[Form 2 (to be reported to Committee on Countermeasures for Contaminated Water Treatment and to be disclosed to public)

| Technology Information | |
|---|---|
| Area | 1-(3) Technologies for detection of minor leaks |
| Title | Detection of Leaks in Aboveground Storage Tanks |
| Submitted by | Vista Engineering Technologies, Inc. |

**1. Overview of Technologies (features, specification, functions, owners, etc.)**

Vista Engineering Technologies, Inc /Vista Precision Technologies, Inc., has developed a TRL 9 technology for the detection of small leaks in aboveground storage tanks (ASTs). For reference please refer to the Vista Precision web site at http://www.vistaprecision.com/ and the section on the use of the LRDP for large bulk tanks (http://www.vistaprecision.com/solutions/2011-10-04-07-38-32/lrdp). This device is an on-line, automatic, in-tank, leak detection monitoring testing equipment and services, used mainly in the petroleum industry. The LRDP system has been evaluated and certified by the U.S. EPA for use in all liquid tanks. The LRDP system for on-line monitoring is the best system in the United States, and it is the only in-tank system in the United States that is offered for routine monitoring of the tank for small leaks.

The LRDP is listed for use in compliance testing of large bulk storage tanks by the U.S. EPA. While the results are reported for petroleum fuels, the LRDP can be used for all liquids, and will perform significantly better for liquids, like water. The system was initially developed, evaluated, and implemented by Dr. Maresca of Vista Engineering for the U. S. Navy (the Naval Facilities Engineering Service Center (NFESC), Port Hueneme, California) for bulk storage tanks) over 15 years ago.

***Overview of the LRDP.*** The LRDP is a differential pressure sensing technology that will detect liquid leaks in water-based tanks that is smaller than 0.05 gal/h with a probability of detection of greater than 99% ($P_D > 99\%$) and a probability of false alarm less than 1% ($P_{FA} < 1\%$). This performance is significantly better than would be achieved in the petroleum AST in which it was evaluated for performance, because the welded and bolted ASTs in Japan, which have diameters of approximately 12 m, are much smaller than the AST in which the LRDP was evaluated, which had a diameter of 50 m (164.5 ft) and contained 6,400,000 gals (150,000 barrels) of jet fuel (see Figure 1). A leak detection test can be done automatically and can be completed is less than 24 h.

**Figure 1.** The performance of the LRDP was evaluated using the 50-m diameter Aboveground Storage Tank (AST), which contained 6,400,000 gal (150,000 barrels) of jet fuel

The LRDP was initially developed for the world's largest USTs, which are owned and operated by the U.S. Navy. The Red Hill tanks, buried over 100 feet deep in the hills above Honolulu, are 100 feet in diameter and 250 feet high, and each contains 12.5 million gallons of fuel. The LRDP has also been used for testing some of the bulk USTs owned by the Department of Defense (DoD) [1]. The LRDP has been integrated into the DoD Fuels Automated System, making it compatible with all the DoD's bulk fuel storage facilities.

The LRDP consists of three integrated components:

- an in-tank sensor unit for making measurements
- a local controller to implement a test and analyze the data from the test
- a host computer to initiate a test and to report and archive the results of the test

***How the LRDP Works.*** The key component of the LRDP is the vertical "reference" tube, which spans the full usable height of the tank (see diagram). The liquid in the tank is allowed to enter or leave the reference tube through a valve located at the bottom of the tube. When the tank is to be tested, the valve is closed, isolating the fuel in the tube from the fuel in the rest of the tank.

The level of fuel in the reference tube mimics that in the tank in every way except for the

level changes due to a leak. A differential-pressure sensor, which is housed in a sealed container at the bottom of the tube (which is itself at the bottom of the tank) then detects very small changes in pressure between the fuel in the tank and the fuel in the tube, with the LRDP converting pressure changes to the equivalent level changes. Thus, when the valve is closed, the differential-pressure sensor directly senses, and the LRDP quantifies, the level changes due to a leak (if a leak is present).

The LRDP not only delivers high performance, but it is rugged and field-worthy. Because of its unique design, the LRDP eliminates the two factors responsible for the poor performance of other mass-based measurement systems—thermal drift of the pressure sensors and thermally induced vertical movement of the in-tank sensor unit. All of the sensors are mounted in a sealed container at the bottom of the tank, where temperature changes are too small to affect sensor performance; and the in-tank sensor is held in place by a bellows-type mounting system that prevents changes in tank geometry from affecting the position of the sensor.

2. Notes (Please provide following information if possible.)

- Technology readiness level (including cases of application, not limited to nuclear industry, time line for application)

  As stated above, the LRDP for ASTs is a TRL-9 system and is commercially available by Vista Precision Solutions, Inc. It was developed, evaluated, and implemented by the U.S. Navy. It can be installed and checked out in 1 to 2 days per tank.

- Challenges

  No development is needed.

- Others (referential information on patent if any)

  N/A