The oil pipeline industry has undertaken a voluntary environmental performance tracking initiative, recording detailed information about spills and releases, their causes and consequences.

The pipeline members of the American Petroleum Institute and the Association of Oil Pipe Lines believe that tracking and learning from spills will improve performance, thus demonstrating the industry's firm commitment to safety and environmental protection by its results.

This is one of a series of fact sheets and industry advisories drawn from the data compilations of the Pipeline Performance Tracking System, PPTS.

PPTS ADVISORY FOR OPERATORS: HVLS: HANDLE WITH CARE

HVL incidents account for 12% of all PPTS incidents, 53% of all incidents that involve public safety impacts

Highly Volatile Liquids (HVL)[1] present unique challenges to the liquid pipeline industry in the event of a release. The vaporization of HVL may release the full contents of the pipeline segment between block valves. Because it is heavier than air, HVL can settle near the ground in a vapor cloud under certain atmospheric conditions. The vapor cloud creates risk for fire, explosion, or asphyxiation until it disperses into the atmosphere.

Among the commodity groups transported by liquid pipeline -- crude, refined products, and HVL -- HVL releases account for the highest percentage of incidents on onshore pipelines with a public safety impact. Table 1 shows how the lower percentage of HVL incidents (12%) contributes to a disproportionate percentage (53%) of the incidents involving public safety impacts as defined by PPTS for "Long Form" incidents. PPTS public safety impacts include precautionary and mandatory evacuations, fires, explosions, incidents with injury, and incidents with fatality. (The focus on impacts to *public* safety should not be taken as ignoring the potential for personal harm to employees and contractors. From 1999-2003, however, no HVL incidents involved such impacts.)

HVL releases contribute to an even higher percentage of the incidents with fire, explosions, and incidents with injury (63% to 86%). Also, HVL releases account for the largest percentage of volume released (46%).

The right side of Table 1 focuses on the top five causes for HVL incidents. Third party causes dominate all of the public impact categories. Overall, third party damage accounted for 7% of all PPTS incidents, but accounted for a large percentage of incidents involving a death, injury, fire/explosion, and impacts to public safety.

TABLE 1 - Onshore Pipe, PPTS 1999-2003, Long Form

	Commodity Group Comparison					HVL Incidents Only: Top Five Causes				
	HVL	Ref. Prod.	Crude	Total	HVL %	Third Party	Other	Equip. failure	Corro-sion	Pipe matl
Total incidents	61	152	314	527	12%	20	11	10	8	7
Total volume, 000 bbls	162	78	112	352	46%	90	<1	4	41	25
Public Impact Incidents	25	15	7	47	53%	11	2	3	3	5
Impacts*:										
Evacuations	13	13	5	31	42%	8	0	2	0	1
Fires	10	4	2	16	63%	4	0	0	3	3
Explosions	6	0	1	7	86%	3	0	0	1	2
Incident with injury(s)	10	1	1	12	83%	4	1	1	0	2
Incident with fatality(s)	3	1	0	4	75%	2	1	0	0	0

*Some incidents may have more than one impact. Long Form: 5 bbl or more, or death, injury, fire, or explosion

[1] Highly volatile liquids are gaseous at atmospheric temperature and pressure, but are transported in a liquid state, under pressure. Examples of HVL are liquefied petroleum gases such propane, butane, and natural gas liquids.

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HVL pipelines were involved in 15% of third party incidents between 1999 and 2003, but accounted for 57% of the total volume released. Large release volumes of HVL significantly influence third party incident data.

Farmers and Homeowners at Risk When Contacting HVLs

Solving third party damage is a continuing problem in the pipeline industry and was a focus of PPTS Operator Advisories 2003-8, 2003-9 and 2003-10. Farming activities and homeowners accounted for roughly 40% of the third party damage incidents reported to PPTS with 38 incidents over the 1999-2003 period. Of these 38, 7 involved HVL – 18%. These HVL incidents accounted for 75% of the volumes released in the farming/homeowner third party incidents. As shown in the table on the right, the HVL incidents also dominated the public safety impacts – evacuations, fires, explosions, incidents involving an injury or fatality.

TABLE 2 - Incidents Due to Third Party Damage Involving Homeowners or Farming Activities, 1999-2003

	HVL	Ref. Prod.	Crude	Total	HVL %
Total incidents	7	19	12	38	18%
Total volume, 000 bbls	31.3	7.9	2.6	41.8	75%
Public Impact Incidents	3	3	0	6	50%
Impacts*					
Evacuations	2	3	0	5	40%
Fires	2	0	0	2	100%
Explosions	1	0	0	1	100%
Incident with injury(s)	3	0	0	3	100%
Incident with fatality(s)	1	0	0	1	100%

***Some incidents may have more than one impact**

Potential Good News Related to HVL Data for Operators?

HVL is estimated to make up approximately 30% of the total hazardous liquids mileage.[2] As shown in Table 3, HVL's share of incidents for most cause categories is significantly less than this share. The lowest percentage is 3% of the releases caused by "operator error or other incorrect operation." Corrosion and natural forces are also under 10%, with all but the "other" category at 14% or less. The "other" category is the highest comparative percentage of incidents for HVL, however the volumes are only 3% of the total for that category.

TABLE 3 – Causes of Incidents in PPTS, 1999-2003

	Number of Incidents				000 Barrels Released			
Cause of release	**HVL**	**Non HVL**	**Total**	**HVL %**	**HVL**	**Non HVL**	**Total**	**HVL %**
Corrosion	34	743	777	4%	41.0	79.7	120.8	34%
Equip./non-pipe failure	116	933	1049	11%	5.1	49.9	55.0	9%
Natural Forces	3	41	44	7%	0.6	3.1	3.8	17%
Operator error	11	352	363	3%	1.6	29.7	31.3	5%
Other	40	143	183	22%	0.5	15.1	15.7	3%
Pipe material/seam	21	132	153	14%	25.4	41.6	67.0	38%
Third party damage	26	166	192	14%	89.8	66.9	156.7	57%

- Assuming proper reporting, do these results mean operators are more effective in reducing HVL incidents?

[2] This may understate the HVL share, as batched pipelines are classified with the predominate commodity.

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- If so, is this a factor of the average age of the systems or the technical sophistication used in operating the systems?
- Is it driven by an understanding of the potential consequences of an HVL release?

Potentially, the study of systems used to reduce incidents transporting HVL, if used as a model, may lead to decreases in the number of incidents in refined products and crude oil transportation systems.

Environmental Impacts of HVL Releases

Environmental impacts are not significant with most HVL releases. Many HVL releases require no environmental remediation due to the vaporization of the product. Flora and fauna may be damaged in cases where an explosion or fire occurs. The exception is ammonia which can be damaging to flora and fauna in its liquid form or if it becomes a solution in water.

Considerations for Operators with HVLs

- Although this Advisory has focused on the public safety impacts associated with onshore pipeline operations, operators should be aware of the risks to employees and contractors in working around HVL in facilities. While there were no operator injuries associated with HVL operations, HVL systems accounted for 50% of the fires occurring in facilities. With abundant ignition sources and known consequences, these fires should be considered a significant hazard.
- Operators need to consider the risk of third party damage and the increased potential consequences in the risk analysis process for HVL lines.
- Operators need to consider educational communications specifically targeted to the characteristics and recognition of HVLs, the threats they pose in the case of a release, and the specific actions to take in case of a release.
- Operators should consider more frequent or expanded communications based upon a risk analysis which considers the specific characteristics of HVLs.
- Based upon the percentage of HVL incidents compared to non-HVLs, operators appear to be more successful in reducing the number of incidents in HVL systems. There may be lessons from this success that could be applied for better performance in refined products and crude oil.

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