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STUDY INDICATES RISK TO LDC ASSETS POSED BY STATIC ELECTRICITY

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The danger of static electricity in natural gas distribution pipe has been well-documented by third-party industry associations and federal oversight agencies. The American Gas Association issued static electricity precautions in the Plastic Pipe Manual in 1985. It recommended external static suppression procedures as well as procedures for static suppression during purging operations.

In 1988 the Occupational Safety and Health Administration issued a safety hazard information bulletin about static electricity in natural gas operations as a result of at least one fatality linked to static electricity. As recently as September 2010, the federal government's Chemical Safety Board issued urgent safety recommendations concerning purging and ignitions as a result of its investigation into the Feb. 7, 2010 Kleen Energy natural gas explosion.

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Despite these advisories, many local distribution companies may believe they don't have a risk issue with static electricity in their systems and therefore do not need to include static electricity mitigation in their distribution integrity management program (DIMP). As the deadline for implementing DIMP plans approaches, a more comprehensive investigation is necessary in order to accurately determine if static electricity truly does pose a risk for the natural gas distribution industry in DIMP risk-mitigation planning. Instead of relying on perceived notions of risk, the extensive database of PHMSA's OPS Distribution Incident Reports provides an extensive historical basis to make a determination of risk, based upon statistical analysis of actual industry-reported incidents.

In order to identify trends, you must have something similar with which to make a comparison. The closest and most obvious basis of comparison of natural gas distribution pipelines is to petroleum pipelines. Both are tightly and similarly regulated pipelines carrying flammable fuels, with similar construction and operation and both are randomly situated throughout the nation. The database of OPS incident reports is large enough and the time frame of incident reports long enough that if you observe a difference in trends between petroleum and natural gas pipeline incidents, this can identify risks for natural gas DIMP plans.

DIMP's goal for incident reports is to identify potential risks that primarily affect the public. Generally these are incidents involving a fire, explosion, injury or loss of life. OPS Natural Gas incident reports did not begin including information on whether the incident involved a fire or explosion until March 2004. Since this is a key risk factor in our comparison, we can only compare petroleum to natural gas incidents which involved an ignition or explosion from March 2004 to the most recent incident report disclosure of November 2010. However, this still provides six years of nationwide, industry-supplied incident reports for comparison.

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To make a meaningful comparison of natural gas pipeline incidents to petroleum pipeline incidents useful for DIMP static electricity risk identification, we must determine which type of incidents to compare. Therefore, to make a uniform comparison between petroleum and natural gas incidents, we eliminate those incidents which are dissimilar in nature between the pipelines or contain too many variables to isolate to compare. For example, we would eliminate any comparison to non-similar hazardous liquid failures involving liquids such as ammonia, carbon dioxide, etc.

Since natural gas distributors have few, if any, underwater pipelines, we would mutually exclude both hazardous liquid pipeline and natural gas underwater incidents. Similarly, since most natural gas incidents are above ground, we would mutually ignore below-ground or offshore incidents. Incidents inside buildings, in tanks or under a structure are too difficult to isolate for similar circumstances and are also eliminated.

Elimination Criteria Listed

Here are the resulting criteria used to eliminate incidents within the six years of OPS Hazardous Liquid and Natural Gas Distribution Incident Reports in order to make a uniform comparison between petroleum and natural gas pipelines incidents: 1) commodities other than natural gas or petroleum-based liquids; 2) incidents involving underwater pipelines; 3) incidents involving offshore pipelines; 4) incidents involving underground pipelines; and 5) incidents inside a building, tank, or under a structure.

Using these incident elimination criteria, the remaining petroleum pipeline and natural gas incidents consist of the same circumstances in order to determine if there are any dissimilar trends. The remaining incidents are natural gas or petroleum-based liquid events either above ground, at ground level or in an open ditch. Additionally, for accuracy in tallying, incidents which had fatalities or injuries but did not have a fire or explosion were excluded. Based upon the remaining incidents, from March 2004 to November 2010, the incident totals are shown in Table 1.

Table 1: Remaining incidents from March 2004 to November 2010.
static1.PNG

(Raw OPS data files, the working spreadsheets used in this analysis, as well as any referenced publications, directives or advisories are available for review at www.IonixGasTechnologies.com. Missing incident numbers in the Incident list indicate excluded incidents. Incidents not listed in the worksheet can be looked up for reference in the raw OPS data files on the Ionix website.)

From March 2004 to November 2010, petroleum pipelines had 474 above ground, at ground level or in an open ditch petroleum incidents resulting in five fatalities, one injury, 24 ignitions and nine explosions.

From March 2004 to November 2010, natural gas pipelines had 386 above ground, at ground level or in an open ditch natural gas incidents resulting in 10 fatalities, 47 injuries, 293 ignitions and 29 explosions.

Petroleum pipelines had one ignition per 19.7 incidents while natural gas pipelines had one ignition per 1.3 incidents. Petroleum pipelines had one explosion per 52.6 incidents while natural gas pipelines had one explosion per 13.3 incidents.

Petroleum pipelines had one injury per 474 incidents while natural gas pipelines had one injury per 8.3 incidents. Finally, petroleum pipelines had one fatality per 94.8 incidents while natural gas pipelines had one fatality per 35 incidents.

First, we recognize a statistically significant trend is present. While your organization may not believe it has a risk issue, this nationwide comparison of similar OPS incident report data clearly shows the natural gas distribution industry has a distinctly higher incidence of ignitions, explosions, injuries and fatalities than petroleum pipelines. Organizations may feel the incidents they incur are just the nature of the business in which they are engaged. However, when compared to a similar industry, what may appear normal for one industry is not normal when compared to similar industries.

The next question is what accounts for this significant difference in the rate of ignitions and explosions between natural gas and petroleum pipelines? Is natural gas more susceptible to ignite? If that is the case, then there should be more petroleum ignitions since petroleum products have lower auto-ignite points. Diesel/fuel oil ignites at 494 degrees F. Gasoline vapors ignite at about 536 degrees F. Crude oil vapors ignite at about 800-1,000 degrees F (depending upon composition). Natural gas ignites at 1,076 degrees F.

Even with significantly lower ignition points, the number of petroleum incidents that ignited was 10 times less than natural gas incidents. All things being equal, since liquid petroleum products are more likely to ignite than natural gas, they should have more ignitions. However, the opposite is documented to be reality. Therefore, the problem is not the fuel, but the ignition source.

Is the cause of the increased number of ignitions of natural gas due to the presence of more random ignition

sources or more third-party damage to their pipeline areas of operation as compared to petroleum pipelines? Petroleum pipelines actually had 23% more incidents for the same time period than natural gas pipelines. This indicates their pipelines are at least as equally vulnerable to third-party damage as natural gas lines yet did not ignite or explode at the same rate as natural gas pipeline incidents.

Since these two explanations do not realistically or adequately explain the difference in the ignition and explosion rates between petroleum and natural gas pipeline incidents, one is left with the only conclusion that there must be an ignition source unique to natural gas.

By process of elimination of sources of ignition, static electricity becomes by default the only viable explanation, especially in light of industry trade associations and government warnings of the danger of static electricity. As natural gas industry research has consistently shown, natural gas escaping under pressure creates friction at the point of exit. This friction creates static electricity at the point of leak. Natural gas leaks can be self-igniting since they create their own ignition source during leaking – static electricity. This analysis of OPS Incident Reports provides strong empirical evidence of that self-igniting phenomenon since random ignition sources or third-party damage cannot account for the large difference in ignition trends between petroleum and natural gas pipelines.

The problem of static is not unique to the natural gas distribution industry. At any petroleum fueling location such as gasoline stations there are placard warnings about static electricity. Any liquid petroleum fueling operation always includes the first step of fueling by attaching a grounding wire between the fueling source and the fueling delivery point in order to prevent ignitions due to static electricity. Whatever is being done in liquid petroleum to control static electricity is working. Conversely, whatever is currently being done for static control in natural gas distribution is insufficient to reduce ignitions to a similar ignition level experienced in petroleum pipeline incident reports.

Whether or not it appears to the reader that his or her organization has a static electricity risk in its natural gas distribution operation, this six-year national analysis of OPS incident reports demonstrates a distinct and systemic risk of ignitions and explosions in the natural gas distribution industry that can reasonably be attributed only to the presence of static electricity.

As natural gas distributors prepare their DIMP, a careful review of static electricity risk issues is now not just good safety policy. As an identified risk, the review is required by the law.

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