

SPATIALLEAK Gas Leak Detection

Background

Pipeline safety regulations have been in place since the early 1970's. The U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) is responsible for administering these regulatory requirements, assuring the safe transportation of natural gas, petroleum, and other hazardous materials by pipeline.



One of these regulations is the Distribution Integrity Management Program (DIMP), which requires gas distribution operators to develop and implement a program that details the Knowledge, Evaluation, Measurement/Monitoring, and Reporting of the gas distribution system. One of these areas, Knowledge, requires the development and maintenance of maps, drawings, or sketches with the latest infrastructure information available. As a result, many gas operators have implemented GIS technology as a way to manage and map their gas infrastructure while complying with DIMP's Knowledge component.

Another part of DIMP suggests that gas distribution operators are responsible for ensuring their system is operating correctly and safely. One of the requisite safety measures is to perform periodic leakage surveys of the distribution system. Under Code of Federal Regulations (CFR) 49, Part 192.723, operators are responsible for completing scheduled surveys of their distribution system. Specifically, this regulation requires "the following minimum requirements: (1) A leakage survey with leak detector equipment must be conducted in business districts, including tests of the atmosphere in gas, electric, telephone, sewer, and water system manholes, at cracks in pavement and sidewalks, and at other locations providing an opportunity for finding gas leaks, at intervals not exceeding 15 months, but at least once each calendar year. (2) A leakage survey with leak detector equipment must be conducted outside business districts as frequently as necessary, but at least once every five calendar years at intervals not exceeding 63 months. However, for cathodically unprotected distribution

lines subject to § 192.465(e) on which electrical surveys for corrosion are impractical, a leakage survey must be conducted at least once every three calendar years at intervals not exceeding 39 months¹."

These leak surveys are completed using methane gas detectors that read the amount of gas emitting from the distribution system. The amount of methane gas read by the detection device determines the severity classification of the leak and, in turn, the corresponding required response time. Many of these inspection procedures have in the past required recording the leak information on paper maps or ledgers, which assist in completing the hand written leak report forms. This process can be time consuming and vulnerable to the elements in the field. Additionally, many leakage survey crews rely on phones to relay information which could potentially contribute to misinformation should service be an issue.

To help streamline these workflows, SSA built a GIS-integrated Leak Detection Application that provides the leakage survey crews with mobile access to the distribution data, the ability to track locationally what has been surveyed, and to auto-document and communicate methane gas leaks to the dispatcher as they are found.

Application

The Leak Detection Application uses Esri's ArcGIS Mobile technology with a GPS-enabled ruggedized tablet. This allows the survey crew to complete their survey process, but removes the need for paper maps to be taken into the field. All of the gas data and associated attribute information is available to the survey crew on the tablet device in the field along with traditional base map information (planimetrics, orthophotography, etc.) The core application functionality includes:

- GPS tracking of all lines inspected with time/date stamp and inspector information for archiving purposes
- GPS leak location point populated with leak and GIS infrastructure information

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<http://www.phmsa.dot.gov/portal/site/PHMSA/menuitem.ebdc7a8a7e39f2e55cf2031050248a0c/?vgnextoid=a7c6ca170a574110VgnVCM1000009ed07898RCRD&vgnextchannel=67027e2cd44d3110VgnVCM1000009ed07898RCRD&vgnextfmt=print#page5>

- Auto generation of leak report
- Leak alert system providing dispatch center with leak report form showing location of leak, leak severity, and necessary repair information
- On-the-fly data updates to distribution operator server via ArcGIS Server via wireless web connection
- Mobile cache updates in areas without wireless connectivity—auto-sync occurs when web is available

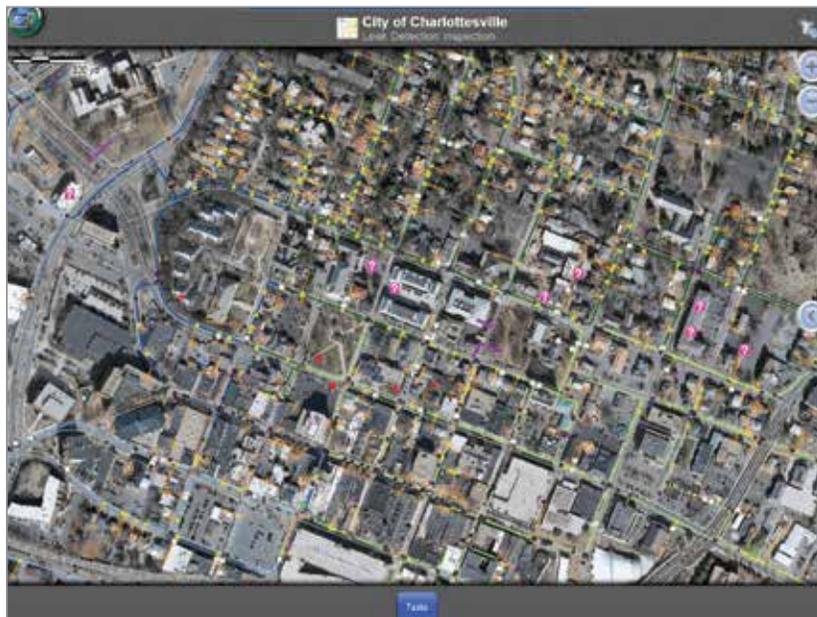


The Leak Detection Application can provide gas distribution operators with a streamlined approach for completing the federally-regulated leakage surveys. By providing the leakage surveyors with comprehensive gas infrastructure data at their fingertips and a mechanism to quickly record and communicate gas leak locations, the job of leakage surveys can be completed more quickly and efficiently. In the event of a subsequent major gas leak, the GPS's location information can be quickly referenced to determine when the infrastructure was last inspected to ensure compliance with the federal regulations.

Adoption of a leak detection system like SpatialLeak helps to assure that the gas distributor is in compliance with federally-mandated inspection requirements. When combined with Esri's GIS, the system provides a completely automated records management tool that can be adopted by the regional (typically State) regulatory authority to ensure consistent compliance by all regional gas operators. Automated reporting routines can be added that:

- Check for compliance with the leak detection recurrence requirements of the federal regulations
- Demonstrate the timeframe in which reported leak response is provided
- Summarize the number of leaks found and the locations of multiple leaks within a given geographic region to assist in identifying infrastructure that may be susceptible to future leaks

In Charlottesville, Virginia, this application is one component of a comprehensive gas distribution infrastructure information system that includes pressure modeling, component batch identification, and could soon include spare part inventory. For more information regarding the SpatialLeak application or the more complete gas distribution system GIS, please contact Spatial Systems Associates.



This image, taken from the field screen, shows a portion of the gas distribution system for the City of Charlottesville, Virginia. The available digital orthophotography is overlaid with lines depicting the location of the regional gas distribution infrastructure. The color of the line represents the diameter of the gas line. The red dots are intended to represent leaks that were found by the application during field surveys. The question mark symbols represent locations at which the inspection staff has identified something other than a leak that they believe deserves further attention, i.e. observed corrosion.

