2021 Q1 SMP Quarterly Report: Engineering Study Updates

Background

In the third quarter of 2017 Peoples Gas selected ABB, Inc. to provide advanced leak detection and quantification ("ALD") technology. Specifically, Peoples Gas selected ABB's Mobile Guard Methane Detection System. This system is mounted on a vehicle and consists of ABB's OA-ICOSTM technology methane/ethane analyzer, a global positioning system unit, a sonic anemometer and proprietary leak detection software.

Starting in 2018, Peoples Gas used this equipment to measure the methane emissions in neighborhoods where the SMP projects would begin during the next three-year planning cycle. This recorded emission data was used as the final step in establishing the priorities for SMP neighborhood work. Specifically, when prioritizing construction in SMP neighborhoods that had risk-ranking index within 3 points of each other, Peoples Gas would choose the neighborhood with the highest emissions per mile to proceed first, subject to constructability constraints.

Costs, benefits and experience with ALD equipment

Below are the costs associated with the program to date.

Year	Hardware Costs	Software Costs	Operations and Maintenance Costs	Incremental Staff Costs (Labor Hours)	Annual Cost
2018	$250,000	$0	$27,430.28	404.75	$277,430.28
2019	$0	$65,000	$6,812.22	120.00	$71,812.22
2020	$0	$65,000	$28,358.02	253.00	$93,358.02
Total	$250,000	$130,000	$62,600.52	777.75	$442,600.52

Costs incurred by PGL in support of the Methane Mapping Pilot Program

- Hardware Costs: Initial startup cost of the ABB Ability MobileGuard Mobile Gas Leak Detection System consisting of methane/ethane analyzer, mapping software, sonic

anemometer, GPS, internal fast-flow vacuum pump and proprietary data logging software.

- Software Costs: Annual license fee for ABB's proprietary mapping software which allows perpetual upgrades and improvements for as long as the license is renewed. First 12 months fee included with cost of analyzer.
- Operations & Maintenance Costs: Total cost of wages and benefits for employees in various departments directly involved with the project.
- Incremental Staff Costs: Total hours spent by employees in various departments in assistance with the project. This included hours from Information Systems, Business Support, Training, and staffing to perform the work.

The benefits of this technology for use in tracking overall methane emissions included the ease of use as well as the speed at which the detection can be made. This technology is capable of distinguishing the source of the emission and helps Peoples Gas understand, through calculation of the leak rate over time, the potential amount of lost gas, which is not possible with existing leak survey technologies. It would be more difficult to quantify the impact of replacement programs on methane emissions without this technology and Peoples Gas would instead rely on industry averages for emissions by pipe type.

The challenges to the technology principally relate to the limitations of when it may be used. The system is weather dependent; it cannot be used in inclement weather or when there is no wind or too much wind. This limits the reliable use of this technology for emergency use. PGL's current survey equipment is operable without regard to wind and has fewer limitations due to weather conditions.

Conclusions

Peoples Gas has found the ALD technology and equipment easy to use and that it provides insight into both the quantity and general location of methane emissions. The technology is not a substitute for the current state of the art leak detection technologies that are deployed for leak surveys, which provide more information in determining the potential safety impact of the leak.

The ALD technology has enabled Peoples Gas to use the resulting data to make construction-planning decisions for neighborhood replacement as part of the SMP program,

which can help reduce methane emissions quicker when those planning decisions are incorporated into the SMP. Peoples Gas' first priority when planning construction is safety, but we can overlay additional information gained from the ALD technology to prioritize neighborhoods with greater methane emissions.

Peoples Gas is committing to use this technology going forward as part of the SMP project. Peoples Gas will continue to leverage the methane emission data to prioritize neighborhood work.

Recommendation 10

Background

Kiefner & Associates made twelve recommendations in its 2020 Engineering Study. The Peoples Gas Light and Coke Company (PGL) responded to these recommendations in May of 2020. Recommendation 10 was that PGL collect cast and ductile iron pipe coupons from the 3, 6, and 9 o'clock position when safe, feasible and cost effective in order to supplement PGL's current coupon collection at the 12 o'clock position. PGL supported this recommendation, subject to further review, and has now completed its evaluation of the cost and effort required to purchase tools and equipment and develop procedures for maintaining the additional data, as well as the overall benefit of implementing this recommendation.

Evaluation of Data Collection at 3, 6, and 9 o'clock Positions

PGL began its analysis by identifying and evaluating options for additional coupon collection that could be integrated into its current procedures. Further, the benefit of obtaining this data had to be evaluated given the impending retirement of all iron pipe facilities.

PGL's primary concern with retrieval of coupons from the 3, 6, and 9 o'clock pipe locations is employee and public safety. Most cast iron and ductile iron pipes have reached or will be reaching the end of their useful life, and therefore are at a higher risk of failure. Exposing this type of piping and then taking coupons at the 3, 6, and 9 o'clock positions may affect the structural integrity of the pipe by further increasing the risk of pipe failure resulting in a gas leak, a pipe crack or pipe break.

From a safety and risk perspective, the ideal pipe candidates for 3, 6, and 9 o'clock coupon collection are iron pipes that are to be removed and/or retired as part of either planned system upgrade or emergent replacement. Once retired, a segment of pipe can be cut out and coupons removed at all clock positions without compromising the structural integrity of in-service pipe. In addition, no separate permits or openings are needed in order to obtain this data, thereby minimizing cost. While the data obtained using this method would be limited to pipe no longer in service, PGL believes that such pipe is reasonably representative of the remaining pipe in the ground. Therefore, PGL views this as a feasible approach to collecting additional coupons.

PGL considered five non-destructive testing methods that could be used on active pipes. Although non-destructive testing options do not directly impact the structural integrity of the pipe, use of the testing equipment requires that the cast or ductile iron pipe be fully exposed. It should be noted that soil disturbance around the pipe can and has led to pipe failures. This means that its "real-world" use may be limited to specific situations where the equipment can be safely used with the piping exposed and in compliance with 49 CFR Part 192.317 (Protection from Hazards).

Table 1 details the results of PGL's research into non-destructive testing techniques.

Non-Destructive Testing Technique	Technology	Pros	Cons
Discrete Ultrasonic	High frequency short wave	Instantaneous results of wall thickness	- CI and other rough materials impedes accuracy - Pipe needs to be extensively cleaned
Guided Wave	High frequency propagated wave	Continuous detection from single probe	- Only measures defects - Impeded by Cast iron bell joints
Remote Field Eddy Current	Low frequency AC signal	No direct contact to metal required	- Can only be used internally through a pigging process - Limited frequencies
Broadband Electromagnetic (BEM)	Frequency Spectrum	Spectrum allows for metal loss and defect detection	- Minor pipe cleaning required - Gives only mean wall thickness
Magnetic Flux Leakage	Induced Magnetic Field	Measures wall thickness accurately	- Pipe wall needs to be extensively cleaned

Table 1 – Comparison of Non-Destructive Testing Techniques

PGL used three criteria to narrow its search, which can be seen in Table 2 below. It was important that the technology: (1) be effective in evaluating the remaining wall thickness of a pipe; (2) be capable of being used externally; and (3) require minimal preparation of the pipe prior to data collection. Broadband Electromagnetic (BEM) satisfied all criteria. BEM is best suited for accurately measuring cast and ductile iron compared to the other methods, and mean wall thickness can easily be incorporated into the existing PGL main ranking index.

Non-Destructive Testing Technique	Effective for Remaining Wall Thickness Measurement	External Application	Minimal Pipe Preparation
Discrete Ultrasonic	✓	✓	×
Guided Wave	×	✓	✓
Remote Field Eddy Current	✓	×	✓
Broadband Electromagnetic	✓	✓	✓
Magnetic Flux Leakage	✓	✓	×

Table 2 – Comparison of Non-Destructive Testing Techniques against PGL Criteria

Cost Analysis

PGL compared the cost of taking coupons from retired pipe ("the Pipe Removal/Retirement option") to the cost of the BEM method using technology costs provided by Rock Solid Group, an Australian vendor. Rock Solid Group offers a tool similar to a stethoscope-like sensor that can take a wall thickness measurement (or "virtual coupon") at required clock positions without the removal of the pipe from the ground and without taking a pipe coupon.

This cost comparison can be seen in Table 3. The initial costs include any costs required for start-up, which only apply to BEM for the purchase of tools, software and equipment. It is important to note that additional BEM equipment is anticipated to be required approximately every 10 years. Recurring costs and costs per use include both internal operational costs to collect the data as well as software licensing and external data processing expenses. The total annual costs for each method are also included below.

	Pipe Removal/Retirement	Non-Destructive Technology (BEM)
Initial Cost*	$-	$113,000
Re-occurring Annual Cost	$2,000	$28,000
Cost per Use	$2,000	$1,000
Total Annual Cost	$163,000	$120,000

*re-occurring every 10-years

Table 3 – Cost Comparison between Data Collection Methods

In addition to costs associated with each method, there are intangible costs and benefits associated with each option.

Benefits of the Pipe Removal/Retirement option include leveraging existing processes, procedures and field construction work activities to collect the additional coupons. Additionally, there are no software, licensing, technology costs or reliance on vendors for data processing and reporting. However, the coupons collected would be from retired pipe as opposed to in-service pipe and so would arguably be slightly less representative of pipe remaining in the ground.

BEM's primary benefit is that the data collected would be from iron pipe that would remain in-service. This method could also leverage field construction work to avoid necessitating additional permits and excavation.

Although both options would require internal oversight and may result in additional costs associated with addressing coupon data flow into existing systems and databases, the costs and risks are higher with BEM due to the significant change required to identify pipe candidates; modify processes and procedures; obtain and process BEM data and ensure the data is processed correctly within PGL's systems and models. Further, the necessity of establishing contracts with an international vendor;

the implementation impact on the current data collection process; the increase in administrative and procedural oversight; and ongoing reliance on a vendor for software licensing and data processing are significant concerns with the BEM technology.

Conclusions

In conclusion, PGL has evaluated several options to obtain cast and ductile iron pipe coupons from the 3, 6, and 9 o'clock position including the use of non-destructive technology.

PGL has determined that the most cost-effective and beneficial option is to move forward with a combination of the current coupon collection practices. In other words, PGL will continue coupon collection at the 12 o'clock position on main in poor condition, when performing maintenance, and add coupon collection at the 3, 6, and 9 o'clock positions when pipe is being retired/replaced or abandoned and will not use BEM or any non-destructive testing method. This approach addresses PGL's safety concerns and addresses Kiefner's recommendation while balancing the impact of change with the fact that the inventory of remaining iron pipes continues to decrease.

PGL will begin the implementation of the combined solution in 2021 and will re-evaluate its efficacy after two years. Depending on the pipe data/information collected, PGL will determine whether to continue obtaining coupons from the 3, 6 and 9 o'clock position, as the inventory of iron pipe in PGL's system continues to decrease. As an option, PGL will evaluate, at that time, the use of a multiplier based on the obtained 3, 6, 9 o'clock data that can be used to extrapolate a 12 o'clock coupon to more accurately represent corrosion experienced by a pipe without taking additional coupons at the 3, 6, and 9 o'clock positions.