

Report to Congress
Results of Hazardous Liquid Incidents at Certain Inland Water Crossings Study

Table of Contents

- A. Executive Summary
- B. Background
- C. Extent of Hazardous Liquid Pipeline Crossings of Inland Bodies of Water
- D. Pipeline Safety Regulations
- E. Integrity Management (IM) Oversight
- F. PHMSA Advisory Bulletins
- G. Accidents from 1991 to 2009
- H. Accidents from 2010 to October 2012
- I. Environmental Consequences of Spills
- J. Conclusions

Appendix I – PHMSA Advisory Bulletins

Appendix II - Hazardous Liquid Failures with Depletion of Cover at Inland Bodies of Water

A. Executive Summary

Section 28 of the Pipeline Safety, Regulatory Certainty, and Job Creation Act of 2011 directs the U.S. Department of Transportation (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA) to conduct a study of hazardous liquid pipeline incidents at crossings of inland bodies of water with a width of at least 100 feet from high water mark to high water mark to determine if the depth of cover over the buried pipeline was a factor in any accidental release of hazardous liquids.

PHMSA determined that hazardous liquid pipelines cross inland bodies of water at 18,136 locations. Furthermore, the water body has a width greater than or equal to 100 feet at 5,110 locations. PHMSA could not find a Geographic Information System dataset providing inland water body width from high water mark to high water mark.

49 CFR Part 195.452 requires that hazardous liquid pipeline operators develop and implement an integrity management (IM) program to provide enhanced protection to pipeline segments that could affect high-consequence areas in the event of failure. These enhanced protections include measures to prevent spills as well as measures to mitigate the effects of spills. The IM regulations also require operators to perform a critical, investigative, risk-based evaluation of their leak detection capabilities.

PHMSA construction regulations require hazardous liquid pipelines to be installed 48 inches below the river bottom at crossings of inland bodies of water with a width greater than 100 feet from high water mark to high water mark. When solid rock is encountered and blasting is required to create a trench for the pipeline, a burial depth of 18 inches is allowed. These burial depth requirements apply during the construction of the pipeline, but not during the operation of the pipeline system.

Effective leak detection systems are crucial to minimizing spill volume. PHMSA inspections include a thorough review of operator risk-based evaluations of leak detection capabilities.

Since 1993, PHMSA has published three Advisory Bulletins in the Federal Register that are related to pipeline system crossings of inland water bodies. These bulletins urged pipeline operators to evaluate right-of-way conditions at water crossings during flooding.

Report to Congress
Results of Hazardous Liquid Incidents at Certain Inland Water Crossings Study

To identify specific incidents relevant to the study, PHMSA used hazardous liquid pipeline accident data submitted by pipeline operators from 1991 through October 2012. The PHMSA is unable to definitively identify water crossings exceeding 100 feet from high water mark to high water mark, so all accidents at all inland water crossing accidents are included. The PHMSA identified 20 accidents occurring at inland water crossings between 1991 and October 2012.

A depletion of cover, sometimes in the waterway and other times in new channels cut by floodwaters, was a factor in 16 accidents. The dynamic and unique nature of rivers and flood plains was a factor in each accident. These 16 accidents are 0.3 percent of all reported hazardous liquid accidents and 0.5 percent of the hazardous liquid significant incidents.

Pipeline failures caused by the October 1994 flooding of the San Jacinto River in Harris County, TX, account for 62 percent of the gross spill volume at inland water crossings. The failures were evenly distributed among crude oil, refined petroleum products, and highly volatile liquids. Fifty-nine percent of the gross spill volume was released from refined petroleum products pipelines.

The PHMSA will report to Congress again within one year with an update on plans to ensure the sufficiency of PHMSA regulations regarding pipeline depth of cover.

B. Background

Section 28 of the Pipeline Safety, Regulatory Certainty, and Job Creation Act of 2011 directs the DOT's PHMSA to conduct a study of hazardous liquid pipeline incidents at crossings of inland bodies of water with a width of at least 100 feet from high water mark to high water mark to determine if the depth of cover over the buried pipeline was a factor in any accidental release of hazardous liquids. A report on the results of the study is due no later than one year after the date of enactment of section 28. Since the 2011 Act was signed into law on January 3, 2012, the report is due no later than January 3, 2013. The report is to be transmitted from the Secretary of Transportation to the Committee on Transportation and Infrastructure and the Committee on Energy and Commerce of the House of Representatives; and the Committee on Commerce, Science, and Transportation of the Senate.

If the report finds that depth of cover is a contributing factor in the accidental release of hazardous liquids, PHMSA requirements for the depth of cover must be reviewed to determine whether they are sufficient. The sufficiency review must be completed within one year of this report.

C. Extent of Hazardous Liquid Pipeline Crossings of Inland Bodies of Water

The National Pipeline Mapping System (NPMS) dataset was used to identify the number of hazardous liquid pipelines that cross inland bodies of water. The PHMSA could not find a Geographic Information System (GIS) dataset providing inland water body width from high water mark to high water mark.

The metadata did not specify river flow levels for the width data. Therefore, PHMSA created the most accurate water body dataset feasible by combining the 2011 hydrolin and hydropropy datasets from the National Transportation Atlas Database (NTAD). When water features appeared in both datasets, PHMSA removed the duplicates before counting the pipeline crossings.

Report to Congress
Results of Hazardous Liquid Incidents at Certain Inland Water Crossings Study

After combining the NPMS hazardous liquid pipeline dataset and the water body dataset, PHMSA determined that hazardous liquid pipelines cross inland bodies of water at 18,136 locations. Furthermore, the water body has a width greater than or equal to 100 feet at 5,110 locations.

D. Pipeline Safety Regulations

PHMSA promulgated 49 CFR Part 195 to establish minimum pipeline safety standards for hazardous liquid pipeline systems. Regulations relevant to depth of cover are found in two subparts: Construction, and Operation and Maintenance. Integrity management (IM) regulations are included in the Operations and Maintenance subpart.

The regulation, 49 C.F.R. Part 195.452, requires that hazardous liquid pipeline operators develop and implement an IM program to provide enhanced protection to designated pipeline segments that could affect high-consequence areas (HCAs) in the event of failure. HCAs are populated areas, unusually sensitive environmental areas, sole-source drinking water supplies, and commercially navigable waterways. These enhanced protections include measures to prevent leaks, failures, and incidents, as well as measures to mitigate the effects of spills.

Pipeline integrity is assured by controls and programs that prevent or minimize the likelihood of a spill. Many of these programs are embodied in regulations that predate the IM rule. These include such fundamental programs as damage prevention, patrolling, corrosion control practices, overpressure controls, and operator qualification.

Timely leak detection is a critical part of prompt leak mitigation because an operator's response does not begin until the leak is detected. Operators are required, by the IM rule, to have a means to detect leaks. Operators must also perform a critical, investigative, risk-based evaluation of their leak detection capabilities. The operator's evaluation of its leak detection capabilities must consider, at a minimum, the following factors:

1. Length and size of the pipeline;
2. Type of product carried;
3. The pipeline's proximity to the high consequence area;
4. The swiftness of leak detection;
5. Location of nearest response personnel;
6. Leak history; and
7. Risk assessment results.

Operators must modify and improve their means of detecting leaks, as necessary, to protect HCAs if the evaluation indicates modifications are needed. While the IM rule focuses on additional protections for HCAs, operators also have an obligation to detect and respond to leaks outside of HCAs. Typically, the same leak detection systems and procedures are used to detect leaks both inside and outside HCAs.

Regulations in the Construction subpart require a burial depth of 48 inches under the river bottom at crossings of inland bodies of water with a width greater than 100 feet from high water mark to high water mark. When solid rock is encountered and blasting is required to create a trench for the pipeline, a burial depth of 18 inches is allowed. These burial depth requirements

Report to Congress
Results of Hazardous Liquid Incidents at Certain Inland Water Crossings Study

apply during the construction of the pipeline, but not during the operation of the pipeline system. The PHMSA has no regulation requiring burial depths to be maintained during operation.

Subpart D – Construction - Part 195.248 - Cover over buried pipeline.

(a) Unless specifically exempted in this subpart, all pipe must be buried so that it is below the level of cultivation. Except as provided in paragraph (b) of this section, the pipe must be installed so that the cover between the top of the pipe and the ground level, road bed, river bottom, or underwater natural bottom (as determined by recognized and generally accepted practices), as applicable, complies with the following table:

Cover inches (millimeters)		
Location	For normal excavation	For rock excavation ¹
Industrial, commercial, and residential areas	36 (914)	30 (762)
Crossing of inland bodies of water with a width of at least 100 feet (30 meters) from high water mark to high water mark	48 (1219)	18 (457)
Drainage ditches at public roads and railroads	36 (914)	36 (914)
Deepwater port safety zones	48 (1219)	24 (610)
Gulf of Mexico and its inlets in waters less than 15 ft (4.6 meters) deep as measured from mean low water	36 (914)	18 (457)
Other offshore areas under water less than 12 ft (3.7 meters) deep as measured from mean low water	36 (914)	18 (457)
Any other area	30 (762)	18 (457)

¹ Rock excavation is any excavation that requires blasting or removal by equivalent means.

(b) Except for the Gulf of Mexico and its inlets in waters less than 15 feet (4.6 meters) deep, less cover than the minimum required by paragraph (a) of this section and Sec. 195.210 may be used if—

- (1) It is impracticable to comply with the minimum cover requirements; and
- (2) Additional protection is provided that is equivalent to the minimum required cover.

Regulations in the Operation and Maintenance subpart require operators to make repairs on its pipeline system.

Subpart F - Operation and Maintenance – Part 195.401 General requirements.

Report to Congress

Results of Hazardous Liquid Incidents at Certain Inland Water Crossings Study

(b) An operator must make repairs on its pipeline system according to the following requirements:

(1) *Non Integrity management repairs.* Whenever an operator discovers any condition that could adversely affect the safe operation of its pipeline system, it must correct the condition within a reasonable time. However, if the condition is of such a nature that it presents an immediate hazard to persons or property, the operator may not operate the affected part of the system until it has corrected the unsafe condition.

(2) *Integrity management repairs.* When an operator discovers a condition on a pipeline covered under § 195.452, the operator must correct the condition as prescribed in § 195.452(h).

Regulations in the Operation and Maintenance subpart require operators to inspect surface conditions above pipelines every three weeks and inspect each crossing under a navigable waterway, at intervals not exceeding five years, to determine the condition of the crossing.

Subpart F - Operation and Maintenance – Part 195.412 Inspections of rights-of-way and crossings under navigable waters.

(a) Each operator shall, at intervals not exceeding 3 weeks, but at least 26 times each calendar year, inspect the surface conditions on or adjacent to each pipeline right-of-way. Methods of inspection include walking, driving, flying or other appropriate means of traversing the right-of-way.

(b) Except for offshore pipelines, each operator shall, at intervals not exceeding 5 years, inspect each crossing under a navigable waterway to determine the condition of the crossing.

E. Integrity Management (IM) Oversight

The PHMSA's oversight program for IM includes specific inspection protocols that guide inspectors to examine the operator's leak detection capabilities and periodic evaluations, including the basis for any decision to modify the means of leak detection currently employed on a pipeline. The PHMSA inspectors are trained and instructed to inspect the following characteristics of an operator's program for evaluating leak detection capabilities:

1. Inclusion of all seven of the required system risk evaluation factors in Part 195.452(i)(3). If all required factors are not considered, a basis for excluding the evaluation factor(s) must be documented.
2. Identification and evaluation of a sufficient spectrum of leak scenarios to adequately determine the overall effectiveness of leak detection capability (e.g., "most likely" in addition to "maximum possible").
3. Consideration of additional important evaluation factors such as:
 - Current leak detection method for the HCAs;
 - Use of SCADA systems;
 - Thresholds for leak detection;
 - Flow and pressure measurement;

Report to Congress
Results of Hazardous Liquid Incidents at Certain Inland Water Crossings Study

- Specific procedures for lines that are idle but still under pressure;
 - Additional leak detection means for areas in close proximity to sole-source water supplies; and
 - Leak detection testing.
4. Evaluation of all modes of line operations including slack line, idled line, static conditions, and the impact of special or unique operating modes.
 5. If Computational Pipeline Monitoring (CPM) is part of the leak detection system, CPM is reviewed for compliance with American Petroleum Institute (API) Recommended Practice 1130.
 6. Evaluation of leak detection performance during transient conditions, and a strategy to manage any related short-term reduced or inhibited performance.
 7. Evaluation of the operational availability and reliability of the leak detection systems, and the operator's process to manage system failures.
 8. Consideration of enhancements to existing leak detection capability.
 9. Consistent application of a risk-based decision making process for leak detection.
 10. A documented basis for all operator reactions credited in the leak detection evaluation (e.g., operational procedures and/or training materials).
 11. Measures applied to assure that required actions are accomplished and prudently restored if varying modes of pipeline operations require controllers or other personnel to engage/activate or mute/disable certain attributes of the overall leak detection capabilities.
 12. Integration of emergency response procedures and incident mitigation plans with associated leak detection indications.
 13. Adequate guidance in documented work processes to assure that operating personnel have the authority and responsibility to initiate response actions, up to and including shutting down the pipeline if warranted.
 14. Assurance that supervision is always promptly available if procedures require that operating personnel contact supervision prior to initiating response actions and/or shutting down the pipeline.

PHMSA's inspectors review operator plans and procedures for conducting the leak detection evaluation and check if the considerations listed above have been included. If the operator's leak detection evaluation has been completed, PHMSA's inspectors critically review the technical basis for the evaluations, including the conclusions and recommendations.

F. PHMSA Advisory Bulletins

Since 1993, the Office of Pipeline Safety has published three Advisory Bulletins in the Federal Register that are related to pipeline system crossings of inland water bodies:

PHMSA Advisory Bulletin #ADB-11-04 July 27, 2011

Advises operators to direct resources to determine the potential effects to their pipeline systems, perform frequent patrols to evaluate right-of-way conditions at water crossings during flooding, determine if flooding has exposed or undermined pipelines as a result of flooding, and perform surveys to determine the depth of cover.

Report to Congress
Results of Hazardous Liquid Incidents at Certain Inland Water Crossings Study

RSPA Advisory Bulletin # ADB-94-05 Nov 2, 1994

Advises operators to evaluate rights-of-way condition at water crossings affected by flooding and perform surveys to determine the depth of cover and identify exposed pipelines.

RSPA Advisory Bulletin# ADB-93-03 July 29, 1993

Advises operators to perform frequent patrols to evaluate right-of-way conditions at water crossings during flooding and perform surveys to determine depth of cover.

The complete text of these Advisory Bulletins is shown in Appendix I.

G. Accidents from 1991 to 2009

For accidents before 2010, the data format does not specifically identify whether the accident occurred at an inland water crossing. For reports ranging from 1991 through 2009, PHMSA searched the narrative portion of the accident report for key words indicating the accident occurred at a water crossing. Reports from 1991 through 2001 caused by outside force damage with a damage-type of “mudslide” or “washout” were reviewed. Reports from 2002 through 2009 caused by natural forces with a sub-cause of “heavy rains/floods” were also reviewed.

Hazardous liquid pipeline operators reported 5,094 accidents from 1991 through 2009 and 2,653 exceeded PHMSA’s significant incident threshold. The PHMSA determined that 13 accidents from this time period occurred at inland water crossings. All 13 failures exceeded PHMSA’s significant incident threshold. These 13 accidents are 0.3 percent of all reported hazardous liquid accidents and 0.5 percent of the hazardous liquid significant incidents. The distribution of accidents by year is:

1993: 2
1994: 5
1995: 1
1998: 1
2005: 2
2007: 1
2009: 1

A depletion of cover, sometimes in the waterway and other times in new channels cut by floodwaters, has been a factor in all 13 of these failures.

Amoco Pipeline Co. reported a 390-barrel gasoline spill in the Big Sioux River along the South Dakota and Iowa border occurring on April 1, 1993. The 6-inch diameter pipeline was severed at a girth weld, and the investigation indicated that the pipeline was partially exposed as a result of scouring.

Williams Pipeline Co. reported a 227-barrel liquefied petroleum gas spill in the Big Sioux River in Iowa occurring on July 3, 1993. The report includes speculation that the 6-inch diameter pipeline was damaged by objects carried by floodwaters.

Exxon Pipeline reported a 492-barrel highly volatile liquid spill in the San Jacinto River in Texas occurring on October 19, 1994. The 8-inch diameter pipeline failed after being washed out at the river crossing.

Report to Congress
Results of Hazardous Liquid Incidents at Certain Inland Water Crossings Study

Colonial Pipeline Co reported a 20,000-barrel gasoline spill in the San Jacinto River in Texas occurring on October 20, 1994. The 40-inch diameter pipeline was severed by a new river channel caused by flooding.

Colonial Pipeline Co reported a 10,000-barrel diesel fuel spill in the San Jacinto River in Texas occurring on October 20, 1994. The 36-inch diameter pipeline was severed by the same new river channel as the 40-inch diameter pipeline listed above.

Texaco Pipeline reported a 5,350-barrel crude oil spill in the San Jacinto River in Texas occurring on October 21, 1994. The 20-inch diameter pipeline was severed by a new river channel caused by flooding.

Texas Eastern Product Pipeline reported a 3,181-barrel gasoline spill in the Red River in Louisiana occurring on December 20, 1994. The 20-inch diameter pipeline failed after being washed out during high flow conditions in the river.

Chevron reported a 4,000-barrel crude oil spill in Fresno County, California, occurring on March 11, 1995. The 18-inch diameter pipeline failed at a girth weld after soil eroded from around the pipeline and debris struck the pipeline.

Conoco reported a 1,500-barrel propane spill in Pole Cat Creek in Oklahoma occurring on October 7, 1998. The 10-inch diameter pipeline failed after soil eroded from around the pipeline and debris struck the pipeline.

Mid Valley Pipeline reported a 6,909-barrel crude oil spill in the Kentucky River in Kentucky occurring on January 26, 2005. The 22-inch pipeline failed at a girth weld adjacent to the river due to external stress caused by soil subsidence.

Shell Pipeline Company reported a 3,245-barrel crude oil spill at a levee in Louisiana occurring on September 2, 2005. The 20-inch pipeline passed through a levee that was washed away by the Hurricane Katrina storm surge.

Exxon Mobil reported a 97-barrel highly volatile liquid spill in the Atchafalya River in Louisiana occurring on June 14, 2007. The 8-inch diameter pipeline was exposed by river currents, and a stump lodged under the pipeline contributed to a pinhole leak.

Chevron reported a 5-barrel crude oil spill in Louisiana occurring on December 23, 2009. The failure of the 16-inch pipeline was caused by scouring.

H. Accidents from 2010 to October 2012

From 2010 forward, the accident data specifically indicates if the accident occurred at a water crossing. Hazardous liquid pipeline operators reported 972 accidents from 2010 through October 2012, and 352 exceeded PHMSA's significant incident threshold. Seven of these accident reports indicated that the pipeline crossed a body of water. Two of the accidents occurred in 2010, and five occurred in 2011.

A depletion of cover in the waterway has been a factor in three out of the seven failures. All three of the accidents where depletion of cover was a factor exceeded PHMSA's significant incident threshold. These three accidents are 0.3 percent of all reported hazardous liquid accidents and 0.9 percent of the hazardous liquid significant incidents.

Report to Congress
Results of Hazardous Liquid Incidents at Certain Inland Water Crossings Study

Sunoco Pipeline reported a 0.02-barrel crude oil spill in Pawnee Creek in Oklahoma occurring on April 10, 2010. The 8-inch pipeline was buried at a depth of 36 inches, and the failure was caused by a defective weld.

Coffeyville Resources Crude Transportation reported a 199-barrel crude oil spill in Cotton Creek in Oklahoma occurring on December 9, 2010. The 8-inch pipeline was buried at a depth of 36 inches, and the failure was caused by internal corrosion.

Coffeyville Resources Crude Transportation reported a 95-barrel crude oil spill in Hafner Run Creek in Kansas occurring on May 3, 2011. The 8-inch pipeline was buried at a depth of 48 inches, and the failure was caused by internal corrosion.

ExxonMobil reported a 1,509-barrel crude oil spill in the Yellowstone River in Montana occurring on July 1, 2011. The pipeline was exposed during flood and high water conditions that persisted for more than a month. The pipeline failed at a girth weld as a result of external loading caused by exposure to flood conditions.

NuStar Pipeline Operating partnership reported a 100-barrel anhydrous ammonia spill in the Missouri River in Nebraska occurring on July 15, 2011. The 6-inch diameter pipeline was exposed by scouring during extreme flooding.

Enterprise Products Operating LLC reported a 675-barrel natural gasoline spill adjacent to the Missouri River in Iowa on August 13, 2011. The pipeline was exposed by flood waters and failed at a girth weld due to external loading.

Phillips 66 Pipeline reported a 1.7-barrel crude oil spill in the Red River in Texas occurring on September 13, 2011. The pipeline was buried 25 feet beneath the river bottom. The pipeline was not removed for examination, so the cause of the failure is unknown.

I. Environmental Consequences of Spills

The volume and commodity data for the 16 accidents where depletion of cover was a factor is shown in Appendix II. Three separate volumes are provided: gross spill, recovered, and net spill. The environmental consequences of a spill vary greatly by commodity. Crude oil has a very low evaporation rate and persists as a liquid at atmospheric conditions. Refined petroleum products, such as gasoline and fuel oil, have a higher evaporation rate than crude oil but may remain liquid long enough to harm animals and threaten water supplies. Highly volatile liquids generally evaporate as they spill from the pipeline.

These commodity characteristics are reflected in the volume recovered data. Only crude oil was able to be recovered during the emergency response. Pipeline failures caused by the October 1994 flooding of the San Jacinto River in Harris County, TX account for 62 percent of the gross spill volume. The failures were evenly distributed among crude oil, refined petroleum products and highly volatile liquids. Fifty-nine percent of the gross spill volume was released from refined petroleum products pipelines.

Table 1 – Hazardous Liquid Accidents at Inland Water Body Crossings

Commodity	# of Reports	Gross Spill (barrels)	Recovered (barrels)	Net Spill (barrels)
Crude Oil	6	21,018	6,892	14,126

Report to Congress
Results of Hazardous Liquid Incidents at Certain Inland Water Crossings Study

Commodity	# of Reports	Gross Spill (barrels)	Recovered (barrels)	Net Spill (barrels)
Refined Petroleum Products	5	34,246	0	34,246
Highly Volatile Liquids	5	2,416	0	2,416

J. Conclusions

A depletion of cover, sometimes in the waterway and other times in new channels cut by floodwaters, has been a factor in at least 16 accidents reported to PHMSA from 1991 through late 2012. The dynamic and unique nature of rivers and flood plains has also been a factor in each accident. These 16 accidents are 0.3 percent of all reported hazardous liquid accidents and 0.5 percent of the hazardous liquid significant incidents.

The PHMSA will report to Congress again within one year with an update on plans to ensure the sufficiency of PHMSA regulations regarding pipeline depth of cover.

Report to Congress
Results of Hazardous Liquid Incidents at Certain Inland Water Crossings Study

Appendix I
PHMSA Advisory Bulletins

Advisory Bulletin (ADB-11-04)

To: Owners and operators of gas and hazardous liquid pipeline systems.

Subject: Potential for damage to pipeline facilities caused by severe flooding.

Advisory: Severe flooding can adversely affect the safe operation of a pipeline. Operators need to direct their resources in a manner that will enable them to determine the potential effects of flooding on their pipeline systems.

Operators are urged to take the following actions to prevent and mitigate damage to pipeline facilities and ensure public and environmental safety in areas affected by flooding:

1. Evaluate the accessibility of pipeline facilities that may be in jeopardy, such as valve settings, which are needed to isolate water crossings or other sections of a pipeline.
2. Above the level of anticipated flooding, as appropriate.
3. Coordinate with emergency and spill responders on pipeline location and condition. Provide maps and other relevant information to such responders.
4. Coordinate with other pipeline operators in the flood area and establish emergency response centers to act as a liaison for pipeline problems and solutions.
5. Deploy personnel so that they will be in position to take emergency actions, such as shut down, isolation, or containment.
6. Determine if facilities that are normally above ground (e.g., valves, regulators, relief sets, etc.) have become submerged and are in danger of being struck by vessels or debris; if possible, such facilities should be marked with an appropriate buoy with Coast Guard approval.
7. Perform frequent patrols, including appropriate over flights, to evaluate right-of-way conditions at water crossings during flooding and after waters subside. Determine if flooding has exposed or undermined pipelines as a result of new river channels cut by the flooding or by erosion or scouring.
8. Perform surveys to determine the depth of cover over pipelines and the condition of any exposed pipelines, such as those crossing scour holes. Where appropriate, surveys of underwater pipe should include the use of visual inspection by divers or instrumented detection. Information gathered by these surveys should be shared with affected landowners. Agricultural agencies may help to inform farmers of the potential hazard from reduced cover over pipelines.
9. Ensure that line markers are still in place or replaced in a timely manner. Notify contractors, highway departments, and others involved in post-flood restoration activities of the presence of pipelines and the risks posed by reduced cover. If a pipeline has suffered damage, is shut-in, or is being operated at a reduced pressure as a precautionary measure as a result of flooding, the operator should advise the appropriate PHMSA Regional Office or State pipeline safety authority before returning the line to service, increasing its operating pressure, or otherwise changing its operating status. PHMSA or the State will review all available information and advise the operator, on a case-by-case basis, whether and to what extent a line can safely be returned to full service.

Issued in Washington, DC, on July 22, 2011.

Report to Congress
Results of Hazardous Liquid Incidents at Certain Inland Water Crossings Study

Pipeline Safety Advisory Bulletin ADB-94-05; Pipelines Affected by Flooding

AGENCY: Research and Special Programs Administration (RSPA), DOT.

ACTION: Advisory to each owner or operator of a hazardous liquid or natural gas transmission pipeline operating in areas that may be subject to severe flooding.

SUMMARY: This advisory is for all operators of pipelines which may be affected by flooding. It provides observations from RSPA, Texas Railroad Commission (TRC), and other federal and state agencies as a result of the recent floods near Houston. This advisory also includes actions that operators should consider taking to assure the integrity of pipelines in case of flooding.

Background

As the result of unprecedented flooding of rivers and streams in the Houston area, seven natural gas and hazardous liquid pipelines failed in or near the San Jacinto River over the three day period October 19-21, 1994. These failures included: an Exxon 8-inch diameter LPG line; an Exxon 8-inch diameter fuel line; an Exxon 20-inch diameter hazardous liquid line; a Colonial 40-inch diameter products (gasoline) line; a Colonial 36-inch diameter products (heating oil) line; a Texaco 20-inch diameter crude oil line; and a Valero 12-inch diameter natural gas line. While no determination of cause of failure has been made for any of these lines, RSPA and the TRC believe that the extreme flooding by the San Jacinto River was probably a substantial contributing factor in each of the failures.

The damage to pipelines caused by the flood may have resulted either from the extreme force of the flowing water, as the San Jacinto carved new temporary channels, or from pipelines being struck by heavy debris that was reported as having flowed down river at the height of the flooding. Because RSPA and the TRC cannot at this time determine the exact effects of the flooding, operators should consider the potential effects of flooding as posing a possible threat to the integrity of their lines.

Advisory

As the result of seven natural gas and hazardous liquid pipeline flood-related failures in or near the San Jacinto River in Texas on October 19-21, 1994, operators should consider the actions recommended in this Advisory Bulletin for application to pipelines located in any area of the United States subject to widespread flooding.

RSPA pipeline safety regulations in 49 CFR 192.613 for natural gas pipelines, and 49 CFR 195.401 for hazardous liquid pipelines, requires an operator to maintain continuing surveillance of its facilities and to correct damage to its pipeline that could affect the safe operation of the pipeline (such as damage that may result from extreme flood conditions). If the operator of a natural gas pipeline determines that the pipeline is in unsatisfactory condition and no immediate hazard exists, the operator must recondition or phase out the segment involved, or reduce the maximum allowable operating pressure. For hazardous liquid pipelines, if the condition presents an immediate hazard to persons or property, the operator may not operate the affected part of the

Report to Congress
Results of Hazardous Liquid Incidents at Certain Inland Water Crossings Study

system until the unsafe condition is corrected. In summary, if the operator has reason to believe that flooding has adversely affected, or will adversely affect, its pipeline, the operator must take corrective or preventative action.

In addition, operators must consider the application of RSPA's reporting requirements in 49 CFR Part 191, and subpart B of 49 CFR Part 195, as well as applicable state requirements, that require operators to submit telephonic and written reports when natural gas or hazardous liquids are released causing damages meeting the reporting thresholds. Finally, RSPA regulations also require operators to submit reports of safety-related conditions involving potentially unsafe conditions on natural gas and hazardous liquid pipelines (49 CFR 191.23 and 191.25, and 49 CFR 195.55 and 195.56).

Operators need to direct their resources in a manner that will enable them to determine the potential effects of the flooding on their systems, and take the following actions as appropriate:

- Deploy personnel so that they will be in position to take emergency actions, such as shut down, isolation, or containment
- Extend regulator vents and relief stacks above the level of anticipated flooding, as appropriate.
- Evaluate the accessibility of pipeline facilities that may be in jeopardy, such as valve settings, needed to isolate water crossings or other sections of a pipeline.
- Perform frequent patrols; including over flights as appropriate, to evaluate right-of-way conditions at water crossings during flooding and after waters subside. Determine if flooding has exposed or undermined pipelines as a result of new river channels cut by the flooding or by erosion or scouring.
- Coordinate with emergency and spill responders on pipeline location and condition, and provide maps and other relevant information to them.
- Coordinate with other pipeline operators in the flood area and establish emergency response centers to act as liaison for pipeline problems and solutions.
- Determine if facilities which are normally above ground (e.g., valves, regulators, relief sets, etc.) have become submerged and are in danger of being struck by vessels or debris; if possible, such facilities may be marked with an appropriate buoy with Coast Guard approval.
- Perform surveys to determine the depth of cover over pipelines and the condition of any exposed pipelines, such as those crossing scour holes. Where appropriate, surveys of underwater pipe should include the use of visual inspection by divers or instrumented detection. Information gathered by these surveys should be shared with landowners. Agricultural agencies may help to inform farmers of the potential hazard from reduced cover over pipelines.
- Assure that line markers are still in place or are replaced in a timely manner, and notify contractors, highway departments, and others involved in post-flood restoration activities of the presence of pipelines and the risks posed by reduced cover.

If a pipeline operator has suffered damage to its line, or has shut in the line, or has operated at a reduced pressure as a precautionary measure during the flood, the operator should advise the State Pipeline Safety Office (for intrastate lines), or RSPA's Regional Pipeline Safety Office (interstate lines) prior to returning the line to service, on increasing the operating pressure, or otherwise changing the operating status of the line. The State Safety Division or the RSPA Regional Pipeline Safety Office, as appropriate, will advise on a case-by-case basis whether, and under what conditions, a line can safely be returned to full service.

Report to Congress
Results of Hazardous Liquid Incidents at Certain Inland Water Crossings Study

Issued in Washington, D.C. on October 28, 1994.

Advisory Bulletin: ADB-93-03

To: Owners and Operators of Hazardous Liquid and Natural Gas Pipelines

Subject: Advisory to Owners and Operators of Hazardous Liquid and Natural Gas Pipeline
Facilities in Areas of Flooding

Purpose:

Extended periods of rain and flooding in Midwestern states have resulted in the potential for conditions that threaten the safety of pipelines. The Office of Pipeline Safety (OPS), RSPA, has issued this advisory bulletin to pipeline operators in those flood areas to advise them of measures they should consider to assure the safety of those pipelines. In particular, pipeline operators should review emergency plans to assure they adequately cover conditions possible in the current severe flooding.

Advisory:

For compliance with 49 CFR Sections 192.615(a)(3)(iv) Emergency Plans and 195.402(e)(2) Emergencies, pipeline operators must develop procedures for a prompt and effective response to natural disasters including flooding. In developing and reviewing emergency plans and procedures for natural disasters, operators should consider, as applicable to their pipeline systems, each of the actions outlined below:

Preventive Actions: Operators need to be alert to conditions that may adversely affect their pipelines and should consider the following actions:

- Be alert to flooding and have personnel available for emergency response actions such as shutdown, isolation, and containment.
- Consider extending regulator vents and relief stacks above the level of anticipated flooding as appropriate.
- Evaluate the accessibility of pipeline facilities, such as valve settings needed to isolate water crossings or other sections of pipelines that might be jeopardized.
- Perform frequent patrols to evaluate right-of-way conditions at water crossings during flooding and after waters subside. Determine if flooding has exposed and/or undermined pipelines as a result of forming new channels or erosion of riverbeds.
- Coordinate with other pipeline companies in the flood area and provide personnel to emergency response centers to act as a liaison for pipeline issues. Provide maps and information on pipeline location and condition to emergency responders.
- Determine if normally aboveground facilities (valves, regulator, and relief sets, etc.) that have become submerged could be struck by craft operating in flooded areas and supply maps to emergency response center and mark with buoys as appropriate.

Report to Congress
Results of Hazardous Liquid Incidents at Certain Inland Water Crossings Study

- Perform surveys to determine the depth of cover over pipelines and notify landowners of reduced cover. Agricultural agencies may be helpful in reminding farmers of the potential hazard of reduced cover over pipelines.
- Assure that line markers are still in place and remind contractors, highway departments, and others involved in excavation and clearing activities associated with flood clean-up of the presence of pipelines and the operating hazards that could occur due to reduced pipeline cover.

Background:

Damage to a pipeline may occur as a result of additional stresses imposed on piping by undermining of the support structure and by impact and/or waterborne forces. Washouts and erosion may result in loss of support for both buried and exposed pipelines. The flow of water against an exposed pipeline may also result in forces sufficient to cause a failure. These forces are increased by the accumulation of debris against the pipeline. Reduction of cover over pipelines in farmland may also result in the pipeline being struck by equipment used in farming or clean-up operations.

Additionally, the safety of valves, regulator, and relief sets, and other facilities normally aboveground, or above water, is jeopardized when covered by water. This threat is posed, not only by operational factors, but also by the possibility of damage by outside forces, floating debris, current, and craft operating on the water. Boaters involved in rescue operations, emergency support functions, sightseeing, and other activities, are generally not aware of the seriousness of an incident that could result from their craft damaging a pipeline facility that is unseen beneath the surface of the water. Depending on the size of the craft and the pipeline facility struck, significant pipeline damage may result. Pipeline failure could occur immediately or in the future.

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Report to Congress
Results of Hazardous Liquid Incidents at Certain Inland Water Crossings Study

Appendix II
Hazardous Liquid Failures with Depletion of Cover at Inland Bodies of Water

OpID	Operator Name	Date	Commodity	Gross Spill (barrels)	Recovered (barrels)	Net Spill (barrels)
19226	TEXACO PIPELINE INC	10/21/1994	CRUDE OIL	5,350	2,900	2,450
2326	CHEVRON USA - WESTERN REGION PRODUCTION	3/11/1995	CRUDE OIL	4,000	-	4,000
12470	MID VALLEY PIPELINE COMPANY	1/26/2005	CRUDE OIL	6,909	3,987	2,922
31174	SHELL PIPELINE COMPANY LP	9/2/2005	CRUDE OIL	3,245	-	3,245
2731	CHEVRON PIPE LINE CO	12/23/2009	CRUDE OIL	5	5	-
4906	EXXONMOBIL PIPELINE CO	7/1/2011	CRUDE OIL	1,509	-	1,509
			CRUDE OIL Total	21,018	6,892	14,126
22610	WILLIAMS PIPELINE CO	7/3/1993	HIGHLY VOLATILE LIQUID (HVL)	227	-	227
4906	EXXON PIPELINE CO	10/19/1994	HIGHLY VOLATILE LIQUID (HVL)	492	-	492
13131	CONOCO INC (AKA CONOCO PIPE LINE)	10/7/1998	HIGHLY VOLATILE LIQUID (HVL)	1,500	-	1,500
4906	EXXONMOBIL PIPELINE COMPANY	6/14/2007	HIGHLY VOLATILE LIQUID (HVL)	97	-	97
10012	NUSTAR PIPELINE OPERATING PARTNERSHIP L.P.	7/15/2011	HIGHLY VOLATILE LIQUID (HVL)	100	-	100
			HIGHLY VOLATILE LIQUID (HVL) Total	2,416	-	2,416
443	AMOCO PIPELINE CO	4/1/1993	REFINED PETRO PROD	390	-	390
2552	COLONIAL PIPELINE CO	10/20/1994	REFINED PETRO PROD	20,000	-	20,000
2552	COLONIAL PIPELINE CO	10/20/1994	REFINED PETRO PROD	10,000	-	10,000
19237	TEXAS EASTERN PRODUCT PIPELINE CO	12/20/1994	REFINED PETRO PROD	3,181	-	3,181
31618	ENTERPRISE PRODUCTS OPERATING LLC	8/13/2011	REFINED PETRO PROD	675	-	675
			REFINED PETRO PROD Total	34,246	-	34,246
			Grand Total	57,680	6,892	50,788