

**BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION**

MEGHAN FLYNN	:	
ROSEMARY FULLER	:	
MICHAEL WALSH	:	
NANCY HARKINS	:	
GERALD MCMULLEN	:	DOCKET NOS. C-2018-3006116
CAROLINE HUGHES and	:	P-2018-3006117
MELISSA HAINES	:	
Complainants	:	
v.	:	
SUNOCO PIPELINE L.P.,	:	
Respondent	:	

**COMPLAINANTS' EXHIBITS
IN SUPPORT OF DIRECT TESTIMONY
OF JEFFREY MARX**

EX. MARX - 1

Jeffrey D. Marx, P.E.
Quest Consultants Inc.®
Senior Engineer

EDUCATION

- 2002 M.S., Mechanical Engineering
Georgia Institute of Technology, Atlanta, Georgia
- 1993 B.S., Mechanical Engineering
University of Oklahoma, Norman, Oklahoma

EXPERIENCE

- 1993 - Present Quest Consultants Inc., Norman, Oklahoma
Staff Engineer, Project Engineer, Senior Engineer

Directs quantitative risk analysis (QRA) studies involving refineries or refinery units, toxic and flammable gas/liquid pipeline systems, oil and natural gas production systems, LPG import/export terminals, LNG import/export terminals, gas treatment and processing plants, reinjection systems, and road/rail transportation systems. Work on these projects included data gathering, accident selection, analysis structuring, consequence calculations, frequency analysis, risk mapping, and risk assessment. Organized and input all data required by the risk quantification software, CANARY+, and presented the results in the form of risk contours and F-N curves. Explained the results and findings of QRA studies in reports for client's internal use, presentation to the public, and for submission to regulatory authorities.

Manages and conducts building siting studies to assess occupied building damage from fires, vapor cloud explosions, and toxic or flammable vapor infiltration. Tasks include accident selection, hazard calculation, and results presentation in the form of overpressure exceedance curves, vulnerability zones, and location-specific risk contours, with building risk assessment and recommendations for hazard mitigations.

Responsible for software package and model development for the consequence modeling package CANARY by Quest®. Responsible for computer codes that model thermal radiation from pool fires, torch fires, flares, and BLEVE fireballs. Directs development and maintenance of the CANARY+ computer codes for risk quantification, as well as numerous supporting tools for risk analysis and assessment.

Conducts and coordinates consequence analysis studies including plant spacing and layout for regulatory compliance, pipeline integrity management program calculations, flare sizing and siting, and explosion impact analyses. Uses the CANARY consequence modeling package to perform vapor dispersion, explosion, and fire radiation calculations for refineries, pipelines, LNG and LPG terminals, chemical plants, and gas plants.

Jeffrey D. Marx

Instructor or co-instructor for several of Quest's short courses, including *Risk Analysis Methodology*, *Liquefied Gas Safety*, *LNG Safety Technology and Inspection* (conducted for the U.S. DOT to train 49 CFR 193 inspectors), and *Introduction to Consequence Analysis*. Instructor for CANARY by Quest® software training.

Facilitated team meetings for HAZOP studies, including the following projects.

RMS Engineering; US PolyCo RDS Asphalt process HAZOP
Bechtel; Driftwood LNG HAZID
Tonmoor International; HAZOP for LPG storage and distribution terminal
Bechtel; SPLNG Vendor Packages HAZOP and SIL assessment
Williams Pipeline; Distribution Lines and Valve/Meter Station HAZOPs
Bechtel; APLNG offsites facilities HAZID
Basic Engineering; Natural Gas Storage Caverns Fill/Withdrawal Systems; HAZOP
Bechtel; Denali Alaska Gas Pipeline Project; HAZID
CB&I; Southern LNG Expansion Projects; HAZOP
SemGas; Natural Gas Treatment and Compression Facilities; HAZOP
BE&K Engineers; LPG Storage, Pipeline, and Delivery Facilities; HAZOP
Keyspan; LNG Peakshaver; HAZOP
Willbros Engineers, Inc.; Unocal Bibyana Gas Plant; HAZOP
Engelhard Corporation; Fuel Cell; HAZOP
Willbros Engineers, Inc.; Explorer Mainline Expansion; "What if?"
Bechtel; Brass Offshore LNG; "What if?"

Co-inventor of a patented community response guideline device. The device allows local emergency response agencies (police, fire department, etc.) to quickly assess the nature and severity of hazards posed by accidental releases of hazardous fluids. It also provides a visual indication of the area in which the public might be told to evacuate or shelter-in-place, based on the specific properties of the material being released, the relative size of the release, and the wind direction.

1990 - 1993 Quest Consultants Inc., Norman, Oklahoma
Engineer Trainee (part-time)

Assisted in scenario definition, case input and results presentation for various consequence analysis studies. Used CAD to prepare technical drawings and illustrations for inclusion in reports, course texts, and presentations.

1990 - 1991 Hilti, Inc., Tulsa, Oklahoma
Co-op Student Intern in Mechanical Engineering

CADD operator for product design, development, and testing. Assisted with implementation and editing of CAD database. Assisted with development and testing of existing construction fastening system products, and the design, testing, and fabrication of new products.

Jeffrey D. Marx

PROFESSIONAL MEMBERSHIPS

American Society of Mechanical Engineers
American Institute of Chemical Engineers
Registered Professional Engineer – Oklahoma
Member of the Technical Committee for CSA Z276: *Liquefied natural gas (LNG) — Production, storage, and handling*
Member of the Industrial Advisory Board, *Fire Protection and Safety Engineering Technology Program*, Oklahoma State University

PUBLICATIONS

- Marx, J.D. and B.R. Ishii (2019), “*A New Look at Release Event Frequencies.*” Presented at Mary Kay O’Connor Process Safety Center International Symposium, College Station, Texas, October 22-24, 2019.
- Marx, J.D., Ishii, B.R., Wesevich, J.W., and S. Dara (2018), “*Radiant Heat Flux Impact Criteria for API RP 752 Building Siting Studies*”. Presented at 2018 AIChE Spring Meeting & 14th Global Congress on Process Safety, Orlando, FL, April 22-25, 2018.
- Marx, J.D. and B.R. Ishii, “*Revisions to the QMEFS Vapor Cloud Explosion Model*”. 2017 AIChE Spring Meeting & 13th Global Congress on Process Safety, San Antonio, TX, March 2017.
- Marx, J. D. and Ishii, B. R., “*A Comprehensive Approach to API RP 752 and 753 Building Siting Studies.*” *Journal of Loss Prevention in the Process Industries*, Volume 44, November 2016.
- Marx, J.D. and C.R. Jimenez (2016), “*Facility Siting Studies – A Comprehensive Methodology.*” Presented at 2016 AIChE 7th Latin America Conference on Process Safety, Lima, Peru, August 22-23, 2016.
- Marx, J.D. and A. Nicotra (2016), “*Is a Two-Inch Hole Adequate for a Siting Study?*”. Presented at 2016 AIChE Spring Meeting & 12th Global Congress on Process Safety, Houston, TX, April 11-13, 2016.
- Marx, J. D. and Ishii, B. R., “*Infiltration hazards for building siting studies.*” *Process Safety Progress*, Vol. 35, No. 1, 61–67, March 2016.
- Marx, J.D. and B.R. Ishii (2014), “*Review of the Risk Analysis Option in NFPA 59A (2013).*” Presented at Mary Kay O’Connor Process Safety Center International Symposium, College Station, Texas, October 28-30, 2014.
- Marx, J.D., Werts, K.M., “*Application of F–N curves in API RP 752 building siting studies*”. *Journal of Loss Prevention in the Process Industries*, Vol. 30, 301-306, July 2014.
- Marx, J.D., Werts, K.M., “*The Application of Pressure-Impulse Curves in a Blast Exceedance Analysis*”. *Journal of Loss Prevention in Process Industries*, Vol 26, Issue 3, 478-482, May 2013.
- Marx, J.D., Werts, K.M., “*The Use of Overpressure Exceedance Curves in Building Siting*”. 2011 AIChE Spring Meeting & 7th Global Congress on Process Safety, Chicago, IL, March 2011.
- Marx, J.D., Cornwell, J.B., “*The Importance of Weather Variations in a Quantitative Risk Analysis*”. *Journal of Loss Prevention in the Process Industries*, Vol. 22, Issue 6, 803-808, November 2009.

Jeffrey D. Marx

Melton, T.A., Marx, J.D., "Estimating Flame Speeds for Use with the BST Blast Curves". Process Safety Progress, Vol. 28, No. 1, 5-10, March 2009.

Marx, J.D., Cornwell, J.B., "Selection and Evaluation of Release Scenarios for an LNG Import Terminal". American Institute of Chemical Engineers 2005 Spring National Meeting Process Plant Safety Symposium, Atlanta, GA, April, 2005.

Martinsen, W. E., and J. D. Marx (1999), "An Improved Model for the Prediction of Radiant Heat from Fireballs." Presented at the 1999 International Conference/Workshop on Modeling Consequences of Accidental Releases of Hazardous Materials, San Francisco, California, September, 1999.

Cornwell, J.B., Marx, J.D., and Lee, W.W. (1998), "Application of Qualitative and Quantitative Risk Analysis Techniques to Building Siting Studies". Process Plant Safety Symposium, Houston, TX, October 26-27, 1998.

RELEVANT PROJECT EXPERIENCE

LNG Facility Siting Review: Project Manager for a reviews of various submittals to the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) regarding proposed liquefied natural gas (LNG) projects and compliance with the requirements of 49 CFR Part 193; assistance to PHMSA in reviews; subject matter expert consulting to PHMSA regarding general LNG issues and development of the frequently-asked-questions (FAQs) guidance to assist with compliance with the siting provisions of 49 CFR 193; coordination with the Federal Energy Regulatory Commission (FERC) regarding facility siting issues. *Client: PHMSA*

LNG Facility Siting Safety Study: Project Manager for a study to demonstrate compliance with the siting provisions of 49 CFR 193 and other PHMSA requirements, as well as requirements of the FERC. The study included design spill selection, vapor dispersion and fire radiation modeling, coordination of a contractor for computational fluid dynamics (CFD) studies, as well as verification of adequate facility layout and assistance with development of regulatory filings. *Client: Bechtel Oil, Gas, and Chemicals*

Buildings Siting Evaluation for Coal Gasification Plant: Project Manager for a study to evaluate the potential impacts at occupied permanent plant buildings and temporary buildings. Hazard types included toxic vapor exposure (CO, H₂S, SO₂), fire, and vapor cloud explosion. Recommended building mitigation measures. *Client: Duke Energy*

Quantitative Risk Analysis, Siting Study, Fire and Explosion Analysis, and Emergency Systems Survivability Analysis for a Large LNG Export Terminal: Project Manager for multiple risk studies for a competitive FEED LNG liquefaction and export terminal on the coast of Mozambique. Risk was calculated for workers, public, as well as equipment damage and risk of escalation. Risk studies were submitted as part of the FEED. *Client: Anadarko Petroleum Corporation through Bechtel*

Quantitative Risk Analysis for a Natural Gas Transmission Line: Project Manager for a QRA of a large diameter gas transmission line in the New Jersey and southern New York areas. The QRA was done to evaluate the risk to the public in sensitive locations along the pipeline route. *Client: Kiefner and Associates/Spectra*

Quantitative Risk Analysis for a Proposed LPG Storage and Loading Facility: Project Manager for a full QRA of a facility for receipt, cavern storage, rail loading and truck loading of LPG (propane and

Jeffrey D. Marx

butane) products. The QRA was used to demonstrate acceptable levels of public risk in the areas around the facility. *Client: Inergy Midstream*

LNG Facility Siting Safety Study: *Project Manager* for a study to demonstrate compliance with the siting provisions of CSA Z276, Canada's LNG safety code. The study included vapor dispersion and fire radiation, as well as verification of adequate facility layout and generally good engineering design. *Client: Fortis BC and Black & Veatch*

Quantitative Risk Analysis for a Proposed Gas-to-Liquids Facility: *Lead Process Risk Analyst* for a full QRA of a new gas-to-liquids facility along the Nigerian coast. QRA was submitted to local and Federal Nigerian authorities. *Client: Chevron Energy and Technology*

Pipeline Hazard Calculations: *Lead Analyst* for a study to evaluate the potential hazards associated with accidental NGL pipeline release events to evaluate high consequence area (HCA) impacts. The evaluation included flammable vapor cloud travel, product loss estimation, and blowdown time estimation. *Client: Williams Field Services*

Quantitative Risk Analysis for a Refinery: *Lead Process Risk Analyst* for a full QRA of a large refinery in the USA. QRA was conducted to understand the potential risk to the public, as well as to occupied buildings on the site. Analysis included evaluation of flammable and toxic fluids, vapor cloud explosions, and fires from crude units, hydrocrackers, separation and distillation units, sulfur recovery, and product storage and transportation facilities. *Client: Chevron Energy and Technology*

Process Hazards Analysis for Refinery and Petrochemical Facility: *Lead Process Safety Engineer* for coarse HAZOP of proposed design of a refinery and petrochemical facility in Malaysia. Facilitated coarse Hazard and Operability Studies (HAZOP) for multiple units of the refinery and integrated petrochemical facility. *Client: Technip, for Petronas (Malaysia)*