PERFORMANCE OF THE VISTA LRDP FOR DETECTION OF LEAKS IN ABOVEGROUND STORAGE TANKS (ASTS)

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The LRDP (Low-Range Differential Pressure) system is a mass-based leak detection and monitoring system for bulk underground storage tanks (USTs) and aboveground storage tanks (ASTs). The LRDP can be permanently installed for on-line monitoring and periodic tightness testing, or it can be transported to a site for a one-time tightness test. The performance of the LRDP on bulk USTs has undergone three third-party evaluations in the last four years. Its performance on ASTs, during a third-party evaluation conducted by Ken Wilcox Associates, Inc. (KWA), is described below.

TEST METHODOLOGY

The LRDP for ASTs is the same as the one used on USTs, except that a single temperature sensor is attached to the exterior of the steel shell, on the north side of the tank. Test duration is 20 hours or more. The test starts and ends during darkness, beginning between 0400 and 0530 and ending between 0100 and 0530. Several tests can be averaged together to improve performance.

THIRD-PARTY EVALUATION

The performance of the LRDP was evaluated by Ken Wilcox Associates during tests conducted between June 19 and August 29, 2002. The tank used in the evaluation was a 164.5-foot-diameter, fixed-roof AST located in a tank farm at Pearl Harbor, Hawaii. The AST was filled to a depth of 40.7 feet and contained approximately 6,470,000 gallons of JP-5 fuel. The product surface area during the evaluation was 21,253.1 square feet.

Twenty-four tests were conducted, during which KWA introduced leaks ranging from 0.0 to 2.0 gallons per hour. Neither the presence of the leaks nor their size was known to the vendor until after all test results had been reported. KWA also examined whether the LRDP was sensitive to effects related to the filling of the tank; the results of the evaluation showed no adverse impact on the performance of the LRDP even if a test was started immediately after the tank had been filled. The mean and standard deviation of the evaluation results were –0.004 gal/h and 0.272 gal/h, respectively.

PERFORMANCE

A minimum detectable leak rate (MDLR) was computed—an estimate of the smallest leak that can be detected by the LRDP. The MDLR is defined as the leak rate that can be detected with a probability of detection (P_D) of 95% and a probability of false alarm (P_{FA}) of 5%. The MDLR attainable in a single test was computed, as well as that attainable by averaging several tests. The evaluation also looked at the LRDP's performance over a range different tank diameters. Some of the results are shown in Tables 1 and 2. The performance of the LRDP scales with the cross-sectional area of the product surface, i.e., the diameter of the tank (the smaller the area, the better the

performance). The LRDP's MDLR for the tank used in the evaluation (i.e., one with a diameter 164.5 feet) is 0.932 gallons per hour, and the threshold (the volume rate at which a leak would be declared) is 0.466 gallons per hour.

Table 1. Largest Tank Diameter that Can Be Tested with a P_D = 95% and a P_{FA} = 5% as a function of Leak Rate and Number of Tests, n, Averaged Together

				n = 1	n = 2	n = 4	n = 6	n = 12
Leak Rate (gal/h)	**Threshold** (gal/h)	**P_D** (%)	**P_{FA}** (%)	**Tank Diameter** (ft)	**Tank Diameter** (ft)	**Tank Diameter** (ft)	**Tank Diameter** (ft)	**Tank Diameter** (ft)
0.20	0.10	95%	5%	76.2	90.6	107.8	119.3	141.8
0.30	0.15	95%	5%	93.3	111.0	132.0	146.1	173.7
0.50	0.25	95%	5%	120.5	143.3	170.4	188.6	224.3
1.00	0.50	95%	5%	170.4	202.6	241.0	≤ 260.1	≤ 260.1
2.00	1.00	95%	5%	241.0	≤ 260.1	≤ 260.1	≤ 260.1	≤ 260.1

Table 1 summarizes the largest AST that the LRDP can test with MDLRs of 0.2, 0.3, 0.5, 1.0, and 2.0 gallons per hour with a P_D = 95% and a P_{FA} = 5% as a function of the number of tests, n, averaged together. For example, on an AST with a diameter of 107.8 ft or less the LRDP can attain an MLDR of 0.20 gallons per hour when four tests are averaged. Table 2 is identical to Table 1, except that the results are for a P_{FA} = 1% instead of 5%.

Table 2. Largest Tank Diameter that Can Be Tested with a P_D = 95% and a P_{FA} = 1% as a function of Leak Rate and Number of Tests, n, Averaged Together

				n = 1	n = 2	n = 4	n = 6	n = 12
Leak Rate (gal/h)	**Threshold** (gal/h)	**P_D** (%)	**P_{FA}** (%)	**Tank Diameter** (ft)	**Tank Diameter** (ft)	**Tank Diameter** (ft)	**Tank Diameter** (ft)	**Tank Diameter** (ft)
0.20	0.119	95%	1%	68.6	81.6	97.0	107.4	127.7
0.30	0.178	95%	1%	84.0	99.9	118.8	131.5	156.4
0.50	0.297	95%	1%	108.5	129.0	153.4	169.8	201.9
1.00	0.595	95%	1%	153.4	182.4	216.9	240.1	≤ 260.1
2.00	1.190	95%	1%	216.9	258.0	≤ 260.1	≤ 260.1	≤ 260.1

SUMMARY

The performance of the LRDP is more than sufficient to meet operational and regulatory requirements for monitoring and/or periodic tightness testing of ASTs.

To explore Vista's product line or to obtain background information and technical details about the underlying concepts, visit www.vistaleakdetection.com.