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June 5, 2015

Via Hand Delivery

Rosemary Chiavetta, Secretary
Pennsylvania Public Utility Commission
P.O. Box 3265
Harrisburg, PA 17105-3265

Re: Pennsylvania Public Utility Commission, Bureau of Investigation and Enforcement
v. Philadelphia Gas Works; Docket No. C-2011-2278312

Dear Secretary Chiavetta:

Enclosed for filing please find Philadelphia Gas Works' (PGW) report to the Commission describing the results of the Leak Detection Pilot Program.

Please contact me if you have any questions.

Sincerely,



Daniel Clearfield

DC/lww
Enclosure

cc: Cert. of Service w/enc.

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**BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION**

Pennsylvania Public Utility Commission,
Bureau of Investigation and Enforcement v.
Philadelphia Gas Works

C-2011-2278312

Leak Detection Pilot Program

Philadelphia Gas Works'

Report on Leak Detection Pilot Program

Dated: June 5, 2015

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Summary

Philadelphia Gas Works (“PGW” or “Company”) hereby submits this Report on the Leak Detection Pilot Program (“LDPP”).

Periodic gas leak surveys are an important part of PGW’s safety efforts. The LDPP was intended to identify and test new practical measures that ultimately could be implemented by PGW on a permanent basis to further enhance leak detection in the Company’s service territory.

To accomplish this goal, PGW initiated a solicitation process to explore and identify alternative practical measures that could be implemented in PGW’s service territory to enhance PGW’s existing leak detection programs. That process identified two enhanced leak detection measures that were trialed by PGW: First, PGW chose to test the Heath Detecto Pak-Infrared (DP-IR) Detector, which is Heath’s latest infrared based innovation in leak detection survey instrumentation. Second, PGW chose to test Ubisense’s VeroTrack gas leak detection software, which is an automated surveying solution that uses Global Positioning System (GPS) technology to capture real-time gas leak survey data aligned with existing Geographic Information System (GIS) asset data.

The results of the pilot testing were as follows. The detection instrument paired with the VeroTrack software was successful in discovering leaks due to its enhanced sensitivity and selective detection of methane gas, but the DP-IR is not an optimal choice for walking survey. PGW [does not intend] to continue to use the DP-IR for walking surveys. PGW intends to use software, such as VeroTrack, , for walking surveys once PGW’s GIS gas main location data has been reconciled and notes that it may couple the software with a more desirable detector device, such as a Bluetooth enabled Sensit. Reconciling PGW’s GIS data is a prerequisite to

implementing such software because proper geospatial location of the assets is a critical component for the optimal performance of the software. It is important to note that PGW has already started the process of reconciling its internal GIS gas main location data with the GIS data owned by the City. Once the GIS data is reconciled and PGW is able to implement the software in connection with a practical device for walking surveys, PGW is confident that there will be distinct and measurable improvement in its leak detection capabilities.

As an interim approach to improving leak detection efforts, PGW also conducted additional year-round leak detection surveys on all the high pressure cast iron mains in the City using traditional measures. The increased frequency resulted in an increase in the number of leaks discovered. While these “interim measures” are not sustainable in the long-term due to man-power concerns, they will be maintained until a system of “enhanced leak detection measures” are properly identified, tested, and approved for wide-spread adoption by PGW.

Background

On July 26, 2013, the Pennsylvania Public Utility Commission (Commission) entered an Order (“July 26 Order”) approving and modifying a Joint Settlement Petition (Settlement) that was entered into by the Commission’s Bureau of Investigation and Enforcement (I&E) and Philadelphia Gas Works (PGW) in conjunction with the *Torresdale incident*.¹ In the July 26 Order, the Commission directed PGW to explore enhanced leak detection measures and file a pilot program to utilize one or more of these enhanced leak detection measures. On September 19, 2013, PGW submitted its Leak Detection Pilot Program (LDPP) and on November 9, 2013, the LDPP was published in

¹ Pennsylvania Public Utility Commission, Bureau of Investigation and Enforcement v. Philadelphia Gas Works, PUC Docket No. C-2011-2278312, Opinion and Order entered July 26, 2013.

the *Pennsylvania Bulletin*. The Commission then issued its Order, dated January 23, 2014 instructing PGW to proceed with its leak detection pilot program, as further reflected in the body of that Order.² The only caveat to the Order approving PGW's LDPP was that PGW utilize a different vendor from that in the LDPP already underway at UGI.³ PGW's LDPP, as approved by the Commission, committed to performing the following actions:

1. Explore and select alternative leak detection measures to be introduced into the Pilot Program test area to determine the potential benefit of their wide-spread adoption into PGW's existing leak detection protocol.
2. In the interim, while exploring means to improve leak detection through the LDPP, PGW committed to increasing the mobile leak survey frequency of all high pressure cast iron mains. The need for this increased frequency will be reduced once PGW identifies and implements enhanced measures currently being evaluated by PGW under the other aspect of the LDPP.
3. To draft a report "describing the results of the LDPP, including interim measures," "to assist in analyzing the success or failure of the LDPP."⁴ This report was drafted in response to that commitment.

² Pennsylvania Public Utility Commission, Bureau of Investigation and Enforcement v. Philadelphia Gas Works, PUC Docket No. C-2011-2278312, Leak Detection Pilot Program Opinion and Order entered January 23, 2014.

³ January 23, 2014 Order, at 2, fl. 1.

⁴ January 24, 2015 Order, at 6.

Discussion

The discussion is divided into two parts: The first part discusses the results of the solicitation process and the enhanced leak detection programs implemented by PGW pursuant to that process. The second part discusses the results of the additional surveys conducted by PGW as an interim approach to improving leak detection efforts.

1. ALTERNATIVE NATURAL GAS LEAK DETECTION MEASURES

As the first step in the Pilot Program, PGW issued a Request for Information (“RFI”) for alternative natural gas leak detection measures. The purpose of this RFI was to help PGW understand the full range of options that are available for alternative natural gas leak detection measures which are designed to enhance or improve the natural gas leak detection surveys and patrols currently performed by PGW for its natural gas facilities. The scope of information requested for the RFI affirmed that the responses could include alternative approaches, services, surveys, patrols, processes, procedures, equipment and/or technologies that were designed to enhance PGW’s existing leak detection program.

A total of six (6) responses to the RFI were received and evaluated by PGW:

- Three of the responses proposed supplementing existing PGW’s leak survey programs with additional surveys using newer leak survey and leak detection equipment.
- One response recommended modernizing, streamlining and automating PGW’s existing leak survey processes by adopting and implementing new survey tracking technology.
- Two of the responses fell short of satisfying the scope of the RFI.

Based on the analysis of the 6 proposals received and the recommendation from the Commission to utilize a different vendor than UGI, PGW's choice for enhanced leak detection utilized two of the solutions submitted. PGW purchased one (1) Heath Consultants DP-IR Infrared Detector to be utilized in conjunction with Ubisense's VeroTrack software.

1.1 Background of Enhanced Leak Detection Equipment

VeroTrack is a gas leak survey tracking solution. It enables improved surveying of gas facilities by automatically tracking and marking user progress, digitizing leak survey forms and inspections, and storing data for quick retrieval. VeroTrack streamlines the leak survey process, saving surveyors' time in the field while also providing a more auditable survey.

This software automatically highlights facilities when surveyed. This goes above capturing GPS "breadcrumb" tracking trails because VeroTrack is configured using GIS data, allowing users to view facilities on screen and see in real-time whether surveying has been successfully completed. Because this is an automatic process, surveyors can focus on compliance and safety instead of paperwork.

In addition to monitoring and documenting the progress of the facilities surveyed, VeroTrack is also capable of recording gas detector readings when encountered. The Heath Detecto Pak-Infrared (DP-IR) gas detection instrument was paired with the VeroTrack software via a Bluetooth connection to automatically capture these readings.

The DP-IR uses highly advanced optical technology capable of detecting methane gas utilizing the Infrared Controlled Interference Polarization Spectrometry method which is designed to be highly selective to detecting methane gas and will not provide false alarms on other hydrocarbons which occurs using other leak detection equipment during a normal, natural gas leak survey.

VeroTrack not only captures the readings but also stores GPS locations of the leaks detected and can tie back to assets stored in WMS, GIS, or other systems.

VeroTrack is designed with a robust API and several preconfigured reports. These reports show daily progress, user activity, miles of main surveyed, counts of services, and number of leaks found in the field. With the API, reports can be tailored to meet the specific need of any utility. VeroTrack is designed with larger system integration in mind. The enhanced accuracy of the VeroTrack system also provides a useful “control” against which to evaluate the accuracy of the current, paper based system.

Accordingly, this combination of enhanced leak detection equipment provided some measurable benefits which are more fully explained in the results and benefits sections listed below.

1.2 Results of the Enhanced Leaks Detection Pilot Program

Ubisense proposed a Proof of Concept (POC) project over a sample area that included data cleanup and expansion of records by PGW. Currently PGW is in the early stages of reconciling its internal GIS gas main location data with the geospatial data owned by the City of Philadelphia. Before the Pilot Program

could be conducted, the Pilot Area had to undergo this reconciliation, as will any area in which these measures are implemented.

Following the reconciliation of the geospatial accuracy of the gas main in the pilot area, targeted field trials using the VeroTrack software in conjunction with Heath's DP-IR gas detection instrument were performed. The POC field trials ran from December 2014 through March 2015 with continued survey activity into April 2015.

The area identified to be surveyed is located in NW Philadelphia, known as Survey District 2. It was calculated that this area contains approximately 112 miles of gas mains.

During the POC field trial, PGW leak surveyors were able to survey for 63 individual days or a total of 98 man days of surveying during which time 124.36 miles of gas main were surveyed and 129 gas leak indications were discovered. The total number of miles surveyed exceeds the total number of miles contained within the POC area due to situations in which gas mains crossed the individual grid boundaries so they were surveyed more than once, or occasions in which mains were surveyed by multiple users. The chart below details the survey work completed during the Proof of Concept.

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| | Total Distance Walked (Miles) | Total Main Surveyed (Miles) | Number of Leaks Discovered | Number of Days Surveying | Daily Average Distance Traveled (Miles) | Daily Average Length of Mains Surveyed (Miles) |
|---------------------|--|--|---|---|--|---|
| Technician 1 | 172.15 | 51.88 | 54 | 37 | 4.65 | 1.4 |
| Technician 2 | 164.62 | 51.28 | 62 | 39 | 4.22 | 1.31 |
| Technician 3 | 34.14 | 10.94 | 1 | 13 | 2.63 | 0.84 |
| Technician 4 | 33.69 | 10.26 | 12 | 9 | 3.74 | 1.14 |
| Grand Total | 404.6 | 124.36 | 129 | 98 | 4.13 | 1.27 |

During the course of the POC the leak surveyors used a Panasonic H2 ruggedized tablet with integrated GPS. VeroTrack captured GPS readings while in active surveying mode. Due to variations in GPS signal strength, caused by atmospheric conditions, buildings and tree cover, an average buffer radius of 5 meters was used to ensure that although the GPS indicated the surveyor was not in their true physical location facilities would be marked as surveyed (as shown in screen shots below).



Gas Main Facility

Poor GPS signal Quality

GPS Breadcrumb

Good GPS signal Quality



Based on the availability of devices with enhanced location sensing, that use a combination of GPS and wireless connectivity, and increased facility data accuracy it is expected that the GPS buffer radius could be minimized to less than or equal to 1 meter for a full production system.

1.4 Benefits of Enhanced Leak Detection

Traditionally most asset inspections are completed using manual, paper based techniques. This causes many issues, including:

- Wasted time through slow data entry and having to transcribe paper-based data into systems
- Inaccuracies and data errors caused by manual entry
- Lack of accountability and proof that the survey actually took place causing potential network reliability and compliance disputes
- Inability to perform targeted, risk-based leak surveys

Ubisense's VeroTrack software (now known as myWorld Inspection & Survey) will assist survey inspectors to gather information rapidly and electronically, removing all paper collection. Without the ability to centrally coordinate and manage different inspections confusion can occur resulting in duplication of effort. This inefficiency results in wasted time, additional cost and potential safety and compliance issues.

The software is able to centrally organize all inspections, allowing optimization of manpower and clearer communication of information and status across all teams. It also provides the opportunity and flexibility to shift to a proactive or risk-based network inspection and maintenance approach to leak survey.

PGW currently performs cycle-based inspection and maintenance operations. This type of scheduling is not always the most effective means of ensuring network

reliability or minimizing risk. By shifting to a proactive or risk-based network inspection, focus can be placed on areas that pose the most risk. This approach can reduce expenses associated with performing unneeded inspections and ensure the areas that pose the most risk are surveyed more frequently.

Software, such as VeroTrack, allows increased flexibility in defining surveys, and provides a platform from which to implement proactive or risk-based inspection and maintenance. By shifting to this type of operating model network reliability will improve while minimizing cost increases.

1.5 Next Steps

Of the 124.36 miles of adjusted gas main surveyed during the proof of concept field trials, 1.33 miles were manually surveyed or approximately 1.00%, to account for either poor GPS signal or misaligned data.

Ubisense analyzed gas main facility data for the Pilot Area, both adjusted (by PGW) and unadjusted. By overlaying the two different dataset sets Ubisense was able to do several spot measurements and found differences of up to 324 feet between the shifted and non-shifted data. Based on these measurements, had the data for the pilot area not been adjusted prior to the proof of concept, Ubisense estimates that the percentage of missed pipe facilities would have been over 75% due to an average misalignment of the facility data in the pilot area of approximately 125 feet.

To account for the misalignment of the gas network data and to reduce manual surveying the GPS buffer size would have to have been increased to a size of

approximately 40 meters instead of the 5 meters used during the proof of concept (had the surveyors walked the same routes as they did during the Proof of Concept).

With enhanced facility data, the GPS breadcrumb trail points captured during the survey activity will better align to the physical gas network. When facility data is spatially accurate the need for adjustment of GPS tracking is greatly reduced.

PGW has already received approval for the Capital Budget expenditures associated with system-wide reconciliation, and once Operating Expenditures are approved, work will begin on the system-wide reconciliation.

The detection instrument paired with the VeroTrack software, the Heath DP-IR was successful in discovering leaks due to its enhanced sensitivity and selective detection of methane gas but is not an optimal choice for walking survey. There are ergonomic factors, such as weight and size of the instrument that impact the user to a point where their system-wide implementation of this device is not feasible.

However, once PGW is able to couple the Verotrack software (with reconciled GIS data), with a more desirable detector device, such as a Bluetooth enabled Sensit, PGW is optimistic that its leak detection rates will improve substantially.

2. "INTERIM MEASURES", OR ADDITIONAL YEAR-ROUND LEAK DETECTION SURVEYS ON ALL THE HIGH PRESSURE CAST IRON MAINS IN PHILADELPHIA USING TRADITIONAL SURVEY TECHNIQUES

2.1 Results of Interim Measures

In addition to the exploration and testing of enhanced leak detection measures, as more fully described above, PGW committed to increase the frequency of its existing mobile leak survey. PGW fulfilled its commitment over the course of the past year, and as a result of the increased survey frequency experienced an increase in the number of leaks detected. The tables contained below highlight the effectiveness of the increased frequency:

Mobile Survey of High Pressure (10 - 35 psig) Cast Iron Mains

| Leak Classification | FY 2014 | | | FY 2015 | | |
|---------------------|------------------|----------------|------------------------------------|------------------|----------------|------------------------------------|
| | Leaks Discovered | Miles Surveyed | Leaks Discovered per Mile Surveyed | Leaks Discovered | Miles Surveyed | Leaks Discovered per Mile Surveyed |
| Recheck | 87 | 75.1 | 1.16 | 208 | 147.8 | 1.41 |
| Work Immediate | 4 | 75.1 | 0.05 | 9 | 147.8 | 0.06 |
| TOTAL | 91 | 75.1 | 1.21 | 217 | 147.8 | 1.47 |

% of Hazardous Leaks Discovered and Eliminated

FY 2014 4.40%
FY 2015 4.15%

Mobile Survey of 12" High Pressure (10 - 35 psig) Cast Iron Mains

| Leak Classification | FY 2013 | | | FY 2014 | | |
|----------------------------|-------------------------|-----------------------|---|-------------------------|-----------------------|---|
| | Leaks Discovered | Miles Surveyed | Leaks Discovered per Mile Surveyed | Leaks Discovered | Miles Surveyed | Leaks Discovered per Mile Surveyed |
| Recheck | 10 | 44.6 | 0.22 | 58 | 133.8 | 0.43 |
| Work Immediate | 1 | 44.6 | 0.02 | 10 | 133.8 | 0.07 |
| TOTAL | 11 | 44.6 | 0.25 | 68 | 133.8 | 0.51 |

| Leak Classification | FY 2015* | | |
|----------------------------|-------------------------|-----------------------|---|
| | Leaks Discovered | Miles Surveyed | Leaks Discovered per Mile Surveyed |
| Recheck | 73 | 62.5 | 1.17 |
| Work Immediate | 2 | 62.5 | 0.03 |
| TOTAL | 75 | 62.5 | 1.20 |

% of Hazardous Leaks Discovered and Eliminated

| | |
|----------------|---------------|
| FY 2013 | 9.1% |
| FY 2014 | 14.71% |
| FY 2015 | 2.67% |

*PGW has mobile surveyed all 12” high pressure cast iron mains three (3) times to date and is on schedule to complete all six (6) by August 31, 2015.

2.2 Next Steps

Again, the increased survey frequency that PGW has implemented is an interim measure to improve leak detection by, very simply, upping the volume of inspection. As expected, the increased frequency resulted in an increase in the number of leaks discovered. While these “interim measures” are not sustainable in the long-term due to man-power concerns, they will be maintained until a system of “enhanced leak detection measures” is properly identified, tested, and approved for wide-spread adoption by PGW.

Conclusion

Simply put, PGW submits that the LDPP has identified practical measures that ultimately may be implemented by PGW on a permanent basis to further enhance leak detection in the Company’s service territory. Once the few issues impacting the effectiveness of the LDPP identified enhanced leak detection measures are resolved, as detailed above, PGW is confident that there will be distinct and measurable improvement in its leak detection capabilities. Such improvements will render the increase in survey frequency, undertaken as an “interim measure,” unnecessary, as the improvements will grow from enhanced procedures rather than simple addition of effort.

CERTIFICATE OF SERVICE

I hereby certify that I have this day served a true copy of PGW's Report on Leak Detection Pilot Program upon the participant listed below in accordance with the requirements of § 1.54 (relating to service by a participant).

VIA EMAIL AND FIRST CLASS MAIL

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