Flexible Piping Failures: A Growing Problem; A Serious and Alarming Risk

Item 1.
From an article entitled "Flexible-Pipe Concerns Drive Home the Need for Tank-Owner Vigilance" in the October 2002 edition of a newsletter published by the New England Interstate Water Pollution Control Commission (NEIWPCC):

> John Mason, U.S. EPA Region 4 UST Program Manager, says he has received reports from several states regarding several different generations of polyethylene flexible piping exhibiting unusual physical changes. "Some of the changes appear to be an elongation of the pipe resulting in torn containment sump boots, compressed test boots, contorted flex connectors, and splitting of the pipe as it grows over metal fittings. There are other reports where the outer layer has wrinkled, softened, and split," says Mason.
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> "The reports described changes that occurred sometimes within weeks or even days of installation," notes Mason. "There seem to be more and more reported incidents as inspectors and owner/operators become more familiar with what to look for in the piping and dispenser sumps. The majority of the piping incidents have been detected in time, and within secondary containment; however, there have been some catastrophic failures resulting in releases to the environment of several thousand gallons of product."

This article goes on to mention an independent risk management consultant who "has reviewed reports of close to 200 failures in double-walled flexible piping in 11 states." It can be viewed in PDF format at …

www.state.ak.us/dec/dspar/stp/documents/flexible_pipe03.pdf

Item 2.
From a warning letter to underground petroleum storage tank owners posted on the State of Florida Web site in early 2003, signed by Michael E. Ashey, Bureau of Petroleum Storage Systems chief for the Florida Department of Environmental Protection:

> The use of thermoplastic flexible piping in Florida for underground petroleum storage tank systems has increased significantly since 1995. Although most of these systems are apparently functioning properly, the Department is aware of a large number of incidents that have occurred, especially during the last year, where flexible piping systems have failed and/or otherwise not performed as intended.

Similar letters have been sent to UST owners by environmental authorities in Mississippi and Tennessee:

www.deq.state.ms.us/MDEQ.nsf/pdf/pages/UST_FlexPipeLetter/$file/flexletter.pdf
www.tennessee.gov/environment/ust/pdf/TOFlexPipeBulletin.pdf

These letters, like the Florida letter, describe "visible evidence that might indicate the integrity of the piping system is compromised":

> The ells, tees, riser pipes, and flex connectors found within the sumps where the piping is terminated may be twisted, over-stressed, or pushed out of normal alignment.
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> The pipe may be over-bent within the tank sump, or it may be folding over on itself (kinked).
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> The outer jacket of double-walled (coaxial) piping may be extended over the metallic ferrule of the pipe coupling [or] may be splitting as it attempts to grow over the metallic coupling.
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> The pipe may be swelling and appear to be bulging or "ballooned" … wrinkling … sticky/spongy … softer than it was originally.
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> The outer walls of the primary pipe and/or the secondary jacket may be cracking.
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> The rubber boots that are installed in the walls of the containment sumps may be stretched or torn.
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> The donuts that make up part of the boot of some pipe systems may be dislodged or the clamps may not be in place.
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> The rubber "test" boots that are installed at the pipe terminations of some coaxial pipe systems may appear to be compressed or distorted.
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> The metallic ferrules that are part of some pipe system couplings may be cracked.
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> Piping manufactured prior to 1994 that is yellow in color may be delaminating and a fungus/microbial growth may be attacking the outer walls of the pipe.

Item 3.
Photographs posted on the Mississippi Department of Environmental Quality's Web site illustrating the conditions described above:

www.deq.state.ms.us/MDEQ.nsf/pdf/UST_partone/$file/flexConcernsPart1.pdf
www.deq.state.ms.us/MDEQ.nsf/pdf/UST_parttwo/$file/flexConcernsPart2.pdf
www.deq.state.ms.us/MDEQ.nsf/pdf/UST_partthree/$file/flexConcernsPart3.pdf

Item 4.
From an informational Web page posted by the Maryland Department of the Environment, shedding light on the basic etiology of all of these problems:

> In general, polyethylene materials are subject to expansion when they come in direct contact with petroleum. [While] not used as the primary fuel barrier, [they are used] as part of the outer wall of the flexible piping system.

> The expansion rate of polyethylene upon its contact with petroleum depends on a number of factors, including but not limited to the production grade of the polyethylene, the volume of petroleum product making direct contact with the material, and the duration of the contact. The purpose of the outer wall of flexible piping is to channel any released product from the primary portion of the pipe to the containment sump on the top of the tank, where it will be detected and removed in a timely manner. If fuel is allowed to sit in these areas, then swelling problems can occur. It is very important that no fuel be allowed to remain in the containment sump.
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> Also, swelling of the piping might be caused by a small release, such as that caused by a leaky fuel filter, in the dispenser area. If the released fuel gets between the inner and outer wall of the piping it will begin to gradually flow towards the tank top. Depending on the volume of the leak, it could take some time before the product is detected in the tank. It is probable that swelling could occur in the piping without product being observed in the containment sump.

Read the complete MDE report at …

www.mde.state.md.us/Programs/LandPrograms/Oil_Control/USThome/thermoplastic%20guidance.asp

Why Polyethylene?

One can reasonably assume that the flexible pipe manufacturers using polyethylene for secondary containment do so because it is relatively inexpensive and easily extruded. If that's why they use it, then the question remains, "*Why* do they use it?" Why would anyone use, for the secondary containment of petroleum products, a material known to be susceptible to degradation from prolonged exposure to gasoline and other fuels?

Commonly available chemical resistance guides often list polyethylene as marginal or unsatisfactory for gasoline and other hydrocarbons. At omega.com, for example, the "Chemical Resistance Chart for Tubing and Fluid-Handling Products" gives polyethylene a D rating (*severe effect, not recommended*) for gasoline. To view the chart, click the following link:

www.omega.com/pdf/tubing/technical_section/chemical_chart_2.asp

The "Chemical Resistance of Major Polymers" chart at plasticsusa.com provides a more lenient but nevertheless cautionary C rating (*moderate*). You can view the chart by clicking the following link:

www.plasticsusa.com/chemres.html

Inasmuch as fuel often accumulates in real-world sumps, its occasional if not regular protracted contact with the polyethylene layer of flexible piping would seem entirely foreseeable. And with such being the case, should you risk burying a fuel storage and dispensing system whose containment layer can't handle exposure to fuel?

The “Gen-X” Factor

A tacit acknowledgment of flex pipe’s questionable qualifications for underground petroleum service lies in the multiple design changes some manufacturers have seen fit to make: six within 10 years in one instance; 11 within 13 years in another. Predictably, the spin they’ve tried to put on this proliferation of product generations has been that of “constant innovation and improvement.” Course correcting prompted by problems in the field seems to be a reasonable conclusion -- with a good deal more of the same probably going on right now.

In attempting to analyze a given failure, regulators therefore face the cumbersome task of sorting out which design iteration is at fault. Assuming you’re the owner of a flexible piping system, would you be able to tell them if asked? Do you know which product generation you’ve got in the ground? And if it’s been superseded, wouldn’t you be interested in knowing the *real* reason why?

Deflecting Blame

Poor installation. Poor maintenance. Poor monitoring. They’re the triumvirate of causes typically cited, individually or collectively, by the flexible piping industry in attempting to deflect blame for the recent rash of failures.

The “poor installation” plea carries a certain irony, insofar as easy installation has long been touted as a major flex pipe advantage. As for poor maintenance and monitoring, both hark back to the urgency attached to keeping fuel away from polyethylene -- an indictment in itself.

In that regard, at least one prominent flexible piping manufacturer has been urging the Environmental Protection Agency to beef up its leak-detection requirements to include sensors in all containment sumps; little wonder, when it comes to a product generally requiring heroic, as opposed to ordinary, detection measures to preclude a failure. But scroll up to Item 4 above and re-read the caution that “it is probable that swelling could occur in the piping without product being observed in the containment sump.”

How Fiberglass Fits into the Fuel-Handling Picture

Why do major oil companies specify fiberglass underground storage tanks for their U.S. locations? Because fiberglass tanks -- and piping -- can be manufactured to withstand prolonged exposure to the most caustic chemicals and harshest environments imaginable. An estimated 150 million feet of fiberglass pipe have been installed in underground fuel systems.

Smith Fibercast fiberglass piping has been proven in fuel-handling applications since 1968. Our pipe has never been removed for fuel incompatibility or corrosion. The time-tested advantages of Smith Fibercast piping systems include:

- *Complete compatibility with all known fuels and additives*
- *High pressure and temperature ratings*
- *A low coefficient of linear expansion*
- *Superior permeation resistance and flow performance versus thermoplastic flexible piping*

What's more, we warrant our RED THREAD® IIA fiberglass piping for 30 years, providing a level of peace of mind unmatched in the industry. For additional information about RED THREAD IIA piping and our 30-year limited warranty, click here.

When dealing with buried installations demanding leak-free, maintenance-free service for decades on end, dealing with a proven quantity makes absolute sense -- both as a business decision and in the context of responsible environmental stewardship. Fiberglass piping remains, now and for the discernable future, the most reliable and most environmentally sound choice for your underground fuel system.

Contact Smith Fibercast about underground piping systems: alert@smithfibercast.com