Summary of NWGLDE Listed Pipeline Leak Detector Headings
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J. Kendall Wilcox, M.E.S., Environmental Engineer, Ken Wilcox Associates, Inc.

1.0 Introduction

Standard test procedures for evaluating leak detection methods were developed in 1990 requiring a third-party evaluation to show that the methods could meet these performance requirements. However, when the EPA established performance requirements for pipeline leak detection methods as a part of the federal register, no one could have imagined the variety of detection methods that the commercial sector would come up with. Since 1990, KWA, Inc. has evaluated some 200 different leak detection methods which currently comprise a majority of the world's leak detection market.

Pipeline leak detection methods have made up a substantial portion of KWA's evaluations and most of the methods on the NWGLDE list were evaluated by KWA. Although the EPA has provided a "standard" test procedure for pipeline leak detection methods, every system out there is unique and each evaluation has to be designed to accommodate the different operational features of the method. In fact, there have been a number of methods which are so unique that they could not be evaluated according to the EPA's "Standard" evaluation procedures. New procedures have been developed by KWA and other third-parties to evaluate these unique methods and the latest NWGLDE listing even includes a new class of pipeline leak detectors which weren't covered by the original EPA evaluation procedures (large diameter pipeline leak detectors).

Although the NWGLDE list may be a useful tool for locating potential vendors, this list is by no means comprehensive and does not guarantee that the leak detection method works. The primary function of the NWGLDE is to determine whether or not a method was evaluated according to the standard evaluation procedures. Often the evaluator is presented with a unique piece of equipment that cannot be effectively tested by the standard evaluation procedures and has to make a decision on how to proceed. This usually necessitates modifications to the test procedure. A number of state and local regulatory bodies maintain their own list of approved methods which may or may not include methods on the NWGLDE list. KWA also maintains a list of certified methods which are defended not only in the US but internationally.

2.0 Classifications

The NWGLDE classifies five types of pipeline leak detection systems depending on the features of the system. A summary of each of the five classes is provided below. There are however additional methods which can be used to detect pipeline leaks which include: continuous in-tank leak detection systems; SIR; vapor-phase out-of-tank product detectors; liquid-phase out-of-tank product detector; and liquid level sensors. Most of these methods will be discussed in subsequent issues of PE&T.

1. Large diameter pipeline leak detectors

These leak detectors are the newest class of equipment to come into the market. They are designed to test very large pipelines such as those used in airport hydrant systems and above ground storage tanks hydrant systems. Most of the large pipelines are exempt from regulation by the EPA because the technology to test these lines was not present at the time the regulations were written. Without regulation however, the private sector has been slow to develop technologies which can test large pipelines. The NWGLDE lists two manufacturers who have undergone third-party evaluations (EFA Technologies and Vista Research). Other methods do exist which are not on the NWGLDE list because they were either not evaluated or were not submitted to the NWGLDE for consideration. Without a government mandate however, new and better large diameter pipeline leak detectors will be slow to develop.

2. Automatic electronic line leak detectors

There a number of manufacturers of these systems which are used in gas stations to continuously monitor pressurized pipelines for leaks. Many of these systems are capable of conducting Hourly Testing, Monthly Monitoring, and Annual Line Tightness Testing which is described more fully later in this article. Generally these systems operate on either pressure decay or product flow principles and use a microprocessor to determine if leaks are present base upon proprietary algorithms developed by the manufacturer. The systems that operate on pressure decay principles assume that a leaking pipelines cannot hold pressure just as balloons with holes cannot hold air. The systems operating on product flow principles assume that product coming from the tank's pump can continue flowing into a leaking pipeline and out the hole just as water coming from a faucet will continue flowing into a leaking thermos and out its hole. These principles are grossly oversimplified but hopefully they help you understand the functionality of these systems. In the event that the system detects a leak, the equipment may indicate an audible and/or visible alarm to alert the tank operator. Additionally, it may even be connected to the pump controller and may shut down the pump so that product cannot be dispensed.

These methods may vary in their ease of installation, user friendliness, reporting formats, etc. Individual manufacturers should be contacted for specific information.

3. Automatic mechanical line leak detectors

Mechanical line leak detectors are usually installed directly into UST pumps to continuously monitor pipelines for 3.0 gal/hr leaks or larger. These leak detectors are designed to detect catastrophic leaks in cases where a pipeline becomes fractured or broken and large amounts of product might be pumped into the ground. Mechanical line leak detectors normally always run a test before allowing fuel to be dispensed by the pump into the pipeline. If the leak detector finds a leak, it will react by restricting flow from the pump and the result is a customer complaint that the gas is pumping very, very slowly.

4. Line tightness test methods

These leak detection methods were developed solely for conducting annual line tightness testing and generally are manually operated by companies that arrive on-site with their equipment and conduct testing on the spot. Some of these systems are sold outright to individual organizations which is the case with the Horner EZY-Chek. Some of these systems are operated exclusively by the manufacturer and their affiliates which is the case with the NDE and Tanknology systems. These systems have a very wide range of operating principles including: pressure decay; acoustic; vacuum; tracers; etc. Often their unique operating principles have required equally unique evaluation protocols. These methods vary in their difficulty of operation, the amount of training required for operation, and the amount of time required to conduct a test. Individual manufacturers should be contacted for more information.

5. Line tightness test methods (tracer)

Tracer methods are another form of annual line tightness testing method which has been sub-categorized by the NWGLDE. Tracer methods are unique in their procedure for conducting leak detection testing in that they require a chemical to be added to the product which is then looked for outside of the piping. Often the tracer is added directly to the product in the UST and probes in the tank pit and pipeline trench are then sampled for the presence of the tracer chemical. If tracer is detected in any of the probes above a manufacturer specified level, the tank and/or pipeline may be determined to be leaking. This method may also identify the location of the leak depending upon which probes indicate the presence of the tracer chemical. Tracers may or may not be applicable to various environments. Tank operators should consult the manufacturer for more information.

3.0 Chart Categories

The NWGLDE listed methods provided in this issue have been categorized according to some of their unique features which are defined in the next few paragraphs. Hopefully, the descriptions provided can be used by potential buyers, regulators, installers, etc. in identifying appropriate pipeline leak detection systems. The table headers below and have provided a short explanation for each header.

1. Manufacturer

Although this heading is self explanatory, selecting or working with the correct manufacturer is very important. The levels of technical support and interest in providing a quality product may vary greatly. It is important to remember that the test protocols were developed to show that methods can meet minimum performance standards. Careful selection of a manufacturer should not be overlooked.

2. Model

As you can see, many of the manufacturer's listed in the table produce a number of different models of leak detection systems to meet the variety of requirements needed by tank operators. Potential buyers should consult the manufacturer before purchases to assure that the model of leak detector will meet their needs.

Different models may indicate that the method is designed for a certain operating environment. For example, the FE Petro STP-MLD is normally recommended for use in gasoline products and the STP-MLD-D is recommended for use in diesel fuel . Both methods are third-party certified for conducting Hourly Testing for different applications.

Also, model numbers may only indicate a different type of display or console. For example, the Marley PPM 4000, RLM 9000, RLM 10000, ST 1401, and ST 1801 are functionally identical and are listed together under the same certification. The differences lie in the console and display that the leak detector interfaces to. The PPM 4000 is used only for line leak detection whereas the RLM and ST series can also accommodate an Automatic Tank Gauging System.

Differences may also indicate if the method is operated manually or automatically which is the case with the Horner EZY-Chek Series and the Vista Research LT-100 Line Tightness Test Methods. It may be necessary for the manufacturer to produce manual and automatic systems for different user requirements. Some tank operators may only need to have their lines tested occasionally such as airport hydrant systems and it may not be economical to purchase a permanently installed automatic system. It may prove more economical for the tank operator to have a line tightness test conducted by a company that specializes in this service who uses manually operated equipment.

3. Certified Leak Rate

You may have also noticed that the same model numbers have several certification listings. Most Automatic Electronic Line Leak Detectors can perform several different types of tests. The standard EPA requirements Hourly Testing for leaks of 3.0 gal/hr or larger, Monthly Monitoring for leaks 0.2 gal/hr or larger, and Annual Line Tightness Testing for leaks 0.1 gal/hr or larger. Certifications are required for each of the three types of testing (Hourly, Monthly, and Annual) and if the method can meet all three types it may have three listings as is the case with the Incon TS-LLD and the Veeder-Root TLS-350, Series 8475.

4. Probability of Detection (P_D)

The EPA requires pipeline leak detection systems to be capable of detecting leaks of a stated size (3.0, 0.2, or 0.1 gal/hr) with a probability of 95%. The P_D that appears in the charts is a calculated value based on the results of the third-party testing. Generally, the evaluation consists of 25 tests with a leak present in the pipeline. If the leak detector correctly identifies that the line is leaking in all 25 tests, the calculated P_D is 100%. If the leak detector misses one of the 25 leaks, the P_D falls to 96%. Likewise, if two of the 25 leaks are missed, the P_D falls to 92% which is outside the EPA requirements. In this case, the manufacturer would have to make a decision to improve his system and conduct another evaluation.

5. Probability of False Alarm (P_{FA})

In addition to the P_d requirements, the EPA requires pipeline leak detection systems to have a false alarm rate of less than 5%. Again, the P_{FA} values appearing in the charts are calculated values based on the results of the third-party testing. In addition to the 25 tests with leaks present in the line, the test procedures also include 25 tests without a leak in the line (the line is tight). If the leak detector correctly identifies that the line is tight in all 25 tests, the calculated P_{FA} is 0%. If the leak detector incorrectly indicates that the line is leaking in one of the 25 tests, the calculated P_{FA} is 4%. Likewise, if two of the 25 leaks are missed, the calculated P_{FA} is 8%, which is outside the EPA requirements.

6. Leak Threshold

Leak thresholds are perhaps more misdefined and more misunderstood than any other term relating to leak detection. A simple definition of leak threshold is the value used by the leak detection system during a test to determine if the result is reported as a pass or fail. The complete picture is much more complicated than this because of the statistics involved and is beyond the scope of this article. In fact, an entire article could be devoted to defining leak threshold itself.

The EPA requires that the defined leak rates be detectable with a 95% probability or greater and a have a false alarm rate of 5% or less. Manufacturers are free to

determine a threshold which allows their methods to meet these requirements. Tank operators usually find false alarms to be irritating and some manufacturers have adjusted the threshold to minimize false alarms. By raising the threshold, leak detection methods will minimize false alarms but they will also decrease their probability of detection. It can end up being sort of a juggling game for the manufacturer between trying to satisfy the regulations and keep the tank operator happy.

7. Products

The NWGLDE list defines product types that each certified leak detector can be used on. However, the EPA does not require that leak detection methods be designed for specific product types and this is not a part of the evaluation process. Although most of the certifications on the list were conducted with gasoline as the product, the certification does not limit the method to a certain product type. The product types specified in the NWGLDE list have been determined by the manufacturer's themselves. As mentioned earlier, some manufacturers have developed specific models for specific products. Consult the manufacturers individually for specific product applications.

8. Piping Materials

The NWGLDE list defines the piping materials that each certified leak detector can be used on as fiberglass, steel, and flexible. However, the EPA does not require that leak detection methods be designed for specific types of pipelines and this is not a part of the standard evaluation procedures. When the standard evaluation procedures were issued, flexible piping had not come into the picture and flexible piping is not even mentioned as a parameter in the standard evaluation procedures. The state of Wisconsin does however require that some additional testing be conducted on leak detectors used in flexible piping and this is the primary reason that a number of certifications exist for leak detection systems used on flexible piping.

Station owners with flexible piping in the ground should be careful in selecting a leak detector. As you can see in the charts, a number of manufacturers have developed specific models designed for use in flexible piping. For example, the Vaporless has modified their standards mechanical line leak detector and manufactures the LD 2000E Series which is designed specifically for flexible pipeline applications. Flexible piping is much less rigid than fiberglass or steel piping and stretches somewhat when pressurized. Leak detectors that aren't designed to accommodate this "ballooning" may be fooled into a false alarms or missing a small leak.

9. Test Pressure

The test pressures listed in the charts are generally the pressures that the leak detection systems conduct testing at. The EPA has defined the required detectable leak rates at various pressures which can be confusing at first. The leak rate in a pipeline will be a function of the amount of pressure in the line. Increasing the pressure

increases the leak rate. The EPA defines the required detection limits as 3.0 gal/hr at 10 psi for Hourly Testing, 0.2 gal/hr at the pump's operating pressure for Monthly Monitoring, and 0.1 gal/hr at 1.5 times the pump's operating pressure for Annual Line Tightness Testing.

10. Max Volume

The EPA allows leak detectors to be used on pipelines up to twice the size that they were evaluated on. This can be defined as either volume or as a length of pipeline with a certain diameter. The values in the charts vary because of the different pipelines that on which the systems were evaluated.

11. Wait Time after Dispense

Most leak detectors on the list do not require a defined waiting time after dispensing before conducting a test. Many automatic methods begin testing each time the dispenser is turned off. If the dispenser is turned on in the middle of a test, the leak detector aborts the test and then waits for another opportunity to conduct its test. Mechanical methods normally conduct a short test, from two to six seconds in length, prior to each fuel dispensing. If a waiting time is required, the tank operator should adhere to the manufacturers operating procedures to obtain a valid test. Failure to do so can result in either a missed detection or a false alarm. Tracer chemicals that are added to pipelines require 1 to 4 weeks to migrate to the probes where sampling is done.

12. Test Times

Test periods after setup vary depending on the design of the leak detector and the manufacturer's proprietary algorithms. Hourly Testing for 3.0 gal/hr leaks is conducted within a few minutes. Monthly Monitoring and Annual Line Tightness Testing require longer test times because of the smaller leak rates. Some methods have a defined test time and others constantly monitor the pipeline's characteristics until a result can be determined. Both procedures may have advantages.

13. Action if Leak Declared

If an Hourly Test determines that a 3.0 gal/hr leak is present, the regulations require the leak detector to either restrict flow to the pipeline or shut off the pump. Audible and/or visible alarms may also be present to alert the tank operator. All of the leak detectors on the list capable of conducting Hourly Testing adhere to these requirements. Leak detectors which conduct Monthly and Annual Testing may have audible and/or visible alarms and they may or may not restrict flow or turn off the pump. Manually operated methods will provide data to the tester who will present the findings to tank operators.

4.0 Closing

Although the NWGLDE list may be a useful tool for locating potential vendors, this list is by no means comprehensive. Users of this equipment need to check with state and local regulators to make sure that the equipment they are purchasing is approved. Before making a purchase, an understanding of pipeline leak detection system operation principles and the information included in these charts can prove invaluable. Contacting the manufacturer before purchase and installation to make sure that the equipment is appropriate for your application should also not be overlooked.

For more information on leak detection, send a message of “subscribe” to KWA’s e-mail discussion group to leaklist@kwaleak.com or visit the KWA website at http://www.kwaleak.com.