals.
 - Analyzed housing and employment growth at the municipal level for purposes of determining affordable housing requirements in the state.
 - New Jersey Housing Mortgage and Finance Agency (HMFA) – *Analysis of Four HOPE VI Development Proposals*. Evaluated the appropriateness of development costs for several affordable housing projects. (New Jersey)
 - New Jersey Housing and Mortgage Finance Agency (HMFA) – Analyze the economic feasibility of multiple housing developments with and without tax credit assistance. (New Jersey). More than 20 projects evaluated since 2013.
- Gaming
 - Commonwealth of Pennsylvania, Legislative Budget and Finance Committee - *The Current Condition and Future Viability of Casino Gaming in Pennsylvania*. Assessed the state of the casino industry in Pennsylvania, forecast future revenue for the state in the face of increasing competition from other states, identified profit enhancing regulatory changes, and estimated the value of potential additional forms of gaming.
- Tax Analyses
 - Philadelphia Growth Coalition – Modeling impacts on Philadelphia employment, real estate values and tax revenues from proposed changes in Philadelphia’s tax structure.
 - Earned Income Tax Calculations: Estimated the value of potential tax receipts if a community implemented an Earned Income Tax. Conducted the analysis for several communities, including:
 - Middletown Township, Bucks County
 - Bensalem Township, Bucks County
 - Falls Township, Bucks County
 - Upper Darby Township, Delaware County
 - Coalition for Main Street Fairness - *The Impact of Not Collecting Sales and Use Taxes from Internet Sales into Pennsylvania*. Analyzed the economic consequences to

- Pennsylvania if it were able to collect sales tax from all internet retailers (Pennsylvania)
 - Philadelphia Parking Association – Analyzed impact of the Parking tax on the ability to construct new facilities profitably. Estimated the potential revenue from changes to meter rates, loading zone fees, and similar charges
- General Real Estate
 - University of Delaware – Participated in the creation of a strategic plan for a large newly acquired parcel adjacent to its main campus. (Newark, DE)
 - Philadelphia Water Department – *Economic Analysis of Stormwater Fee Changes on Philadelphia Businesses* (Philadelphia, PA)
 - King of Prussia Business Improvement District – Development Incentives Package For the King of Prussia Business Improvement District (King of Prussia, PA)
 - Studied strategic investments in commercial corridors in Philadelphia. The study combined extensive, locally unprecedented data gathering with thorough econometric analysis to investigate the drivers of commercial success for all 265 retail corridors in Philadelphia. The study included an examination of which City and non-profit based interventions in corridors were effective in improving corridor performance. The analysis also included a simulation tool to model and predict the impact of future interventions on corridors.
 - Lower Merion Township TOD - Evaluated proposals for the mixed-use, transit-oriented development in Ardmore, PA. Helped Lower Merion Township evaluate alternative development proposals for downtown Ardmore.
 - Prepared a land consumption analysis for a Mid-Atlantic state experiencing rapid suburbanization and construction on the fringes of metropolitan areas. The county-by-county analysis projected the percent of land that would remain undeveloped after 30 years of growth.
 - Bureau of Labor Statistics - *Analysis of Possible Data Sources for the Estimation of Owner Equivalent Rent*. Conducted four analyses for the BLS to help them improve calculation of the Consumer Price Index. (Washington, DC)
 - Monroe County – Prepared analyses in support of a master plan for Monroe County, Florida. The analysis included the preparation of thematic maps, proposed land uses, and calculations regarding housing capacity. A major constraint was consideration of evacuation capacity in the event of a hurricane. (Florida)
 - Prepared a strategic plan to assist the Parkway Council Foundation realize its vision for the Benjamin Franklin Parkway in Philadelphia as an exceptional cultural destination. (Philadelphia, PA)
- Transportation
 - Delaware Valley Regional Planning Commission – *Using Toll Revenue to Finance Highway and Transit Capital Improvements*. Analyzed the ability of tolls on US 422

- to finance roadway upgrades and the re-establishment of commuter rail service to Philadelphia. (Pennsylvania)
- Select Greater Philadelphia – *US 422 Improvements – Potential Economic Impacts*. Prepared an assessment of the potential economic impacts of restored passenger rail service and upgraded highway infrastructure in the US 422 corridor. (Pennsylvania)
- Central Philadelphia Development Corporation (CPDC) – Fiscal Impacts of the Proposed 22nd Street Subway Station. Evaluated potential economic and fiscal impacts. (Philadelphia, PA).
- Prepared Environmental Impact Statements for the Washington Metropolitan Transportation Authority as it sought regulatory approval for the expansion of its heavy rail network.
- Examined alternatives for reconfiguring Eakins Oval in front of the Philadelphia Museum of Art and the intersection of 25th Street, Pennsylvania Avenue, Kelly Drive and Fairmount Avenue.
- Surveyed users of parking and loading zones on Washington Avenue (Philadelphia, PA)
- Benefit-Cost Analysis
 - Many of these BCA's were prepared for Transportation Investment Generating Economic Recovery (TIGER), Better Utilizing Investments to Leverage Development (BUILD) and similar grant programs:
 - Bronx River Alliance – Bronx River Greenway multiuse trail (New York City) \$10 million awarded
 - Central Philadelphia Development Corporation – Bicycle Lanes and Pedestrian Improvements to Market Street and JFK Boulevard (Philadelphia, PA)
 - Central Philadelphia Development Corporation – Renovation of Dilworth Plaza (Philadelphia, PA) \$15 million awarded
 - Delaware River and Bay Authority – Bridge abutments protection project
 - Haddam and East Haddam – Side path for a swing bridge (Connecticut)
 - King of Prussia – New slip ramp from I-76 to First Avenue (King of Prussia, PA)
 - Lower Merion Township – Ardmore Transportation Center (Lower Merion, PA)
 - New Haven (City) – Downtown Crossing urban boulevard, Phase II (New Haven, CT)
 - Norwalk – Route 7 intersection redesign (Norwalk, CT)
 - PATCO – Franklin Square station reopening (Philadelphia, PA)
 - Passaic County – Paterson-Hamburg Turnpike Intersection at Alps Road
 - Passaic City – infrastructure upgrades along Main Avenue
 - Philadelphia Museum of Art – Roadway and Pedestrian Concourse Improvements (Philadelphia, PA)
 - Philadelphia Regional Port Authority – Infrastructure investment to improve capacity and warehousing (Philadelphia, PA)
 - Sandusky, Ohio – Riverfront Greenway

- Streetworks – Quincy Green project (Quincy, MA)
- Waretown – Roadway Improvements for a New Town Center (Waretown, NJ)
- Secaucus Brownfield Development Corporation – Parking lot at the Lautenberg – Secaucus Train Station (Secaucus, NJ)
- Southeastern Pennsylvania Transportation Authority (SEPTA)
 - Track Segregation of the West Trenton line so CSX and SEPTA traffic does not intermix (Bucks County, PA). \$10 million awarded.
 - 30th Street Station Rehabilitation (\$15 million awarded)
 - 5th Street Station Rehabilitation
 - Lawndale Grade Separation
- Tobyhanna Township – infrastructure improvements as part of the Pocono Summit Economic Development District
- SEPTA – Lawndale Grade Separation Waterbury Connecticut – Waterbury Green bicycle path, access improvements and other greening elements (Waterbury, CT) \$10 million awarded
- Wilmington – Wilmington Riverfront Transportation Infrastructure Project. Full application
- Hoboken – Rebuild by Design – Prepared a BCA for the proposed storm surge barrier in Hoboken, NJ. Submitted to the Army Corps of Engineers.
- General Analysis
 - Delaware Valley Healthcare Funders – *The Economic and Fiscal Impacts of Medicaid Expansion in Pennsylvania*. Conducted analysis regarding the incremental effect of Medicaid expansion from the baseline set by the Affordable Care Act.
 - District of Columbia – Staffed the 2015 District of Columbia Infrastructure Task Force.
 - Evaluated the rates and claims experience of a health plan for a major health insurance company investigating the cause of an increase in claims from one of its clients.
 - Reviewed the numerical advertising claims of a software company for accuracy and appropriateness.
 - New York City Economic Development Corporation – Assessed the competitiveness of trash collection market in New York City. (New York City Economic Development Corporation)

Litigation and Regulatory

- Regulatory

- Analyzed the sales patterns of “premium cigars” by consolidating transaction level sales data from the leading online cigar retailers. (Submitted to the Food and Drug Administration)
- Electricity Markets - market power analyses (Submitted to the Federal Energy Regulatory Commission)
 - Ancillary services for the California Independent System Operator on behalf of Pacific Gas & Electric and Southern Energy.
 - Market based rate authority for sale of ancillary services to ISO New England. (FERC Section 203)
 - Market power studies in support of the purchase by the Southern Company of several generating units in New England. (FERC Section 205)
 - Market power studies in support of the purchase by the Southern Company of several generating units in New York
- Postal Rate Commission
 - Analyzed the rate structure of the U.S. Postal Service in an omnibus postal rates case, focusing on parcel post
 - Analyzed U.S. Postal Service volume forecasts and rate design for media mail and submitted testimony.
- Real Estate Litigation
 - New Jersey Municipalities – Created a comprehensive methodology to assist municipalities New Jersey Municipalities – Created a comprehensive methodology to assist municipalities calculate their “fair share” affordable housing obligations in Mt. Laurel cases in New Jersey, pursuant to the Mt. Laurel IV and Mt. Laurel V rulings in March 2015 and January 2017. Testified in trials in:
 - Mercer County
 - Middlesex County
 - Ocean County
 - Economic hardship analysis before the Philadelphia Historical Commission – Analyzed the financial feasibility of reusing historic structures.
 - Boyd Theater (2014)
 - Royal Theater (2015)
 - 1904-1920 Sansom Street (2015)
 - Trinity Church Oxford (2017)
 - Evaluated the impact of water quality regulations on the feasibility of real estate developments in Monroe County, Pennsylvania
 - Real Estate Tax Assessments – analyzed real estate tax appeals made by school districts in Pennsylvania. Projects included analyses on behalf of school districts and on behalf of taxpayers.
 - Upper Merion School District
 - Maple-Newtown School District
 - Delaware County

- Chester County
 - Downingtown Area School District
 - Monroe County
 - Calculate potential escalation in construction costs during litigation related delay
 - Institute for Advanced Study
 - 625 N. Broad Street Associates
 - Calculated the value of an easement for a billboard in a property taking case.
 - Analyzed the potential profitability of a real estate development as part of lawsuits between developers and their lenders
 - Single family home subdivision in the western suburbs of Kansas City
 - Single family home subdivision in the eastern suburbs of Kansas City
 - Vacation and primary residences in the Poconos – Monroe County, PA
 - Calculated the damages to the developer of a \$1 billion condominium building in New York of delay in selling units because of an error in condominium documentation.
 - Calculated the profitability of commercial real estate development along the Philadelphia waterfront in the absence of tax incentives.
 - Calculated the value of a ground lease to the owners of an undeveloped restaurant pad.
 - Analyzed the likely impact of a shopping center redevelopment on a lead tenant in the center.
 - Calculated the fiscal impact of a tax credit to a developer on a municipality.
 - Assessed the impact of a marijuana dispensary on nearby properties
 - Variance approval – assessed the appropriateness of proposed developments.
- Intellectual Property Litigation and Analysis
 - Microsoft – Royalties for Windows Server protocols. Determined the appropriate royalty program, including royalty rates, maximums, minimums and other terms, for sets of Windows Server protocols that the European Union required Microsoft to License as part of the remedy in an antitrust case against Microsoft.
 - Microsoft – Impact of licensing. The analysis included calculating royalties paid, assessing the markets for products based on the licensed technology, and determining the ways in which the licensees' products were complimentary or competitive to the licensor's products.
 - Johnson & Johnson - Defended patent validity in a case involving an over-the-counter medication.
 - Determined damages in a copyright infringement case involving a luxury jewelry manufacturer and retailer.
 - For a direct response television marketer, determined damages in a copyright infringement case against a competing firm.
 - Analyzed a royalty distribution model used to determine payments to content creator in situations where no record of the originator of the content was kept.

- Conducted reasonable royalty calculations in a patent infringement case. The case involved both the review of the Georgia-Pacific factors to determine a reasonable royalty, and a critique of another calculation of a reasonable royalty.
 - Modeled revenues for several pharmaceutical products in an intellectual property and breach of contract dispute.
- General Litigation
 - Reviewed, analyzed and critiqued an econometrically based damage analysis that estimated how quickly shares of stock in a publicly held company could sell on the London AIM market in a marital dissolution matter.
 - Calculated damages by valuing the lost advertising value of missed appearances of an injured performed on a national television show.
 - Calculated the damages from failure to divide proceeds from the sale of a business and the associated real estate evenly among the heirs of an estate.
 - Determined the appropriate cram down interest rate in a bankruptcy proceeding.
 - Assessed the ability of a private, for-profit, golf course to continue operations as a golf course by forecasting club profit and loss based on industry growth forecasts and financing commitments made by the owners of the course.
 - Calculated the impact of a municipal regulation severely restricting the sale of cigars in packages of fewer than five cigars.
 - Determined the appropriate discount rate to use in a marital dissolution matter.
 - Assisted American Express in the preparation of its business interruption insurance claim related to damages suffered as a result of the September 11 attacks on the World Trade Center.
 - Assisted a health insurance company investigate the impact of errors in claims processing on the appropriate purchase price of the company that made the errors
 - Calculated damages to purchasers of variable universal life insurance, who allege they purchased policies based on misrepresentations made by the insurance agent.
 - Calculated damages and analyzed opposing expert's report in a state-wide class action suit between a health insurance company and member pharmacies.
 - Calculated damages to a not-for-profit organization from the allegedly wrongful actions of a local government.
 - Calculated damages resulting from a company's withdrawal of its long-term care insurance products on its outside sales forces.
 - For a large pharmaceutical company, evaluated the potential exposure of the company in a large class action lawsuit regarding drug pricing.
 - Performed several analyses with respect to drug pricing for a large pharmaceutical company.
 - In a suit alleging that an insurer with a retrospective workers compensation policy was overpaying claims, reviewed records of the largest claims to determine the appropriateness of the payments.

- Determined overcharges in a class-action dispute between resellers of toll-free 800 service and several Local Exchange Carriers.
- Conducted analyses, including a damages calculation, for an independent power producer in a breach of contract dispute with its host utility.
- Calculated damages in a breach of contract dispute between the owners of a chain of cell-phone kiosks in a major discount store with the host discount store.
- Wage Arbitration
 - City of Allentown – Assisted the City of Allentown, Pennsylvania negotiate with its police union.
 - Upper Darby Township – Tax Base Analysis for Upper Darby Township. Conducted a tax base analysis and testified at arbitration for Upper Darby as part of its contract negotiations with its police union. (Upper Darby, PA)
- Antitrust and Securities Litigation
 - 10b-5 damages for a provider of services to internet and small-scale retailers.
 - Evaluated the effect of the defendant's dealer-loyalty program on the ability of new entrants to gain market share.
 - 10b-5 damages against the auditors of a manufacturer of building supplies.
 - CBS-Viacom Merger Review - evaluated the effect on the broadcast advertising market, the market for the sale of first-run television programs to the networks, and the sale of syndicated shows to the local broadcast stations. (Federal Trade Commission)
 - Coastal and El Paso Merger Review - evaluated horizontal overlaps in several geographic regions. (Federal Trade Commission).
 - El Paso and Southern Company Joint Venture review - evaluated several market overlaps and investigated the validity of the government's anticompetitive theories, especially vertical exclusion issues (Federal Trade Commission).
 - Diageo, Pernod, and Seagrams merger review - evaluated the effect of the combination of brands on the consumer. (Department of Justice)

RELEVANT SKILLS

COURSES TAUGHT

University of Pennsylvania, 2004-present

CPLN 502/633: Urban and Regional Economics

CPLN 502: Urban Redevelopment and Infrastructure Finance

CPLN 540: Introduction to Property Development

CPLN 705: Studio

GAFL 622/522: Economic Principles of Public Policy

GAFL 724/534: Infrastructure Investment and Economic Growth
URBS 456: Economics and Urban Affairs

University of Minnesota, 1993-1997

Cost - Benefit Analysis, Industrial Organization, Welfare Economics, Principals of Microeconomics, Intermediate Microeconomics, Principals of Macroeconomics, International Trade and Payments

STUDENTS SUPERVISED

Joshua Warner – *Commercial Corridor Revitalization*. University of Pennsylvania, PhD in City Planning, 2020

Mengke Chen – *Agglomeration Economies and High Speed Rail*. University of Pennsylvania, PhD in City Planning, Independent Study, 2012

Jonathan Broder – *New York City Highline*. University of Pennsylvania, Master of Liberal Arts, Capstone Paper, 2011

University of Pennsylvania Studio – *Cost Benefit Analysis for High Speed Rail in the Northeast Corridor*, City Planning Studio, 2011

Allyson Randolph – *The Reinvestment Fund in Baltimore: A Model for CDFI Expansion*. University of Pennsylvania, Master of Liberal Arts, Capstone Paper, 2009

Scott Zeigler – *Identifying Housing Bubbles: An Analytical Approach*. University of Pennsylvania, Master of Liberal Arts, Capstone Paper, 2008

John Culbertson – *Microfinance*. University of Pennsylvania, Master of Liberal Arts, Capstone Paper, 2007

PROFESSIONAL MEMBERSHIPS

American Economics Association
American Planning Association
American Institute of Certified Planners
Urban Land Institute