

Vehicle-Mounted Natural Gas Leak Detector

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Environmental Problem

In the United States, significant resources are devoted annually to leak inspection of natural gas transmission and distribution pipelines. Leakage surveys are critical to maintaining the integrity and safety of the nation's pipelines and gas distribution systems. Gas utility companies are actively seeking remote detection technology to improve the efficiency and reduce maintenance costs of leak detection. To perform detection surveys, a service person must enter a property and walk the entire length of the service line (from the main to the service entry point of the building). If these surveys could be done at a distance, either from the sidewalk or as a drive-by operation, significant savings could be achieved. Mobile leak detector technology would help the United States prepare to address a large, aging, and expanding natural gas pipeline system.

SBIR Technology Solution

With support from EPA's SBIR Program, the U.S. Department of Energy, Northeast Gas Association, and Health Consultants, Inc., Physical Sciences Inc. (PSI) developed the Remote Methane Leak

Detector (RMLD). This technology uses an optical detector that does not need to be located within the gas leak plume. The leak detection device is based on tunable diode laser absorption spectroscopy.

Remote detection of specific gases is achieved by projecting a laser beam through the air to a target (such as grass, foliage, or buildings). A fraction of the laser beam is scattered from the surface and returned back to the source where it is collected and focused onto a detector. Gas molecules in the air path will absorb specific frequencies of light in a unique pattern as dictated by their structure and spectroscopy. Because the laser beam can be easily scanned over the survey area, the presence of leaks can be quickly determined or eliminated.

The RMLD is a handheld device intended for use in walking pipeline leak surveys. The device, about the size of a breadbox, also can be mounted on top of a vehicle. The laser beam can be projected from the road or sidewalk above the path of the pipeline to the home and indicate the presence or absence of gas. If gas is detected, the survey crew then would walk the length of the pipeline to locate the leak. Because most surveys are negative, the tool would eliminate the need to walk along these pipes, reducing survey times (it takes only seconds to make each measurement) and enabling more efficient use of manpower.

The RMLD can be used to remotely determine the presence of natural gas inside a building or confined space. The RMLD also could be a valuable

tool for use by first responders to determine if an area or building is safe for occupation or to locate the source of a leak after a natural disaster causes a pipeline rupture. PSI recently conducted a successful test of its prototype mobile natural gas detector, which demonstrated the ability to spot natural gas leaks from a distance of up to 30 feet from a vehicle moving at speeds approaching 20 mph. The device can detect methane plumes with concentrations comparable to those of a pilot light as far away as 100 feet. The RMLD has been successful at locating all types of leaks under a variety of field conditions.



PSI's handheld remote natural gas detector can be used for walking pipeline leak surveys and also can operate from a moving vehicle.

Commercialization Information

The prospect of replacing currently available gas detectors that deploy technologies such as flame ionization units and combustible gas indicators with a laser-based device that can rapidly survey off-road pipelines has great appeal to leak detection companies. A conservative estimate indicates that members of NYSEARCH—a premier natural gas research, development, and demonstration program—can save more than \$1 million annually if a remote gas leak detector is developed and implemented. Preliminary estimates for walking survey operations have projected savings in the range of 25-40%. Health Consultants, Inc., and PSI worked together to build pre-commercial instruments in the spring of 2004, and NYSEARCH companies field tested the device. Health Consultants, Inc., and PSI will begin production of the RMLD in 2005, and will market the detector to the natural gas industry. Heath Consultants, Inc., estimates that 3,000 units, valued at approximately \$50 million, will be sold by 2010. This SBIR project has led to more than \$1 million in additional funding to bring this technology to the commercial market.

Company History

Founded in 1973, PSI is located in Andover, Massachusetts, 30 minutes north of Boston. The company has satellite offices in Sterling, Virginia, and San Ramon, California. PSI generates approximately \$25 million in revenue annually, with 80% of this revenue stemming from contracts with the U.S. government. The company's core technologies have been developed with more than \$250 million

of federal and industrial funding. The SBIR Program has played a pivotal role in PSI's technical and commercial success, and has been responsible for a family of intelligent instrumentation products based on proprietary electro-optical and electromechanical technologies. PSI focuses on providing contract

research and development services in a variety of technical areas to both government and commercial customers. The company develops advanced technologies for aerospace, energy, environmental, manufacturing, and medical applications.

SBIR Impact

- Significant resources are devoted annually to leak inspection of natural gas transmission and distribution pipelines.
- PSI developed the Remote Methane Leak Detector (RMLD), which extends the range of remote detection of natural gas leaks in distribution and transmission pipelines.
- The RMLD can identify natural gas leaks from a distance of up to 30 feet from a vehicle moving at speeds approaching 20 mph.
- The technology could save one group of gas companies more than \$1 million annually.