

DOT US Department of Transportation
PHMSA Pipeline and Hazardous Materials Safety Administration
OPS Office of Pipeline Safety
Southwest Region

Principal Investigator Richard J. Lopez
Region Director R. M. Seeley
Date of Report 05/30/2012
Subject Failure Investigation Report – Enterprise Cushing Terminal

Operator, Location, & Consequences

Date of Failure 02/21/2011
Commodity Released Crude Oil
City/County & State Cushing/Lincoln, Oklahoma, East Terminal
OpID & Operator Name 30829, Enterprise Crude Pipeline LLC
Unit # & Unit Name 14464, Oklahoma 30 inch
SMART Activity # 133587
Milepost / Location Cushing East Terminal
Type of Failure Incorrect Operation
Fatalities 0
Injuries 0
Description of area impacted Spill was contained within Enterprise’s East Terminal
Property Damage \$160,374

**Failure Investigation Report – Enterprise Crude Pipeline LLC – Cushing East Terminal
February 21, 2011**

Executive Summary

On February 21, 2011, at approximately 01:45 p.m., a failure occurred on the Enterprise 8-inch Crude Oil (EPCO) pipeline system which resulted in the release of approximately 600 barrels of crude oil. The failure occurred in the Cushing East Terminal in Lincoln County, Oklahoma. The incident was reported to the National Response Center (NRC) as Report # 968257. The released product migrated into a retention pond and was contained within EPCO property.

EPCO personnel were in the process of doing a 'line wash' (purging) over to the Cushing West terminal utilizing their 22-inch Green line. In doing so, EPCO lined up the delivery piping system incorrectly. This misalignment resulted in the delivery being pumped against a closed valve in the Shell 8-inch line.

It was determined that the high pressure shut down did not activate to shut the pump down nor did the station indicate any high pressure alarms during the 15 minute time span that the pump was running. Review of the SCADA data at the time of the incident determined that the pressure on the 8-inch Shell line was 137 psig. Maximum operating pressure (MOP) of the segment where the line failed is 275 psig. The line was not over pressured during these series of events.

The released product from the pipeline failure did not result in a fire. There were no injuries or fatalities. The failure occurred parallel to a lap weld but the lap weld did not disbond or fail. The segment of pipeline involved in the accident was sent to Stork Testing and Metallurgical Consulting, Inc. (Stork) in Houston, TX for analysis. Stork determined that the probable cause of the failure was the result of overheating of the edges of the skelp during the lap welding process causing grain growth and intergranular cracks. The service conditions of the pipeline caused the cracks to connect, over time, to the point where it was unable to withstand the hoop stress.

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System Details

The EPCO 30-inch diameter Seaway pipeline originates on the gulf coast of Texas and delivers crude to Cushing, Oklahoma. The capacity of the Seaway Pipeline is approximately 400,000 barrels per day and is approximately 500 miles long.

The segment of pipeline where the failure occurred is within the Cushing Terminal on the 8-inch (nominal diameter) line designated as the Shell line. The Shell line was intended to ship crude from the West to the East Terminal. This 8-inch pipeline is operated intermittently and has not been actively operated for the past two years.

Pipe Specifications

The segment of pipe was fabricated using 0.312-inch wall thickness, grade unknown, lap welded line pipe. The manufacturer is also unknown. The manufacturing of lap welded pipe ceased about 1950. The pipeline had not been used for two years prior to the accident. The pipeline is cathodically protected by an impressed current system that was installed in 1960. Potentials measured by EPCO personnel indicated effective protection.

The maximum allowable operating pressure (MOP) of the segment of the pipeline where the failure occurred is 275 psig. At time of failure the operating pressure of the pipeline segment was 137 psig. The leak site is within EPCO's East Terminal facility (Cushing, OK).

Events Leading up to the Failure

The 8-inch Shell line had not been in service for at least two years. On the day of the incident, EPCO employees were preparing terminal piping to do a 'line wash' (purge) on the 22-inch Green line from the East to the West Terminal. However, the system was incorrectly lined up, and delivery was initiated utilizing the 8-inch Shell line (Appendix D). When the pumping started, an employee at the East Terminal contacted the West Operator to see if he had started receiving oil. The employee at the receiving station advised him that none had been received. At that time, the employee at the receiving station looked at his security monitor and observed a large leak in the manifold area.

The shipping employee immediately started shutting everything down and closing valves. When the leak was excavated, it was discovered that the 8-inch Shell line was leaking and not the 22-inch Green line that was scheduled to have been used to deliver the product.

Emergency Response

At approximately 01:45 p.m. on February 21, 2011, a failure occurred on the Enterprise 8-inch Crude (EPCO) pipeline system which resulted in the release of approximately 600 barrels of crude. The failure occurred at the Cushing East Terminal in Lincoln County, Oklahoma. The incident was reported to the National Response Center as NRC Report # 968257 (Appendix A). The released product migrated into a retention pond and never left Enterprise property. EPCO submitted an accident report to PHMSA 20110206 (Appendix B).

Immediately after the discovery of the product release, the line was shut down and clean-up was initiated. EPCO reported 593 barrels of the 600 barrels released were recovered.

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Investigation Details

During the internal EPCO investigation, it was determined that the high pressure shut down did not shut the pump down nor did the station indicate any high pressure alarms during the 15 minute time span that the pump was running. Reviewing of the data at the time of the incident, the pressure on the line reached 137 psig. The high pressure shut down on the pump is 271 psig. The pump pressure shutdown was tested and found to be working correctly.

After the excavation of the pipelines it was discovered that the 8-inch line had a split down the seam approximately 49 inches long in the 3 o'clock position. The pipe segment was cut out and sent to Stork for analysis.



Figure 1 - Line split at the 3 o'clock position

Another issue identified was that the manifold was not labeled due to it recently being painted. The operations group was in the process of re-labeling the manifold when the failure occurred. The Green line valve and the Shell line valve are side by side, but the Green line valve has a 10-inch MOV and the Shell line has a 6-inch MOV. A map of the terminal facility is included in Appendix D. The wrong valve was closed and shipping was initiated on the wrong system. Instead of using the 22-inch system, the 8-inch Shell system, which had not been used in the past two years, was used.

The 8-inch shell line is not a line that was utilized a lot prior to the accident. Following the accident EPCO has not returned that line to service. In reviewing the specification for the Shell line, EPCO was not able to produce a valid hydrostatic test report.

A cathodic protection potential survey was conducted during the investigation. Levels of protection met the protection criteria.

A review of the SCADA system indicated that the system had not been over-pressured. The maximum operating pressure (MOP) of the segment of the pipeline is 275 psig. Actual operating pressure of the pipeline segment at time of failure was 135 psig. As can be seen in the SCADA screen the accident occurred below the specified MOP.



Figure 2 - Pipe to Soil Potential Measurement

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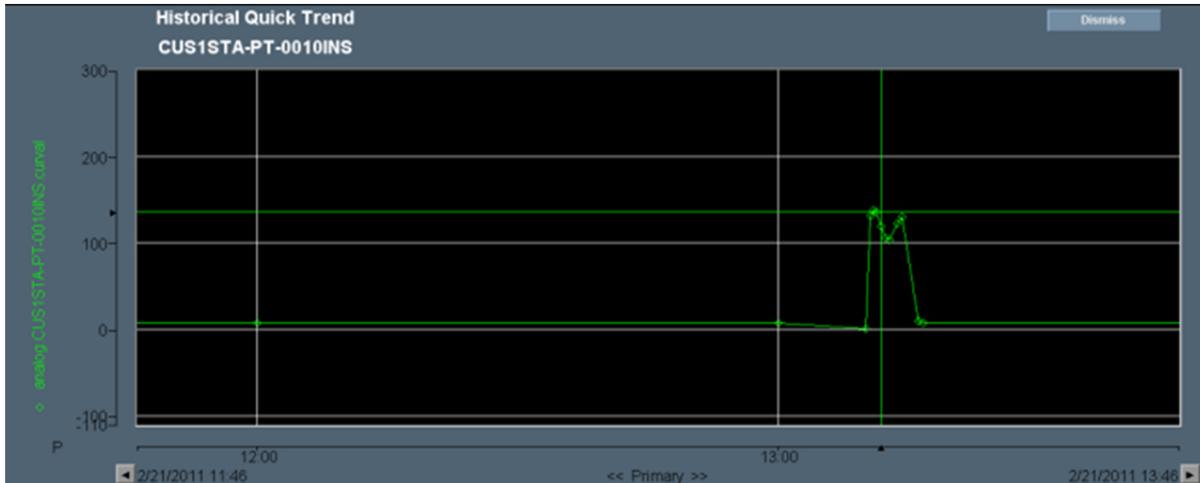


Figure 3 - SCADA recording of the pressure at the time of the accident

During the investigation, it was determined that EPCO did not have a procedure for conducting a line wash from the East to the West Terminal. In EPCO's investigation into the cause of the accident, they identified deficiencies and took the following steps to address the following deficiencies found during the investigation.

1. Changed the Operator training program to include a field verification walk thru and checklist with a signoff by the trainer. Modification of the training program included preparing Procedure (CUSHE-WEST-22-DEL-001) to accomplish safe operation during deliveries from the East to the West Terminal.
 - Procedure Description: The procedure now provides clear instructions to safely deliver crude oil from Cushing East to Cushing West during Abnormal Operation Conditions (AOC). It requires that operators read and understand the Daily Schedule for the product movements to be performed; and, that they verify that affected equipment is not locked out or affected by maintenance.
 - Procedure Requirements: It requires that the operators involved in the delivery of product from Cushing East to Cushing West to be qualified to perform the following OQ Tasks - Task 43.1, Task 43.2, Task 43.3 and Task 43.4.
 - Protective Equipment: It further requires that operators wear personnel protective equipment (PPE) including H2S Monitor, Fire Retardant Clothing, safety glasses, hard hat, and ANSI Z41.1 rated safety shoes.
2. Re-labeled the manifold.
3. Developed, tested, and implemented operating procedures for the East and West terminals.

Metallurgical Analysis

The pipeline segment involved in the accident was shipped to Stork in Houston, TX for metallurgical analysis. Stork's analysis (Appendix C) determined that the probable cause of the failure was the result of overheating of the edges of the skelp during the lap welding process. The overheating of the edges of the pipe during the manufacturing process caused both grain growth and intergranular cracks in the

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pipe. The service conditions of the pipeline caused the cracks to connect, over time, to the point where it was unable to withstand the hoop stress.

Findings & Contributing Factors

The investigation revealed that the lack of procedures for the “line wash” operation contributed to the failure. The lack of processes and controls enabled the piping to be misaligned and the product flowed into the incorrect line. This resulted in the delivery being pumped against a closed valve causing the line to fail.

Also contributing to the failure was the lack of labeling in the manifold area. The two valves in question are in close proximity to each other. Had the valves been properly aligned there could have been a visual confirmation that the pipeline was aligned properly.

From the metallurgical analysis we know:

1. The 8-inch line had a split parallel to the seam of the pipe; it was approximately 49 inches long and in the 3 o'clock position.
2. The fracture was adjacent to a lap weld but it did not cross it or follow the fusion line.
3. The lap weld did not disbond or fail.
4. The ruptured pipe did not show brittle directional fracture marking to indicate an origin.

The 8” Shell line saw an actual operating pressure at time of failure of 135 psig and the accident occurred below the specified MOP (275 psig).

Appendices

- A Telephonic Notice Report - NRC # 968257
- B Enterprise Incident Report to PHMSA – 20110206
- C Metallurgical Evaluation Report
- D Map of EPCO’s Cushing Facility

Appendix A

Telephonic Notice Report - NRC # 968257

NATIONAL RESPONSE CENTER 1-800-424-8802

GOVERNMENT USE ONLYGOVERNMENT USE ONLY***

Information released to a third party shall comply with any applicable federal and/or state Freedom of Information and Privacy Laws

Incident Report # 968257

INCIDENT DESCRIPTION

*Report taken by: CIV NICHULUS THREATT at 15:46 on 22-FEB-11

Incident Type: PIPELINE

Incident Cause: EQUIPMENT FAILURE

Affected Area:

Incident occurred on 21-FEB-11 at 13:45 local incident time.

Affected Medium: OTHER CONTAINMENT AREA

REPORTING PARTY

Name: RANDOLPH STUART

Organization: ENTERPRISE

Address: 210 PARK AVENUE

SUITE 1600

OKLAHOMA CITY, OK 73102

ENTERPRISE reported for the responsible party.

PRIMARY Phone: (405)2080503 ALTERNATE Phone: (405)2395716

Type of Organization: PRIVATE ENTERPRISE

SUSPECTED RESPONSIBLE PARTY

Name: RANDOLPH STUART

Organization: ENTERPRISE

Address: 210 PARK AVENUE >

SUITE 1600

OKLAHOMA CITY, OK 73102

PRIMARY Phone: (405)2080503 ALTERNATE Phone: (405)2395716

INCIDENT LOCATION

County: LINCOLN

City: CUSHING State: OK

Latitude: 35° 56' 23" N

Longitude: 096° 44' 53" W

Section: 23 Township: 17 Range: 5 EAST

EAST CUSHING TERMINAL - NORTH WEST/NORTH WEST CORNER

RELEASED MATERIAL(S)

CHRIS Code: OIL Official Material Name: OIL: CRUDE

Also Known As:

Qty Released: 600 BARREL(S)

DESCRIPTION OF INCIDENT

CALLER IS REPORTING THERE WAS AN 8 INCH PIPELINE THAT RUPTURED AND SPRAYED OIL WHICH WENT INTO A CONTAINMENT POND WHICH IS PART OF THE CONTAINMENT AREA. ////////////THIS IS ADDITIONAL INFORMATION TO PREVIOUS NRC REPORT #968152. THE AMOUNT OF MATERIAL INVOLVED IN THE RELEASE HAS CHANGED.//////////

SENSITIVE INFORMATION

INCIDENT DETAILS

Pipeline Type: TRANSFER

DOT Regulated: YES

Pipeline Above/Below Ground: BELOW

Exposed or Under Water: NO

Pipeline Covered: UNKNOWN

IMPACT

Fire Involved: NO Fire Extinguished: UNKNOWN

INJURIES: NO Hospitalized: Empl/Crew: Passenger:

FATALITIES: NO Empl/Crew: Passenger: Occupant:

EVACUATIONS:NO Who Evacuated: Radius/Area:

Damages: NO

	Hours	Direction of
Closure Type	Description of Closure	Closed Closure
N		
Air:		
N		Major
Road:		Artery:N
N		
Waterway:		
N		
Track:		

Environmental Impact: UNKNOWN

Media Interest: NONE Community Impact due to Material:

REMEDIAL ACTIONS

VACUUM TRUCKS AND CLEAN UP CREWS ARE ONSCENE CONTAINING AND CLEANING UP THE MATERIAL. THE MATERIAL SPILLED INTO SECONDARY CONTAINMENT.

Release Secured: YES

Release Rate:

Estimated Release Duration:

WEATHER

Weather: SUNNY, 65°F Wind speed: 5 MPH Wind direction: W

ADDITIONAL AGENCIES NOTIFIED

Federal: EPA

State/Local: OK. CORP. COMMISSION, LEPC, SHERIFF DEPT

State/Local On Scene:

State Agency Number: NO REPORT #

NOTIFICATIONS BY NRC

USCG ICC (ICC ONI)

22-FEB-11 15:52 (301)6693363

COLORADO INFO ANALYSIS CENTER (FUSION CENTER)

22-FEB-11 15:52 (720)8526705

DHS PROTECTIVE SECURITY ADVISOR (PSA DESK)

22-FEB-11 15:52 (703)2355724

DOT CRISIS MANAGEMENT CENTER (MAIN OFFICE)

22-FEB-11 15:52 (202)3661863

U.S. EPA VI (MAIN OFFICE)

(866)3727745

GULF STRIKE TEAM (MAIN OFFICE)

22-FEB-11 15:52 (251)4416601

NATIONAL INFRASTRUCTURE COORD CTR (MAIN OFFICE)

22-FEB-11 15:52 (202)2829201

NOAA RPTS FOR OK (MAIN OFFICE)

22-FEB-11 15:52 (206)5264911

OFC OF ENV SVC CHEROKEE NATIONS OK (MAIN OFFICE)

22-FEB-11 15:52 (918)4585496

PIPELINE & HAZMAT SAFETY ADMIN (OFFICE OF PIPELINE SAFETY (AUTO))

22-FEB-11 15:52 (202)3660568

SAC AND FOX NATION (EMERGENCY MANAGEMENT)

22-FEB-11 15:52 (918)9680046

DEQ OKLAHOMA (MAIN OFFICE)
22-FEB-11 15:52 (405)7026206

ADDITIONAL INFORMATION

//////////THIS IS ADDITIONAL INFORMATION TO PREVIOUS NRC REPORT
#968152. THE AMOUNT OF MATERIAL INVOLVED IN THE RELEASE HAS
CHANGED.//////////

*** END INCIDENT REPORT #968257 ***

Report any problems by calling 1-800-424-8802
PLEASE VISIT OUR WEB SITE AT <http://www.nrc.uscg.mil>

Appendix B

Enterprise Accident Report to PHMSA - 20110206

NOTICE: This report is required by 49 CFR Part 195. Failure to report can result in a civil penalty not to exceed \$100,000 for each violation for each day that such violation persists except that the maximum civil penalty shall not exceed \$1,000,000 as provided in 49 USC 60122.

OMB NO: 2137-0047
EXPIRATION DATE: 01/31/2013



U.S Department of Transportation
Pipeline and Hazardous Materials Safety Administration

Report Date:	06/27/2011
No.	20110206 - 16456 <small>(DOT Use Only)</small>

**ACCIDENT REPORT - HAZARDOUS LIQUID
PIPELINE SYSTEMS**

A federal agency may not conduct or sponsor, and a person is not required to respond to, nor shall a person be subject to a penalty for failure to comply with a collection of information subject to the requirements of the Paperwork Reduction Act unless that collection of information displays a current valid OMB Control Number. The OMB Control Number for this information collection is 2137-0047. Public reporting for this collection of information is estimated to be approximately 10 hours per response (5 hours for a small release), including the time for reviewing instructions, gathering the data needed, and completing and reviewing the collection of information. All responses to this collection of information are mandatory. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to: Information Collection Clearance Officer, PHMSA, Office of Pipeline Safety (PHP-30) 1200 New Jersey Avenue, SE, Washington, D.C. 20590.

INSTRUCTIONS

Important: Please read the separate instructions for completing this form before you begin. They clarify the information requested and provide specific examples. If you do not have a copy of the instructions, you can obtain one from the PHMSA Pipeline Safety Community Web Page at <http://www.phmsa.dot.gov/pipeline>.

PART A - KEY REPORT INFORMATION

Report Type: <i>(select all that apply)</i>	Original:	Supplemental:	Final:
		Yes	Yes
Last Revision Date:	02/27/2012		
1. Operator's OPS-issued Operator Identification Number (OPID):	30829		
2. Name of Operator	ENTERPRISE CRUDE PIPELINE LLC		
3. Address of Operator:			
3a. Street Address	P.O. BOX 2521		
3b. City	HOUSTON		
3c. State	Texas		
3d. Zip Code	772522521		
4. Local time (24-hr clock) and date of the Accident:	02/21/2011 13:30		
5. Location of Accident:			
Latitude:	35.93964		
Longitude:	-96.748064		
6. National Response Center Report Number (if applicable):	968257		
7. Local time (24-hr clock) and date of initial telephonic report to the National Response Center (if applicable):	02/21/2011 16:02		
8. Commodity released: <i>(select only one, based on predominant volume released)</i>	Crude Oil		
- Specify Commodity Subtype:			
- If "Other" Subtype, Describe:			
- If Biofuel/Alternative Fuel and Commodity Subtype is Ethanol Blend, then % Ethanol Blend:	%		
- If Biofuel/Alternative Fuel and Commodity Subtype is Biodiesel, then Biodiesel Blend (e.g. B2, B20, B100):	B		
9. Estimated volume of commodity released unintentionally (Barrels):	600.00		
10. Estimated volume of intentional and/or controlled release/blowdown (Barrels):			
11. Estimated volume of commodity recovered (Barrels):	593.00		
12. Were there fatalities?	No		
- If Yes, specify the number in each category:			
12a. Operator employees			
12b. Contractor employees working for the Operator			
12c. Non-Operator emergency responders			
12d. Workers working on the right-of-way, but NOT associated with this Operator			
12e. General public			
12f. Total fatalities (sum of above)			
13. Were there injuries requiring inpatient hospitalization?	No		
- If Yes, specify the number in each category:			
13a. Operator employees			
13b. Contractor employees working for the Operator			
13c. Non-Operator emergency responders			
13d. Workers working on the right-of-way, but NOT			

associated with this Operator	
13e. General public	
13f. Total injuries (sum of above)	
14. Was the pipeline/facility shut down due to the Accident?	No
- If No, Explain:	This involved the manifold
- If Yes, complete Questions 14a and 14b: (use local time, 24-hr clock)	
14a. Local time and date of shutdown:	
14b. Local time pipeline/facility restarted:	
- Still shut down? (* Supplemental Report Required)	
15. Did the commodity ignite?	No
16. Did the commodity explode?	No
17. Number of general public evacuated:	
18. Time sequence (use local time, 24-hour clock):	
18a. Local time Operator identified Accident:	
18b. Local time Operator resources arrived on site:	
PART B - ADDITIONAL LOCATION INFORMATION	
1. Was the origin of Accident onshore?	Yes
<i>If Yes, Complete Questions (2-12)</i>	
<i>If No, Complete Questions (13-15)</i>	
- If Onshore:	
2. State:	Oklahoma
3. Zip Code:	74023
4. City:	Cushing
5. County or Parish:	Lincoln
6. Operator-designated location:	
Specify:	
7. Pipeline/Facility name:	Cushing East Facility
8. Segment name/ID:	Manifold
9. Was Accident on Federal land, other than the Outer Continental Shelf (OCS)?	No
10. Location of Accident:	Totally contained on Operator-controlled property
11. Area of Accident (as found):	Underground
Specify:	Under soil
- If Other, Describe:	
Depth-of-Cover (in):	16
12. Did Accident occur in a crossing?	No
- If Yes, specify below:	
- If Bridge crossing –	
Cased/ Uncased:	
- If Railroad crossing –	
Cased/ Uncased/ Bored/drilled	
- If Road crossing –	
Cased/ Uncased/ Bored/drilled	
- If Water crossing –	
Cased/ Uncased	
- Name of body of water, if commonly known:	
- Approx. water depth (ft) at the point of the Accident:	
- Select:	
- If Offshore:	
13. Approximate water depth (ft) at the point of the Accident:	
14. Origin of Accident:	
- In State waters - Specify:	
- State:	
- Area:	
- Block/Tract #:	
- Nearest County/Parish:	
- On the Outer Continental Shelf (OCS) - Specify:	
- Area:	
- Block #:	
15. Area of Accident:	
PART C - ADDITIONAL FACILITY INFORMATION	
1. Is the pipeline or facility:	Interstate
2. Part of system involved in Accident:	Onshore Pump/Meter Station Equipment and Piping
- If Onshore Breakout Tank or Storage Vessel, Including Attached Appurtenances, specify:	
3. Item involved in Accident:	Pipe
- If Pipe, specify:	Pipe Body

3a. Nominal diameter of pipe (in):	8.625
3b. Wall thickness (in):	.312
3c. SMYS (Specified Minimum Yield Strength) of pipe (psi):	1,133
3d. Pipe specification:	
3e. Pipe Seam, specify:	Lap Welded
- If Other, Describe:	
3f. Pipe manufacturer:	
3g. Year of manufacture:	
3h. Pipeline coating type at point of Accident, specify:	None
- If Other, Describe:	
- If Weld, including heat-affected zone, specify:	
- If Other, Describe:	
- If Valve, specify:	
- If Mainline, specify:	
- If Other, Describe:	
3i. Manufactured by:	
3j. Year of manufacture:	
- If Tank/Vessel, specify:	
- If Other - Describe:	
- If Other, describe:	
4. Year item involved in Accident was installed:	
5. Material involved in Accident:	Carbon Steel
- If Material other than Carbon Steel, specify:	
6. Type of Accident Involved:	Rupture
- If Mechanical Puncture – Specify Approx. size:	
in. (axial) by	
in. (circumferential)	
- If Leak - Select Type:	
- If Other, Describe:	
- If Rupture - Select Orientation:	Longitudinal
- If Other, Describe:	
Approx. size: in. (widest opening) by	.3
in. (length circumferentially or axially)	52
- If Other – Describe:	

PART D - ADDITIONAL CONSEQUENCE INFORMATION

1. Wildlife impact:	No
1a. If Yes, specify all that apply:	
- Fish/aquatic	
- Birds	
- Terrestrial	
2. Soil contamination:	Yes
3. Long term impact assessment performed or planned:	No
4. Anticipated remediation:	Yes
4a. If Yes, specify all that apply:	
- Surface water	
- Groundwater	
- Soil	Yes
- Vegetation	
- Wildlife	
5. Water contamination:	No
5a. If Yes, specify all that apply:	
- Ocean/Seawater	
- Surface	
- Groundwater	
- Drinking water: (Select one or both)	
- Private Well	
- Public Water Intake	
5b. Estimated amount released in or reaching water (Barrels):	
5c. Name of body of water, if commonly known:	
6. At the location of this Accident, had the pipeline segment or facility been identified as one that "could affect" a High Consequence Area (HCA) as determined in the Operator's Integrity Management Program?	No
7. Did the released commodity reach or occur in one or more High Consequence Area (HCA)?	No
7a. If Yes, specify HCA type(s): (Select all that apply)	
- Commercially Navigable Waterway:	
Was this HCA identified in the "could affect" determination for this Accident site in the Operator's	

Integrity Management Program?	
- High Population Area:	
Was this HCA identified in the "could affect" determination for this Accident site in the Operator's Integrity Management Program?	
- Other Populated Area	
Was this HCA identified in the "could affect" determination for this Accident site in the Operator's Integrity Management Program?	
- Unusually Sensitive Area (USA) - Drinking Water	
Was this HCA identified in the "could affect" determination for this Accident site in the Operator's Integrity Management Program?	
- Unusually Sensitive Area (USA) - Ecological	
Was this HCA identified in the "could affect" determination for this Accident site in the Operator's Integrity Management Program?	
8. Estimated Property Damage:	
8a. Estimated cost of public and non-Operator private property damage	\$ 0
8b. Estimated cost of commodity lost	\$ 320
8c. Estimated cost of Operator's property damage & repairs	\$ 43,438
8d. Estimated cost of Operator's emergency response	\$ 1,000
8e. Estimated cost of Operator's environmental remediation	\$ 107,692
8f. Estimated other costs	\$ 7,924
	Describe: Lab Analysis
8g. Total estimated property damage (sum of above)	\$ 160,374
PART E - ADDITIONAL OPERATING INFORMATION	
1. Estimated pressure at the point and time of the Accident (psig):	137.00
2. Maximum Operating Pressure (MOP) at the point and time of the Accident (psig):	275.00
3. Describe the pressure on the system or facility relating to the Accident (psig):	Pressure did not exceed MOP
4. Not including pressure reductions required by PHMSA regulations (such as for repairs and pipe movement), was the system or facility relating to the Accident operating under an established pressure restriction with pressure limits below those normally allowed by the MOP?	No
- If Yes, Complete 4.a and 4.b below:	
4a. Did the pressure exceed this established pressure restriction?	
4b. Was this pressure restriction mandated by PHMSA or the State?	
5. Was "Onshore Pipeline, Including Valve Sites" OR "Offshore Pipeline, Including Riser and Riser Bend" selected in PART C, Question 2?	No
- If Yes - (Complete 5a. - 5f. below)	
5a. Type of upstream valve used to initially isolate release source:	
5b. Type of downstream valve used to initially isolate release source:	
5c. Length of segment isolated between valves (ft):	
5d. Is the pipeline configured to accommodate internal inspection tools?	
- If No, Which physical features limit tool accommodation? (select all that apply)	
- Changes in line pipe diameter	
- Presence of unsuitable mainline valves	
- Tight or mitered pipe bends	
- Other passage restrictions (i.e. unbarred tee's, projecting instrumentation, etc.)	
- Extra thick pipe wall (applicable only for magnetic flux leakage internal inspection tools)	
- Other -	
- If Other, Describe:	
5e. For this pipeline, are there operational factors which significantly complicate the execution of an internal inspection tool run?	
- If Yes, Which operational factors complicate execution? (select all that apply)	
- Excessive debris or scale, wax, or other wall buildup	
- Low operating pressure(s)	

- Low flow or absence of flow	
- Incompatible commodity	
- Other -	
- If Other, Describe:	
5f. Function of pipeline system:	
6. Was a Supervisory Control and Data Acquisition (SCADA)-based system in place on the pipeline or facility involved in the Accident?	No
If Yes -	
6a. Was it operating at the time of the Accident?	
6b. Was it fully functional at the time of the Accident?	
6c. Did SCADA-based information (such as alarm(s), alert(s), event(s), and/or volume calculations) assist with the detection of the Accident?	
6d. Did SCADA-based information (such as alarm(s), alert(s), event(s), and/or volume calculations) assist with the confirmation of the Accident?	
7. Was a CPM leak detection system in place on the pipeline or facility involved in the Accident?	No
- If Yes:	
7a. Was it operating at the time of the Accident?	
7b. Was it fully functional at the time of the Accident?	
7c. Did CPM leak detection system information (such as alarm(s), alert(s), event(s), and/or volume calculations) assist with the detection of the Accident?	
7d. Did CPM leak detection system information (such as alarm(s), alert(s), event(s), and/or volume calculations) assist with the confirmation of the Accident?	
8. How was the Accident initially identified for the Operator?	Local Operating Personnel, including contractors
- If Other, Specify:	
8a. If "Controller", "Local Operating Personnel", including contractors", "Air Patrol", or "Guard Patrol by Operator or its contractor" is selected in Question 8, specify the following:	Operator employee
9. Was an investigation initiated into whether or not the controller(s) or control room issues were the cause of or a contributing factor to the Accident?	No, the Operator did not find that an investigation of the controller(s) actions or control room issues was necessary due to: (provide an explanation for why the Operator did not investigate)
- If No, the Operator did not find that an investigation of the controller(s) actions or control room issues was necessary due to: (provide an explanation for why the operator did not investigate)	
- If Yes, specify investigation result(s): (select all that apply)	
- Investigation reviewed work schedule rotations, continuous hours of service (while working for the Operator), and other factors associated with fatigue	
- Investigation did NOT review work schedule rotations, continuous hours of service (while working for the Operator), and other factors associated with fatigue	
Provide an explanation for why not:	
- Investigation identified no control room issues	
- Investigation identified no controller issues	
- Investigation identified incorrect controller action or controller error	
- Investigation identified that fatigue may have affected the controller(s) involved or impacted the involved controller(s) response	
- Investigation identified incorrect procedures	
- Investigation identified incorrect control room equipment operation	
- Investigation identified maintenance activities that affected control room operations, procedures, and/or controller response	
- Investigation identified areas other than those above:	
Describe:	
PART F - DRUG & ALCOHOL TESTING INFORMATION	

1. As a result of this Accident, were any Operator employees tested under the post-accident drug and alcohol testing requirements of DOT's Drug & Alcohol Testing regulations?	Yes
- If Yes:	
1a. Specify how many were tested:	2
1b. Specify how many failed:	0
2. As a result of this Accident, were any Operator contractor employees tested under the post-accident drug and alcohol testing requirements of DOT's Drug & Alcohol Testing regulations?	No
- If Yes:	
2a. Specify how many were tested:	
2b. Specify how many failed:	
PART G – APPARENT CAUSE	
<i>Select only one box from PART G in shaded column on left representing the APPARENT Cause of the Accident, and answer the questions on the right. Describe secondary, contributing or root causes of the Accident in the narrative (PART H).</i>	
Apparent Cause:	G5 - Material Failure of Pipe or Weld
G1 - Corrosion Failure - only one sub-cause can be picked from shaded left-hand column	
External Corrosion:	
Internal Corrosion:	
- If External Corrosion:	
1. Results of visual examination:	
- If Other, Describe:	
2. Type of corrosion: <i>(select all that apply)</i>	
- Galvanic	
- Atmospheric	
- Stray Current	
- Microbiological	
- Selective Seam	
- Other:	
- If Other, Describe:	
3. The type(s) of corrosion selected in Question 2 is based on the following: <i>(select all that apply)</i>	
- Field examination	
- Determined by metallurgical analysis	
- Other:	
- If Other, Describe:	
4. Was the failed item buried under the ground?	
- If Yes :	
□4a. Was failed item considered to be under cathodic protection at the time of the Accident?	
If Yes - Year protection started:	
4b. Was shielding, tenting, or disbonding of coating evident at the point of the Accident?	
4c. Has one or more Cathodic Protection Survey been conducted at the point of the Accident?	
If "Yes, CP Annual Survey" – Most recent year conducted:	
If "Yes, Close Interval Survey" – Most recent year conducted:	
If "Yes, Other CP Survey" – Most recent year conducted:	
- If No:	
4d. Was the failed item externally coated or painted?	
5. Was there observable damage to the coating or paint in the vicinity of the corrosion?	
- If Internal Corrosion:	
6. Results of visual examination:	
- Other:	
7. Type of corrosion <i>(select all that apply):</i> -	
- Corrosive Commodity	
- Water drop-out/Acid	
- Microbiological	
- Erosion	
- Other:	
- If Other, Describe:	
8. The cause(s) of corrosion selected in Question 7 is based on the following <i>(select all that apply):</i> -	
- Field examination	

- Determined by metallurgical analysis	
- Other:	
- If Other, Describe:	
9. Location of corrosion (select all that apply): -	
- Low point in pipe	
- Elbow	
- Other:	
- If Other, Describe:	
10. Was the commodity treated with corrosion inhibitors or biocides?	
11. Was the interior coated or lined with protective coating?	
12. Were cleaning/dewatering pigs (or other operations) routinely utilized?	
13. Were corrosion coupons routinely utilized?	
Complete the following if any Corrosion Failure sub-cause is selected AND the "Item Involved in Accident" (from PART C, Question 3) is Tank/Vessel.	
14. List the year of the most recent inspections:	
14a. API Std 653 Out-of-Service Inspection	
- No Out-of-Service Inspection completed	
14b. API Std 653 In-Service Inspection	
- No In-Service Inspection completed	
Complete the following if any Corrosion Failure sub-cause is selected AND the "Item Involved in Accident" (from PART C, Question 3) is Pipe or Weld.	
15. Has one or more internal inspection tool collected data at the point of the Accident?	
15a. If Yes, for each tool used, select type of internal inspection tool and indicate most recent year run: -	
- Magnetic Flux Leakage Tool	Most recent year:
- Ultrasonic	Most recent year:
- Geometry	Most recent year:
- Caliper	Most recent year:
- Crack	Most recent year:
- Hard Spot	Most recent year:
- Combination Tool	Most recent year:
- Transverse Field/Triaxial	Most recent year:
- Other	Most recent year:
	Describe:
16. Has one or more hydrotest or other pressure test been conducted since original construction at the point of the Accident?	
If Yes -	Most recent year tested:
	Test pressure:
17. Has one or more Direct Assessment been conducted on this segment?	
- If Yes, and an investigative dig was conducted at the point of the Accident:	Most recent year conducted:
- If Yes, but the point of the Accident was not identified as a dig site:	Most recent year conducted:
18. Has one or more non-destructive examination been conducted at the point of the Accident since January 1, 2002?	
18a. If Yes, for each examination conducted since January 1, 2002, select type of non-destructive examination and indicate most recent year the examination was conducted:	
- Radiography	Most recent year conducted:
- Guided Wave Ultrasonic	Most recent year conducted:
- Handheld Ultrasonic Tool	Most recent year conducted:
- Wet Magnetic Particle Test	Most recent year conducted:
- Dry Magnetic Particle Test	Most recent year conducted:
- Other	Most recent year conducted:

Describe:	
G2 - Natural Force Damage - only one sub-cause can be picked from shaded left-handed column	
Natural Force Damage – Sub-Cause:	
- If Earth Movement, NOT due to Heavy Rains/Floods:	
1. Specify:	
	- If Other, Describe:
- If Heavy Rains/Floods:	
2. Specify:	
	- If Other, Describe:
- If Lightning:	
3. Specify:	
- If Temperature:	
4. Specify:	
	- If Other, Describe:
- If High Winds:	
- If Other Natural Force Damage:	
5. Describe:	
Complete the following if any Natural Force Damage sub-cause is selected.	
6. Were the natural forces causing the Accident generated in conjunction with an extreme weather event?	
6a. If Yes, specify: <i>(select all that apply)</i>	
- Hurricane	
- Tropical Storm	
- Tornado	
- Other	
	- If Other, Describe:
G3 - Excavation Damage - only one sub-cause can be picked from shaded left-hand column	
Excavation Damage – Sub-Cause:	
- If Excavation Damage by Operator (First Party):	
- If Excavation Damage by Operator's Contractor (Second Party):	
- If Excavation Damage by Third Party:	
- If Previous Damage due to Excavation Activity:	
Complete Questions 1-5 ONLY IF the "Item Involved in Accident" (from PART C, Question 3) is Pipe or Weld.	
1. Has one or more internal inspection tool collected data at the point of the Accident?	
1a. If Yes, for each tool used, select type of internal inspection tool and indicate most recent year run: -	
- Magnetic Flux Leakage	Most recent year conducted:
- Ultrasonic	Most recent year conducted:
- Geometry	Most recent year conducted:
- Caliper	Most recent year conducted:
- Crack	Most recent year conducted:
- Hard Spot	Most recent year conducted:
- Combination Tool	Most recent year conducted:
- Transverse Field/Triaxial	Most recent year conducted:
- Other	Most recent year conducted:
	Describe:
2. Do you have reason to believe that the internal inspection was completed BEFORE the damage was sustained?	
3. Has one or more hydrotest or other pressure test been conducted since original construction at the point of the Accident?	
- If Yes:	

	Most recent year tested:	
	Test pressure (psig):	
4. Has one or more Direct Assessment been conducted on the pipeline segment?		
- If Yes, and an investigative dig was conducted at the point of the Accident:		
	Most recent year conducted:	
- If Yes, but the point of the Accident was not identified as a dig site:		
	Most recent year conducted:	
5. Has one or more non-destructive examination been conducted at the point of the Accident since January 1, 2002?		
5a. If Yes, for each examination, conducted since January 1, 2002, select type of non-destructive examination and indicate most recent year the examination was conducted:		
- Radiography		
	Most recent year conducted:	
- Guided Wave Ultrasonic		
	Most recent year conducted:	
- Handheld Ultrasonic Tool		
	Most recent year conducted:	
- Wet Magnetic Particle Test		
	Most recent year conducted:	
- Dry Magnetic Particle Test		
	Most recent year conducted:	
- Other		
	Most recent year conducted:	
	Describe:	
Complete the following if Excavation Damage by Third Party is selected as the sub-cause.		
6. Did the operator get prior notification of the excavation activity?		
6a. If Yes, Notification received from: <i>(select all that apply)</i> -		
- One-Call System		
- Excavator		
- Contractor		
- Landowner		
Complete the following mandatory CGA-DIRT Program questions if any Excavation Damage sub-cause is selected.		
7. Do you want PHMSA to upload the following information to CGA-DIRT (www.cga-dirt.com)?		
8. Right-of-Way where event occurred: <i>(select all that apply)</i> -		
- Public		
	- If "Public", Specify:	
- Private		
	- If "Private", Specify:	
- Pipeline Property/Easement		
- Power/Transmission Line		
- Railroad		
- Dedicated Public Utility Easement		
- Federal Land		
- Data not collected		
- Unknown/Other		
9. Type of excavator:		
10. Type of excavation equipment:		
11. Type of work performed:		
12. Was the One-Call Center notified?		
12a. If Yes, specify ticket number:		
12b. If this is a State where more than a single One-Call Center exists, list the name of the One-Call Center notified:		
13. Type of Locator:		
14. Were facility locate marks visible in the area of excavation?		
15. Were facilities marked correctly?		
16. Did the damage cause an interruption in service?		
16a. If Yes, specify duration of the interruption (hours)		
17. Description of the CGA-DIRT Root Cause <i>(select only the one predominant first level CGA-DIRT Root Cause and then, where available as a choice, the one predominant second level CGA-DIRT Root Cause as well):</i>		
Root Cause:		
- If One-Call Notification Practices Not Sufficient, specify:		
- If Locating Practices Not Sufficient, specify:		
- If Excavation Practices Not Sufficient, specify:		
- If Other/None of the Above, explain:		
G4 - Other Outside Force Damage - only one sub-cause can be selected from the shaded left-hand column		

Other Outside Force Damage – Sub-Cause:	
- If Nearby Industrial, Man-made, or Other Fire/Explosion as Primary Cause of Incident:	
- If Damage by Car, Truck, or Other Motorized Vehicle/Equipment NOT Engaged in Excavation:	
1. Vehicle/Equipment operated by:	
- If Damage by Boats, Barges, Drilling Rigs, or Other Maritime Equipment or Vessels Set Adrift or Which Have Otherwise Lost Their Mooring:	
2. Select one or more of the following IF an extreme weather event was a factor:	
- Hurricane	
- Tropical Storm	
- Tornado	
- Heavy Rains/Flood	
- Other	
- If Other, Describe:	
- If Routine or Normal Fishing or Other Maritime Activity NOT Engaged in Excavation:	
- If Electrical Arcing from Other Equipment or Facility:	
- If Previous Mechanical Damage NOT Related to Excavation:	
Complete Questions 3-7 ONLY IF the "Item Involved in Accident" (from PART C, Question 3) is Pipe or Weld.	
3. Has one or more internal inspection tool collected data at the point of the Accident?	
3a. If Yes, for each tool used, select type of internal inspection tool and indicate most recent year run:	
- Magnetic Flux Leakage	Most recent year conducted:
- Ultrasonic	Most recent year conducted:
- Geometry	Most recent year conducted:
- Caliper	Most recent year conducted:
- Crack	Most recent year conducted:
- Hard Spot	Most recent year conducted:
- Combination Tool	Most recent year conducted:
- Transverse Field/Triaxial	Most recent year conducted:
- Other	Most recent year conducted:
Describe:	
4. Do you have reason to believe that the internal inspection was completed BEFORE the damage was sustained?	
5. Has one or more hydrotest or other pressure test been conducted since original construction at the point of the Accident?	
- If Yes:	
	Most recent year tested:
	Test pressure (psig):
6. Has one or more Direct Assessment been conducted on the pipeline segment?	
- If Yes, and an investigative dig was conducted at the point of the Accident:	
	Most recent year conducted:
- If Yes, but the point of the Accident was not identified as a dig site:	
	Most recent year conducted:
7. Has one or more non-destructive examination been conducted at the point of the Accident since January 1, 2002?	
7a. If Yes, for each examination conducted since January 1, 2002, select type of non-destructive examination and indicate most recent year the examination was conducted:	
- Radiography	Most recent year conducted:
- Guided Wave Ultrasonic	Most recent year conducted:
- Handheld Ultrasonic Tool	Most recent year conducted:
- Wet Magnetic Particle Test	Most recent year conducted:
- Dry Magnetic Particle Test	Most recent year conducted:

- Other	
Most recent year conducted:	
Describe:	
- If Intentional Damage:	
8. Specify:	
- If Other, Describe:	
- If Other Outside Force Damage:	
9. Describe:	
G5 - Material Failure of Pipe or Weld - only one sub-cause can be selected from the shaded left-hand column	
Use this section to report material failures ONLY IF the "Item Involved in Accident" (from PART C, Question 3) is "Pipe" or "Weld."	
Material Failure of Pipe or Weld – Sub-Cause:	Original Manufacturing-related (NOT girth weld or other welds formed in the field)
1. The sub-cause selected below is based on the following: <i>(select all that apply)</i>	
- Field Examination	
- Determined by Metallurgical Analysis	Yes
- Other Analysis	
- If "Other Analysis", Describe:	
- Sub-cause is Tentative or Suspected; Still Under Investigation (Supplemental Report required)	
- If Construction, Installation, or Fabrication-related:	
2. List contributing factors: <i>(select all that apply)</i>	
- Fatigue or Vibration-related	
Specify:	
- If Other, Describe:	
- Mechanical Stress:	
- Other	
- If Other, Describe:	
- If Original Manufacturing-related (NOT girth weld or other welds formed in the field):	
2. List contributing factors: <i>(select all that apply)</i>	
- Fatigue or Vibration-related:	
Specify:	
- If Other, Describe:	
- Mechanical Stress:	
- Other	Yes
- If Other, Describe:	See note in narrative.
- If Environmental Cracking-related:	
3. Specify:	
- Other - Describe:	
Complete the following if any Material Failure of Pipe or Weld sub-cause is selected.	
4. Additional factors: <i>(select all that apply)</i> :	
- Dent	
- Gouge	
- Pipe Bend	
- Arc Burn	
- Crack	Yes
- Lack of Fusion	
- Lamination	
- Buckle	
- Wrinkle	
- Misalignment	
- Burnt Steel	
- Other:	
- If Other, Describe:	
5. Has one or more internal inspection tool collected data at the point of the Accident?	No
5a. If Yes, for each tool used, select type of internal inspection tool and indicate most recent year run:	
- Magnetic Flux Leakage	Most recent year run:
- Ultrasonic	Most recent year run:
- Geometry	Most recent year run:
- Caliper	Most recent year run:
- Crack	Most recent year run:

- Hard Spot	Most recent year run:	
- Combination Tool	Most recent year run:	
- Transverse Field/Triaxial	Most recent year run:	
- Other	Most recent year run:	
Describe:		
6. Has one or more hydrotest or other pressure test been conducted since original construction at the point of the Accident?		No
- If Yes:		
	Most recent year tested:	
	Test pressure (psig):	
7. Has one or more Direct Assessment been conducted on the pipeline segment?		No
- If Yes, and an investigative dig was conducted at the point of the Accident -		
	Most recent year conducted:	
- If Yes, but the point of the Accident was not identified as a dig site -		
	Most recent year conducted:	
8. Has one or more non-destructive examination(s) been conducted at the point of the Accident since January 1, 2002?		No
8a. If Yes, for each examination conducted since January 1, 2002, select type of non-destructive examination and indicate most recent year the examination was conducted: -		
- Radiography	Most recent year conducted:	
- Guided Wave Ultrasonic	Most recent year conducted:	
- Handheld Ultrasonic Tool	Most recent year conducted:	
- Wet Magnetic Particle Test	Most recent year conducted:	
- Dry Magnetic Particle Test	Most recent year conducted:	
- Other	Most recent year conducted:	
Describe:		
G6 – Equipment Failure - only one sub-cause can be selected from the shaded left-hand column		
Equipment Failure – Sub-Cause:		
- If Malfunction of Control/Relief Equipment:		
1. Specify: <i>(select all that apply)</i> -		
- Control Valve		
- Instrumentation		
- SCADA		
- Communications		
- Block Valve		
- Check Valve		
- Relief Valve		
- Power Failure		
- Stopple/Control Fitting		
- ESD System Failure		
- Other		
		- If Other – Describe:
- If Pump or Pump-related Equipment:		
2. Specify:		
		- If Other – Describe:
- If Threaded Connection/Coupling Failure:		
3. Specify:		
		- If Other – Describe:
- If Non-threaded Connection Failure:		
4. Specify:		
		- If Other – Describe:
- If Defective or Loose Tubing or Fitting:		
- If Failure of Equipment Body (except Pump), Tank Plate, or other Material:		
- If Other Equipment Failure:		

5. Describe:	
Complete the following if any Equipment Failure sub-cause is selected.	
6. Additional factors that contributed to the equipment failure: <i>(select all that apply)</i>	
- Excessive vibration	
- Overpressurization	
- No support or loss of support	
- Manufacturing defect	
- Loss of electricity	
- Improper installation	
- Mismatched items (different manufacturer for tubing and tubing fittings)	
- Dissimilar metals	
- Breakdown of soft goods due to compatibility issues with transported commodity	
- Valve vault or valve can contributed to the release	
- Alarm/status failure	
- Misalignment	
- Thermal stress	
- Other	
- If Other, Describe:	
G7 - Incorrect Operation - only one sub-cause can be selected from the shaded left-hand column	
Incorrect Operation – Sub-Cause:	
Damage by Operator or Operator's Contractor NOT Related to Excavation and NOT due to Motorized Vehicle/Equipment Damage	No
Tank, Vessel, or Sump/Separator Allowed or Caused to Overfill or Overflow	No
1. Specify:	
- If Other, Describe:	
Valve Left or Placed in Wrong Position, but NOT Resulting in a Tank, Vessel, or Sump/Separator Overflow or Facility Overpressure	No
Pipeline or Equipment Overpressured	No
Equipment Not Installed Properly	No
Wrong Equipment Specified or Installed	No
Other Incorrect Operation	No
2. Describe:	
Complete the following if any Incorrect Operation sub-cause is selected.	
3. Was this Accident related to <i>(select all that apply)</i> : -	
- Inadequate procedure	
- No procedure established	
- Failure to follow procedure	
- Other:	
- If Other, Describe:	
4. What category type was the activity that caused the Accident?	
5. Was the task(s) that led to the Accident identified as a covered task in your Operator Qualification Program?	
5a. If Yes, were the individuals performing the task(s) qualified for the task(s)?	
G8 - Other Accident Cause - only one sub-cause can be selected from the shaded left-hand column	
Other Accident Cause – Sub-Cause:	
- If Miscellaneous:	
1. Describe:	

- If Unknown:
2. Specify:

PART H - NARRATIVE DESCRIPTION OF THE ACCIDENT

Cushing East operator was in the process of doing a line wash over to the Cushing West Station. East operator started up the pump and 15 minutes later discovered a large leak in the manifold. East operator shut the line down and contacted West operator that he had a leak. Crude oil migrated to retention pond but fully contained on the company's property.

East Operator (Employee #1) contacted the West Operator (Employee #2) to let him know he was going to do a line wash on the green line from the East station to the West station. Employee #2 lined up his station to receive the line wash on the green line. The Employee #1 incorrectly lined up his station to deliver down the shell line. Employee #1 started up the pump and contacted the West Operator to see if he had started receiving oil. The Employee #2 advised him no and at that time Employee #1 looked at his security monitor and observed a large leak in the manifold. Employee #1 immediately started shutting everything down and closing valves. When the leak was dug out it was discovered the line that was leaking was the 8 inch Shell line and not the 22 inch green line that the delivery should have been going to.

During the investigation it was determined that the high pressure shut down did not shut the pump down nor did the station indicate any high pressure alarms during the 15 minute time span that the pump was running. In looking at the data at the time of the incident the pressure on the line showed to reach 137 psi. The high pressure shut down on the pump is 271 psi. The pump pressure shutdown was tested and found to be working correctly. Also the manifold was not labeled due to recently being painted. Operations was in the process of re-labeling the manifold. The green line valve and the shell line valve are side by side, but the green line valve is a 10 inch MOV and the shell line is a 6 inch manual Operator valve. There was not a procedure for a line wash from the East to the West. After excavation it was discovered that the line had a split down the seam of the pipe approximately 49 inches in the 3 O'clock position. The pipe will be cut out and sent for analysis.

Update 1/18/2012 - Updated final cost. Lab report on pipe and incident report concerning this leak was forwarded to PHMSA on 6/20/2011.

Part G5, part 2 - Other - The cause of failure was overheating of the edges of the skelp during the lap welding process causing grain growth and intergranular cracks. The service conditions of the pipe caused the cracks to connect over time and eventually reduce the effective wall thickness of the pipe to the point where it was unable to withstand the hoop stress.

File Full Name

[20120118115937_Stork_Testing_Report_-_Examination_of_Failed_8-inch_Pipe_from_the_Cushing_East_Facility_\(Revision\).pdf](#)

PART I - PREPARER AND AUTHORIZED SIGNATURE

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Appendix C
Metallurgical Report

This document is on file at PHMSA

Appendix D

Aerial Photo

This document is on file at PHMSA