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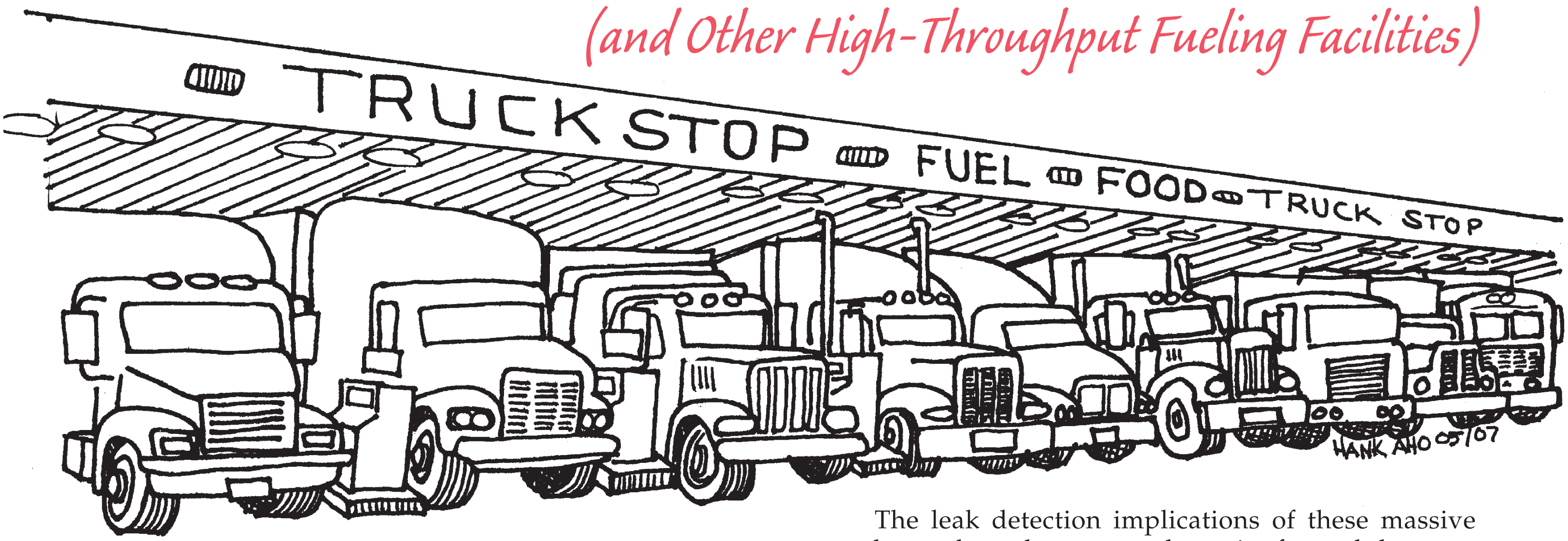
L.U.S.T.LINE

A Report On Federal & State Programs To Control Leaking Underground Storage Tanks

THE TROUBLE WITH TRUCK STOPS

(and Other High-Throughput Fueling Facilities)



By Marcel Moreau

The other day I spotted a tractor-trailer rig with a message on the side that caught my eye. It said, "You need it? It's in here." This message has often been stated another way, "America's needs move by truck." For better or for worse, these statements are no exaggeration. When was the last time you saw a Wal-Mart SuperCenter or a Home Depot or a Target or any other stadium-sized store located near a railroad track or a ship docking facility? The fact is that America's trucking industry is a cornerstone of our economy and our culture.

And all those trucks bringing all those goods within convenient reach of all our homes, guzzle oceans of diesel fuel that is dispensed at a relatively small number of fueling facilities. In 2004, U.S. vehicles consumed 37.3 billion gallons of diesel fuel. According to the National Association of Truckstop Operators (NATSO) website, three-quarters of this diesel fuel is pumped through facilities owned by their members. The average volume of fuel pumped at a typical large-scale NATSO facility is a million gallons per month. A throughput of a million gallons a month means that on average a facility pumps better than 33,000 gallons a day, or about 1,400 gallons an hour, or about 23 gallons each minute of every day.

The leak detection implications of these massive truck stop throughputs were the topic of a workshop presented by Steve Purpora of Purpora Engineering,LLC at this year's National Tanks Conference in San Antonio. Steve's dad, Bill, essentially founded the tank and piping testing industry in the U.S. back in the early 1970s and became the undisputed master of his trade. Steve began his career in UST testing at the tender age of eight and is passionate about leak detection. "Everybody can see that there's a huge potential for problems at truck stops," says Steve, "but because there are no simple answers, most

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everyone is content to be whistling Dixie and crossing their fingers. I can tell you from personal knowledge that this strategy is not working."

The problem is that this kind of very-high-volume-virtually-non-stop throughput leaves little time for leak detection. And because flowing fuel equals cash flow, there is little desire to interrupt fuel dispensing to allow leak detection to occur. And the fact is that traditional leak-detection methods are woefully inadequate to do their job in these high-throughput systems. Let's look at available leak-detection methods to find out why.

Leak-Detection Methods in a High-Throughput Environment

■ Inventory

A new facility less than 10 years old might still be able to use inventory control plus tightness testing every 5 years for leak detection. But with a million gallons of throughput, a variance of 10,000 gallons "passes" the federal standard of 1 percent of throughput plus 130 gallons. Clearly, though it may be legal, inventory control is not going to be protective of the environment at this level of throughput.

■ Automatic Tank Gauging (ATG)

Truck-stop tanks are never shut down at night and most are manifolded together, so ATGs that conduct periodic tests don't qualify as a leak-detection method. ATGs that conduct "continuous" testing still require quiet intervals when there is no pumping activity in order to gather the data required to conclude that a tank is tight or leaking. At throughputs of more than just a few hundred thousand gallons per month, however, these types of tank gauges typically do not have enough quiet time to do their leak-detection job. While ATGs can definitely help improve the quality of inventory data, at high-volume sites, they can serve no acceptable leak-detection function.

■ Statistical Inventory Reconciliation (SIR)

Traditional SIR methods rely on about 30 data points gathered on a daily basis to determine whether a leak is present. The SIR evaluation protocol does not put a throughput limit on the applicability of a SIR method as the continuous ATG protocol does. It would be foolish to conclude from this, however, that a SIR method can be used at a facility no matter how high the throughput. I do not see how a SIR method can reliably detect a 150-gallon loss in a million gallons of sales (that's 0.015 percent of the sales volume) using only 30 data points.

There is a more recently developed "real-time" SIR that can automatically gather thousands of data points by taking "snapshots" of the fueling activity at a site. One vendor of this approach has been certified for throughputs of up to 2.7 million gallons. This approach has promise, especially because it offers facility owners a means of keeping much tighter control over their fuel inventories and thus offers business advantages as well as leak detection.

SIR methods alone will not do the complete job of piping leak detection at a truck-stop facility. Truck stops typically have satellite fuel dispensers that allow tanks on both sides of a truck to be fueled simultaneously in a single sales transaction. Satellite dispensers are typically connected to the master dispenser via a relatively short length of underground piping. Inventory-based methods of leak detection do not see any leakage that may occur after the fuel has passed through the metering mechanism in the master dispenser. Thus, no inventory or SIR-based method of leak detection can be used for leak detection on satellite-dispenser piping.

■ Secondary Containment

Secondary containment with interstitial monitoring is one of the few methods of leak detection whose efficacy is not affected by throughput and could realistically be expected to meet regulatory requirements for monthly leak detection. However, many existing truck stops do not have secondary containment. Replacing existing storage systems is a costly proposition, and not just because of the huge storage capacity and the extensive piping network required for the new system. The cost of interrupting the fueling operations in terms of lost profit as well as the loss of customers to competing facilities during the construction of the new storage system is likely to dwarf the cost of the storage system itself.

■ Soil-Vapor Monitoring

Diesel fuel is not nearly as volatile as gasoline, so soil-vapor monitoring is not a particularly sensitive method for detecting diesel-fuel leaks. Because fuel storage and dispensing systems at truck stops are spread out over a large area, it would also require a multitude of sampling points to achieve effective leak detection. Existing contamination at many sites could also pose problems in detecting new releases.

■ Groundwater Monitoring

The biggest restriction on groundwater monitoring is that it is only acceptable where the groundwater is less than 20 feet from the ground surface. Because of its questionable effectiveness in detecting releases and the difficulties encountered in distinguishing new leaks from old, groundwater monitoring is hardly anybody's favorite method of leak detection. Like soil-vapor monitoring,

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effectively monitoring an entire truck-stop fueling facility would also require an extensive network of wells.

Tightness Testing

Few facilities use inventory control plus tightness testing as a method of tank leak detection today. Tightness testing primarily plays a role in the annual testing plus line-leak-detection option for pressurized-piping leak detection. The biggest obstacle here is cost—not the cost of the actual tightness test but the cost of business lost during the time required to set up and conduct the test.

Few truck-stop designers had the foresight to design a facility so that a portion of the dispensers could be shut down while the rest continued to operate. "Truck-stop designers apparently never heard that saying about 'putting all your eggs in one basket,'" says Steve Purpora. "So when something breaks down, the whole system is down and there's a huge rush to get pumping again. Checking for leaks to be sure the work has been done right is not even a consideration."

This philosophy places great pressure on the piping and distribution system to operate non-stop, because taking the time for maintenance, minor repairs (even of small leaks), and testing is unacceptably expensive due to the lost income from the interruption of sales.

Consequently, if tightness testing is done, facility operators want the testing to be conducted at night and they want it done fast to minimize costs and inconvenience to customers. While this is all very understandable, it puts substantial pressure on tightness testers to be quick rather than accurate. "And," adds Steve Purpora, "tired testers working in the dark around tired truckers driving enormous rigs is hardly the ideal situation from a safety perspective."

Line-Leak Detectors

Perhaps the biggest deficiency associated with truck-stop leak detection is the lack of line-leak detection on the pressurized piping. Remember that the regulatory definition of line-leak detector is "a device that can detect a leak rate of 3 gallons per hour at a pressure of 10 psi within one hour." All line-leak detectors, whether mechanical or electronic, require that the pump be cycled either from off to on (mechanical LLDs) or on to off (electronic LLDs) in order to conduct a test. At a facility where the pumps remain on for many hours at a time (at many facilities the pumps may not shut down for days at a time) the line-leak-detection requirement is not met because the pumps do not shut down on an hourly basis. If a sizable leak were to develop in a truck-stop piping system, it could very likely not be detected by a line-leak detector until many hours had passed.

Truck stops stretch the limits of LLDs in other regards as well. The volume of the extensive, large-diameter piping runs may easily exceed the volume-limit restrictions on the line-leak detector as determined by the third-party evaluation. In addition, if the lengthy piping runs are sloped uniformly towards the tanks, the tanks may end up buried many feet below grade. For mechanical LLDs, this could create a scenario where the static head pressure produced by the product in the pipe would be sufficient to prevent the LLD from ever "tripping" and detecting a leak. (See *LUSTline* #29, "Of Blabbermouths & Tattletales – The Life & Times of Line Leak Detectors" for a more detailed discussion of this issue.)

While in some jurisdictions, double-walled piping with continuously monitored sensors in tank-top and dispenser sumps might be acceptable as line-leak detectors, this is not a position that I am particularly fond of. But given existing technology and the realities of truck-stop operations, this may well be the best that can be done to meet line-leak-detection requirements.

0.2 Gallon per Hour Monthly Testing

Single-walled piping systems are increasingly using the automated 0.2 gph leak-detection capability of most electronic LLDs to meet the monthly piping leak-detection requirements. These tests require the temperature of the product in the piping to be stable in order for the test to be accurate, so most devices conducting this type of testing require a 30-minute or so period of no dispensing before they can run the test. Thirty-minute quiet periods are virtually nonexistent at truck stops, and so electronic LLDs cannot be relied upon to meet leak-detection requirements by conducting monthly 0.2-gph tests.

The Bottom Line

Because of their extraordinary throughputs and extensive piping systems, truck stops present time-based and physics-based challenges to effective leak detection. While secondary containment with interstitial monitoring may be the most-likely-to-succeed method of leak detection, few regulatory agencies have the clout to force existing single-walled facilities to upgrade to secondary containment.

While it is true that the federal Energy Policy Act may by default impose secondary containment on most of the nation's new storage systems, this is a double-edged sword. The increased replacement cost of new storage systems means that owners will keep their existing single-walled storage systems in service as long as possible. And because most state regulations have no mandatory retirement age for storage systems, "as long as possible" means until the storage system can be proven to be leaking. Coupled with the ineffectiveness of leak detection in detecting leaks, this is not a comforting prospect.

Real-time inventory analysis could provide leak detection relief for many facilities with throughputs less than 2.7 million gallons a month, while providing fuel-management benefits like verifying delivery volumes and checking the calibration of meters. Real-time inventory analysis may provide the least objectionable pathway for single-walled storage systems to achieve compliance with monthly leak-detection requirements. Keep in mind, however, that leak detection for satellite piping would still need to be addressed. Line-leak-detection requirements remain problematic under any leak-detection scenario that I can think of.

In the meantime, Steve Purpora is promoting a campaign of awareness and incremental improvement. "People need to know that just because the rest rooms at a high-volume facility are clean doesn't mean that everything below ground is hunky-dory. Regulators need to pay more attention to truck stops and not be intimidated by their size or

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their complexity. Truck-stop operators need to be made aware of their responsibilities and have their feet held to the fire. At a minimum," continues Steve, "a detailed annual inspection, in daylight, should be conducted and fines assessed just like for any other noncompliant facility."

Our High-Throughput Challenge

The continuing increase in our nation's fuel consumption (we used 2 billion more gallons of diesel fuel in 2004 than 2003, and 2.5 billion more gallons of gasoline), together with the dramatic reduction in the number of fuel-storage systems since the onset of the federal tank rules has produced a substantial increase in the throughput volume of the "typical" storage system. As this trend of increasing throughput continues, the leak-detection methods formulated for the storage systems of the 1980s will be stretched to their effective limits at an increasing number of sites. While leak-detection issues associated with high throughput are most obvious at truck stops, they are present in a growing number of today's convenience stores as well.

So my crystal ball is as fuzzy as ever, but I see in its misty depths a growing need for "next-generation" leak-detection methods like real-time SIR and pressure-/vacuum-based interstitial monitoring, as is now required for new facilities in California, to meet the leak-detection challenges of today's (and tomorrow's) high-throughput fueling facilities. ■

NOTE: Curt Johnson chaired a session at the National Tank Conference in San Antonio entitled "Leak Detection — The Next Generation" that provided much interesting information on the state-of-the-art of leak detection. For a copy of the slides presented during this session of the conference, go to: http://www.neiwpcc.org/tanks07/presentations/LeakDetectionSession-All-Handouts.pdf

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Continual Reconciliation Applications for Active Fueling Facilities

by William P. Jones

While the population of regulated USTs has dropped dramatically since storage tank rules were first published in 1988, there has been a major trend in the retail petroleum industry toward the development of high-throughput fueling facilities. Hypermarket fueling stations with customers at each dispenser, convenience stores active at all hours of the day, and travel centers with delivery transports lined up to make their drops are now a common sight. The fueling public is drawn to these facilities because of their competitive fuel prices. The business model that supports these complex operations relies upon moving large amounts of fuel products on thin margins.

Naturally, operation of these high-tempo sites imposes wear and tear on fueling equipment. From a leak-detection standpoint, the concern is whether product containment has been compromised in the face of all this activity. (See "The Trouble with Truck Stops…" page 1.) From a business perspective, costly fuel-inventory losses can take place at active sites because of problems with meters drifting out of calibration or improper blending ratios, theft at the dispenser or upon delivery, or the effects of temperature fluctuations.

Many companies with high-volume sites have realized that the best way to manage their complex operations is to rely upon precise measurements of fuel inventory. Warren Rogers Associates (WRA) has worked with operators of such sites to develop a Continual Reconciliation System to enable them to manage their leak-detection requirements and all of the complex transactions and fueling equipment at high-throughput facilities where problems with fuel-inventory shrinkage are endemic.

The Continual Reconciliation System

As shown in Figure 1, the Continual Reconciliation System uses a processor ("OSP") installed at each facility to acquire data from automatic tank gauges, dispenser controllers, and other related systems. The OSP records data for each dispenser and compiles refined inventory data at the conclusion of every sales transaction by querying the tank gauge for product height and temperature measurements. The OSP develops a complete and ongoing record of fluid flows, transfer, and storage occurring on-site.[1]

Because the Continual Reconciliation System develops precise inventory measurements, it is capable of computing delivery volumes and meter calibration. Further, the system adjusts for the expansion and contraction of product due to temperature change on an ongoing basis. The system also identifies leakage as a continuous loss of product, as opposed to episodic delivery shortfalls, theft, or excess product dispensed due to meter miscalibration.

Given that the Continual Reconciliation System works while the UST system is active, its leak-detection applications function differently than conventional automatic-tank-gauge and line-leak detector monitoring. Typically, volumetric monitoring of tanks and associated lines has taken place when the tank systems are dormant, an infrequent occurrence at high-volume sites. The Continual Reconciliation System instead relies on data from both the static and dynamic operations of the tank so that ongoing monitoring of the tank system can occur.

Because the Continual Reconciliation System tracks product from the point of delivery to the dispenser meter, leaks from almost every component of the storage system can be detected. We have found that leaks originating in the tank shell or buried

1. U.S. and foreign patents apply.