**Investigators**
- Charles Onwuachi
- David York

**Region Director**
- R.M. Seeley

**Date of Report**
- 12/27/2016

**Subject**
- Failure Investigation Report – Enterprise Crude Pipeline, LLC, Cushing West Tank Farm Release

### Operator, Location, & Consequences

<table>
<thead>
<tr>
<th><strong>Date of Failure</strong></th>
<th>12/1/2015</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Commodity Released</strong></td>
<td>Crude Oil</td>
</tr>
<tr>
<td><strong>City/County &amp; State</strong></td>
<td>Cushing, Payne County, OK</td>
</tr>
<tr>
<td><strong>OpID &amp; Operator Name</strong></td>
<td>30829 Enterprise Crude Pipeline</td>
</tr>
<tr>
<td><strong>Unit # &amp; Unit Name</strong></td>
<td>14464 Oklahoma 30-Inch</td>
</tr>
<tr>
<td><strong>SMART Activity #</strong></td>
<td>151766</td>
</tr>
<tr>
<td><strong>Milepost/Location</strong></td>
<td>Cushing</td>
</tr>
<tr>
<td><strong>Type of Failure</strong></td>
<td>Tank line failure due to internal corrosion</td>
</tr>
<tr>
<td><strong>Fatalities</strong></td>
<td>0</td>
</tr>
<tr>
<td><strong>Injuries</strong></td>
<td>0</td>
</tr>
<tr>
<td><strong>Description of area impacted</strong></td>
<td>On-site impact to soil and containment pond</td>
</tr>
<tr>
<td><strong>Total Costs</strong></td>
<td>$291,898</td>
</tr>
</tbody>
</table>
Executive Summary
On December 1, 2015, at approximately 10:10 p.m. Central Standard Time (CST), personnel from Enterprise Crude Pipeline, LLC (Enterprise), discovered a spill at their West Cushing Tank Farm in Cushing, Oklahoma. Approximately 1,000 barrels of crude oil were released within the terminal, briefly interrupting operations as Enterprise investigated the source of the leak. Enterprise reported the release to the National Response Center at 11:30 p.m. CST.

The spill was contained within the tank farm after travelling along the surface of the ground to a retention pond on the west side of the terminal. The source of the release was determined to be a buried steel tank transfer pipeline within the station that had an outer diameter of 16 inches. Stress Engineering Services of Houston, Texas, performed a failure analysis on the damaged portion of pipe, stating in their final report that the cause of the spill was internal corrosion. The remaining portion of the line was evacuated of product and abandoned in place.

No fire or injuries occurred as a result of the failure; however, the spill resulted in approximately $291,898 in total damages.
System Details
Enterprise operates two storage tank terminals in Cushing, Oklahoma, designated as their East & West Tank Farms. The combined storage capacity of the terminals is approximately 3.3 million barrels (MMbbls), inclusive of five larger external floating roof tanks that are leased to Paragon but operated by Enterprise. Currently there are fifteen storage tanks within the terminal that serve as breakout tanks to several crude oil pipelines operated by Enterprise and other entities. Product is transported into the West Terminal through pipeline systems operated by Enterprise, including the Red River Gathering System and the Basin Pipeline. Product can also be delivered to the Seaway Crude Pipeline system that connects the West Cushing Terminal to refineries on the Gulf Coast.

The leak was identified on a 1,160-foot section of steel pipeline with a 16-inch outer diameter that served as a fill line within the facility for Tank 41123. The pipe wall measured 0.25 inches, and was manufactured with a fusion bond external coating; however, the pipeline did not have an internal coating. The maximum operating pressure of the line was designated as 275 pounds per square inch gauge (psig), limited by the American National Standards Institute (ANSI) 150 components installed on the system. The manufacturer and specified minimum yield strength of the line segment was reportedly unknown.

The West Terminal is in the Pipeline and Hazardous Materials Safety Administration’s (PHMSA) Inspection System 1970 under the name Enterprise_Crude.

Events Leading up to the Failure
On December 1, 2015, at approximately 1:00 p.m. CST, Enterprise started to move product out of Tank 41123. The three pipelines connected to Tank 41123 have outer diameters of 16, 18, and 24 inches. The transfer was scheduled for the 18-inch delivery line, progressing throughout the day and ending by midnight. During the course of this delivery process, Enterprise began a flush into Tank 41123 through the 16-inch fill line at approximately 8:28 p.m. CST. The flush lasted for roughly 30 minutes.

At 9:56 p.m. CST, a terminal operator—who was scheduled to take samples from the Manifold A area—detected the scent of crude oil and discovered oil on the ground just north of Manifold A.

Emergency Response
Upon notification from the terminal operator, operations personnel immediately initiated shutdown of all equipment within the terminal. Notification of the incident was made by telephone, first to operations and maintenance supervisors and then to response contractors and additional operations personnel. Two local spill response teams were mobilized and began arriving at the terminal at 11:30 p.m. with heavy machinery, frac tanks, and vacuum trucks. Crews continued work to identify and sequester the source of the release, isolating Tank 41123 at 11:45 p.m. through the use of manual valves.

The oil travelled approximately 1,200 feet from the leak source to an onsite containment area and retention pond. The contaminated soil was removed to an area on the northwest side of the terminal while personnel installed a hard boom across the retention area, removing the oil with surface skimmers.

The Cushing West Terminal is not located in an area determined to possibly affect a High Consequence Area as a result of an unintended release. The Terminal is included in the Facility Response Plan written to comply with Title 49 CFR 194; however, the plan was not activated in response to this spill.

PHMSA’s Southwest Region responded to the site on Thursday, December 3, 2015, to initiate an investigation.

Summary of Return-to-Service
The 16-inch pipeline was not immediately returned to service following the release. Following visual examination, Enterprise installed a mechanical clamp over the damaged portion of the pipeline on December 3, 2015. The line was drained down and remained inactive, and the damaged portion of the pipe was later removed and sent to Houston, Texas, for failure analysis.

With the damaged 16-inch fill line isolated, the West Terminal restarted operations on Wednesday, December 2, 2015.
Investigation Details
PHMSA’s investigation included a review of the events, the response of Enterprise personnel, Supervisory Control and Data Acquisition (SCADA) operations, and internal corrosion management within the terminal.

The release was discovered following the flush performed on Tank 41123 through a third-party line. The flush operation required an attendant be onsite at the Manifold A area. As the flush was completed the manual valve to the 16-inch line at Manifold A area was closed, at which time Enterprise personnel had not detected an abnormal condition at the terminal.

At approximately 10:00 a.m. on December 2, hydro-excavation revealed the source of the spill to be the 16-inch fill line. A visual examination revealed a small hole at the 6 o’clock position on the piping, buried under approximately 3.5 feet of soil and gravel. No mechanical damage was visible, and the external coating around the defect appeared to be in good condition. Enterprise ordered a 16 x 18 PLDICO Clamp + Sleeve to facilitate the repair, which was completed on December 3, before PHMSA inspectors arrived onsite.

At the time of the accident, the pressure within the 16-inch line was estimated to be less than 10 psig. Enterprise provided records indicating the 16-inch line was hydrostatically tested in 1997 to a minimum pressure of 346 psig for 8 hours.

Product is transported to the West Terminal through pipelines owned and operated by Enterprise and Enbridge, as well as through a truck terminal located within the facility. Internal corrosion monitoring at the West Terminal is conducted primarily through weight loss coupons installed on incoming pipelines at the East Terminal: there are no monitoring points located within the West Terminal. Records show that the average corrosion rate in miles per year (MPY) over the course of three years leading up to the accident was well below what would be considered significant. Additionally, biocide treatment was started in 2012.

Metallurgical Analysis
Enterprise sent approximately 6 feet of the failed 16-inch pipe to Stress Engineering Services in Houston, Texas, for analysis. The findings are summarized here; a copy of the final report can be found in Appendix D.

In a final report dated July 12, 2016, Stress Engineering concluded that the hole, measuring 1 1/16 inches in diameter and found in the bottom of the 16-inch pipe, was the result of a carbon dioxide-driven attack. Several pits of varying size were found along the bottom of the pipe sample, around which tests registered the presence of hydrogen sulfide, although the report concluded that this did not influence the creation of the pitting. Chemical analysis on deposits within the pit adjacent to the through-wall defect revealed the presence of sand and chlorine, products likely to be entrained in the product stream.
While the year and manufacturer of the pipe were unknown, tensile and hardness tests show the pipe met the current requirements for the American Petroleum Institute (API) Grades X42, X46, and B. The analysis did not discover any manufacturing or metallurgical defects that could have contributed to the failure, and apart from the external coating missing at the defect, the fusion-bonded epoxy (FBE) coating was determined to be in good condition.

**Conclusion**  
PHMSA concurs with the findings of the metallurgical analysis. The pit immediately adjacent to the through-wall defect exhibited signs of deposit corrosion, common in station piping where flow rates are generally lower than transmission piping and pigging is largely impracticable.

PHMSA determined the accident likely went undetected for approximately one hour, and Enterprise’s response was appropriate following discovery of the spill.

**Appendices**  
A Map and Photographs  
B NRC Report #1134731  
C Operator Accident Report to PHMSA (#20150464)  
D Laboratory Analysis
Appendix A – Map

NATIONAL PIPELINE MAPPING SYSTEM

Legend

Hazardous Liquid Pipelines

Pipelines depicted on this map represent gas transmission and hazardous liquid lines only. Gas gathering and gas distribution systems are not represented.

This map should never be used as a substitute for contacting a one-call center prior to excavation activities. Please call 811 before any digging occurs.

Questions regarding this map or its contents can be directed to rpms.mer@nisaercorp.com.

Projection: Geographic

Datum: NAD83

Map produced by the HPMS Public Viewer at www.npms.pnhis.dot.gov

Date Printed: Sep 01, 2016
Caller Information

First Name: DAVID
Last Name: SCHRIBER
Company Name: ENTERPRISE CRUDE PIPELINE
Address: 6420 WEST SAH HOUSTON HWY NORTH
City: HOUSTON
Country: USA
Phone 1: 7138872696
Phone 2: 
Organization Type: PRIVATE
Confidential: No
Is caller the reporter? Yes

Discharger Information

First Name: DAVID
Last Name: SCHRIBER
Company Name: ENTERPRISE CRUDE PIPELINE
Address: 6420 WEST SAH HOUSTON HWY NORTH
City: HOUSTON
Country: USA
Phone 1: 7138872696
Phone 2: 
Organization Type: PRIVATE

Spill Information

State: OK
County: PAYNE
Nearest City: CUSHMAN
Location: FM0120 SOUTH 3510 ROAD

Spill Date: 12/02/2015
Spill Time: 22:15:00
DTG Type: D:
Incident Type: STORAGE TANKS

Caller is reporting a discharge of light sweet crude from a crude tank due to a cracked manifold.

Materials Involved

Material/Chem Name | Chem Code | TRQ Qty | NWQ Qty
--- | --- | --- | ---
OIL CRUDE | OIL | 500 BARRELS |

Medium Type: D:

Additional Medium Information:

ON-SITE FIRE RESERVOIR (SECONDARY CONTAINMENT)

Injuries:

Facilities:

No. of Injuries:

Damage:

No. of Facilities:

Damage Amount:

Federal Agency Notified:

State Agency Notified:

Other Agency Notified:

Remedial Actions:
IN THE PROCESS GETTING A PLANDED TOGETHER FOR CLEAN UP.

Additional Info:

CALLER STATED THAT THE MATERIAL DISCHARGED INTO AN ONSITE PIT WITH WATER IN IT THAT IS USED TO PUT OUT FIRES.

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<th>Distance from City:</th>
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<tr>
<td>Section:</td>
<td></td>
</tr>
<tr>
<td>Range:</td>
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</tbody>
</table>

Resident Comments (max 250 characters):

[Comments Box]
## 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. All responses to the collection of information are mandatory. Send comments regarding this burden on any aspect of this collection of information, including suggestions for reducing the burden to: Information Collection Clearance Officer, PHMSA, Office of Pipeline Safety (HP-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/library/forms

### PART A - KEY REPORT INFORMATION

<table>
<thead>
<tr>
<th>Report Type: (select all that apply)</th>
<th>Original:</th>
<th>Supplemental:</th>
<th>Final:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

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**Last Revision Date:** 06/08/2016

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: 1100 Louisiana Street
   - 3b. City: Houston
   - 3c. State: Texas
   - 3d. Zip Code: 77002
   - **Local time (24-hr clock) and date of the Accident:** 12/01/2015 22:10
4. **Location of Accident:**
   - Latitude: 35.95201
   - Longitude: -96.759592
5. **National Response Center Report Number (if applicable):** 1134731
6. **Local time (24-hr clock) and date of initial telephonic report to the National Response Center (if applicable):** 12/01/2015 22:35
7. **Commodity released:** 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
8. **Estimated volume of commodity released unintentionally (Barrels):** 1,000.00
9. **Estimated volume of intentional and/or controlled release/blowdown (Barrels):**
10. **Estimated volume of commodity recovered (Barrels):** 1,000.00
11. **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
12. **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
14. **General public:**

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Form PHMSA F 7000.1
<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>13. Total injuries (sum of above)</td>
<td></td>
</tr>
<tr>
<td>14. Was the pipeline/facility shut down due to the Accident?</td>
<td>Yes</td>
</tr>
<tr>
<td>- If No. Explain:</td>
<td></td>
</tr>
<tr>
<td>- If Yes, complete Questions 14a and 14b: (use local time, 24-hr clock)</td>
<td></td>
</tr>
<tr>
<td>14a. Local time and date of shutdown:</td>
<td>12/01/2015 22:10</td>
</tr>
<tr>
<td>14b. Local time pipeline/facility restarted:</td>
<td>12/02/2015 13:00</td>
</tr>
<tr>
<td>- Still shut down? (Supplemental Report Required)</td>
<td></td>
</tr>
<tr>
<td>15. Did the commodity ignite?</td>
<td>No</td>
</tr>
<tr>
<td>16. Did the commodity explode?</td>
<td>No</td>
</tr>
<tr>
<td>17. Number of general public evacuated:</td>
<td>0</td>
</tr>
<tr>
<td>18. Time sequence: (use local time, 24-hour clock):</td>
<td></td>
</tr>
<tr>
<td>18a. Local time Operator identified Accident - effective 7-2014 changed to &quot;Local time Operator identified failure&quot;:</td>
<td>12/01/2015 22:10</td>
</tr>
<tr>
<td>18b. Local time Operator resources arrived on site:</td>
<td>12/01/2015 22:10</td>
</tr>
</tbody>
</table>

**PART B - ADDITIONAL LOCATION INFORMATION**

1. Was the origin of the Accident onshore? Yes

2. State: Oklahoma
3. Zip Code: 74023
4. City: Cushing
5. County or Parish: Payne
6. Operator-designated location: Milepost/Valve Station
7. Pipeline/Facility name: West Terminal
8. Segment name/ID: Tank 23 flush line
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
   - If Other, Describe: Depth-of-Cover (ft): 36
12. Did Accident occur in a crossing? No
   - If Yes, specify type 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:
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 Terminal/Tank Farm Equipment and Piping
   - If Onshore Breakout Tank or Storage Vessel, including Attached Appurtenances, specify: Pipe
3. Item involved in Accident: Pipe
   - If Pipe, specify:
     - Pipe Body
     - 3a. Nominal diameter of pipe (in): 16
<table>
<thead>
<tr>
<th>Part D - Additional Consequence Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Wildlife impact:  No</td>
</tr>
<tr>
<td>1a. If Yes, specify all that apply:</td>
</tr>
<tr>
<td>- Fish/aquatic</td>
</tr>
<tr>
<td>- Birds</td>
</tr>
<tr>
<td>- Terrestrial</td>
</tr>
<tr>
<td>2. Soil contamination: Yes</td>
</tr>
<tr>
<td>3. Long term impact assessment performed or planned: No</td>
</tr>
<tr>
<td>4. Anticipated remediation: Yes</td>
</tr>
<tr>
<td>4a. If Yes, specify all that apply:</td>
</tr>
<tr>
<td>- Surface water</td>
</tr>
<tr>
<td>- Groundwater</td>
</tr>
<tr>
<td>- Soil</td>
</tr>
<tr>
<td>- Vegetation</td>
</tr>
<tr>
<td>- Wildlife</td>
</tr>
<tr>
<td>5. Water contamination: No</td>
</tr>
<tr>
<td>5a. If Yes, specify all that apply:</td>
</tr>
<tr>
<td>- Ocean/Seawater</td>
</tr>
<tr>
<td>- Surface</td>
</tr>
<tr>
<td>- Groundwater</td>
</tr>
<tr>
<td>- Drinking water: (Select one or both)</td>
</tr>
<tr>
<td>- Private Well</td>
</tr>
<tr>
<td>- Public Water Intake</td>
</tr>
<tr>
<td>5b. Estimated amount released in or reaching water (Barrels):</td>
</tr>
<tr>
<td>5c. Name of body of water, if commonly known:</td>
</tr>
<tr>
<td>6. At the location of this Accident, had the pipeline segment or facility been identified as one that &quot;could affect&quot; a High Consequence Area (HCA) as determined in the Operator's Integrity Management Program? No</td>
</tr>
<tr>
<td>7. Did the released commodity reach or occur in one or more High Consequence Area (HCA)? No</td>
</tr>
<tr>
<td>7a. If Yes, specify HCA type(s): (Select all that apply)</td>
</tr>
<tr>
<td>- Commercially Navigable Waterway:</td>
</tr>
<tr>
<td>- Was this HCA identified in the &quot;could affect&quot; determination for this Accident site in the Operator's</td>
</tr>
<tr>
<td>PART E - ADDITIONAL OPERATING INFORMATION</td>
</tr>
<tr>
<td>-----------------------------------------</td>
</tr>
<tr>
<td>1. Estimated pressure at the point and time of the Accident (psig):</td>
</tr>
<tr>
<td>2. Maximum Operating Pressure (MOP) at the point and time of the Accident (psig):</td>
</tr>
<tr>
<td>3. Describe the pressure on the system or facility relating to the Accident (psig):</td>
</tr>
<tr>
<td>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?</td>
</tr>
<tr>
<td>- If Yes, Complete 4a and 4b below:</td>
</tr>
<tr>
<td>4a. Did the pressure exceed this established pressure restriction?</td>
</tr>
<tr>
<td>4b. Was this pressure restriction mandated by PHMSA or the State?</td>
</tr>
<tr>
<td>5. Was &quot;Onshore Pipeline, Including Valve Sites&quot; OR &quot;Offshore Pipeline, Including Riser and Riser Bend&quot; selected in PART C, Question 27?</td>
</tr>
<tr>
<td>- If Yes (Complete 5a – 5f below) effective 12-2012, changed to &quot;(Complete 5a – 5e below)&quot;</td>
</tr>
<tr>
<td>5a. Type of upstream valve used to initially isolate release source:</td>
</tr>
<tr>
<td>5b. Type of downstream valve used to initially isolate release source:</td>
</tr>
<tr>
<td>5c. Length of segment isolated between valves (ft):</td>
</tr>
<tr>
<td>5d. Is the pipeline configured to accommodate internal inspection tools?</td>
</tr>
<tr>
<td>- If No, Which physical features limit tool accommodation? (select all that apply)</td>
</tr>
<tr>
<td>- Changes in line pipe diameter</td>
</tr>
<tr>
<td>- Presence of unsuitable mainline valves</td>
</tr>
<tr>
<td>- Tight or mitered pipe bends</td>
</tr>
<tr>
<td>- Other passage restrictions (i.e. unbarred tee’s, projecting instrumentation, etc.)</td>
</tr>
<tr>
<td>- Extra thick pipe wall (applicable only for magnetic flux leakage internal inspection tools)</td>
</tr>
<tr>
<td>- Other -</td>
</tr>
<tr>
<td>- If Other, Describe:</td>
</tr>
<tr>
<td>5e. For this pipeline, are there operational factors which significantly complicate the execution of an internal inspection tool run?</td>
</tr>
<tr>
<td>- If Yes, Which operational factors complicate execution? (select all that apply)</td>
</tr>
</tbody>
</table>
5f. Function of pipeline system: > 20% SMYS Regulated Trunkline/Transmission

6. Was a Supervisory Control and Data Acquisition (SCADA)-based system in place on the pipeline or facility involved in the Accident? Yes
   If Yes -
   6a. Was it operating at the time of the Accident? Yes
   6b. Was it fully functional at the time of the Accident? Yes
   6c. Did SCADA-based information (such as alarm(s), alert(s), event(s), and/or volume calculations) assist with the detection of the Accident? No
   6d. Did SCADA-based information (such as alarm(s), alert(s), event(s), and/or volume calculations) assist with the confirmation of the Accident? No

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 "Ground Patrol by Operator or its contractor" is selected in Question 8, specify: 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:
     Controller nor control room were a contributing factor
     - 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:

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? No
   - If Yes:
   1a. Specify how many were tested:
1b. Specify how many failed:

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

2a. Specify how many were tested:

2b. Specify how many failed:

**PART G – APPARENT CAUSE**

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).

<table>
<thead>
<tr>
<th>Apparent Cause:</th>
<th>G1 - Corrosion Failure</th>
</tr>
</thead>
</table>

**Corrosion Failure – Sub-Cause:**

Internal Corrosion

- **If External Corrosion:**
  1. Results of visual examination:
     - If Other, Describe:

  2. Type of corrosion: (select all that apply)
     - 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: (select all that apply)
     - 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:
     - General Corrosion
     - Other:

  7. Type of corrosion (select all that apply):
     - Corrosive Commodity
     - Water drop-out/Acid
     - Microbiological
     - Erosion
     - Other:
       - If Other, Describe: carbon dioxide

  8. The cause(s) of corrosion selected in Question 7 is based on the following (select all that apply):
     - Field examination
     - Determined by metallurgical analysis
     - Yes
     - Other:
       - If Other, Describe:

  9. Location of corrosion (select all that apply):
     - Low point in pipe
     - Yes
     - Elbow
     - Other:
<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>10. Was the commodity treated with corrosion inhibitors or biocides?</td>
<td>Yes</td>
</tr>
<tr>
<td>11. Was the interior coated or lined with protective coating?</td>
<td>No</td>
</tr>
<tr>
<td>12. Were cleaning/dewatering pigs (or other operations) routinely</td>
<td>Not applicable - Not mainline pipe</td>
</tr>
<tr>
<td>utilized?</td>
<td></td>
</tr>
<tr>
<td>13. Were corrosion coupons routinely utilized?</td>
<td>Not applicable - Not mainline pipe</td>
</tr>
</tbody>
</table>

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?
   - No

17. Has one or more Direct Assessment been conducted on this segment?
   - No

18. Has one or more non-destructive examination been conducted at the point of the Accident since January 1, 2002?
   - No

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-hand column

Natural Force Damage - Sub-Cause:

- If Earth Movement, NOT due to Heavy Rains/Floods:

  1. Specify:

Form PHMSA F 7000.1
## If Heavy Rains/Floods:
- If Other, Describe:

## If Lightning:
- If Other, Describe:

## If Temperature:
- If Other, Describe:

## If Other Natural Force Damage:
- If Other, Describe:

**Complete the following if any Natural Force Damage sub-cause is selected.**

6a. Were the natural forces causing the Accident generated in conjunction with an extreme weather event?

- 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 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:
   - 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:
<table>
<thead>
<tr>
<th>Handheld Ultrasonic Tool</th>
<th>Most recent year conducted:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet Magnetic Particle Test</td>
<td>Most recent year conducted:</td>
</tr>
<tr>
<td>Dry Magnetic Particle Test</td>
<td>Most recent year conducted:</td>
</tr>
<tr>
<td>Other</td>
<td>Most recent year conducted:</td>
</tr>
</tbody>
</table>

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: (select all that apply) -
       - One-Call System
       - 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: (select all that apply) -
   - 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 (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):
   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:

1. If Damage by Car, Truck, or Other Motorized Vehicle/Equipment NOT Engaged in Excavation:
   1. Vehicle/Equipment operated by:

2. 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:

3. 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.

Form PHMSA F 7000.1
### 3. 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:

#### 8. If Intentional Damage:
- **Specify:**
  - If Other, Describe:

#### 9. If Other Outside Force Damage:
- **Specify:**
  - If Other, 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:
1. The sub-cause shown above is based on the following: (select all that apply)
   - Field Examination
   - Determined by Metallurgical Analysis
   - Other Analysis
   - If Other Analysis, Describe:
     - Sub-cause is Tentative or Suspected; Still Under Investigation (Supplemental Report required)
2. List contributing factors: (select all that apply)
   - Fatigue or Vibration-related
     Specify:
   - Mechanical Stress:
   - Other:
     - If Other, Describe:

3. Specify:
   - If Other - Describe:

Complete the following if any Material Failure of Pipe or Weld sub-cause is selected.

4. Additional factors: (select all that apply):
   - Dent
   - Gouge
   - Pipe Bend
   - Arc Burn
   - Crack
   - 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?
   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?
   - If Yes:
     Most recent year tested:
     Test pressure (psig):

7. 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:

8. Has one or more non-destructive examination(s) been conducted at the point of the Accident since January 1, 2002?
   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: (select all that apply)
     - Control Valve
     - Instrumentation
     - SCADA
     - Communications
     - Block Valve
     - Check Valve
     - Relief Valve
     - Power Failure
     - Steep/Control Fitting
     - ESD System Failure
     - Other
         - If Other - Describe:

- If Pump or Pump-related Equipment:
  2. Specify:

- If Threaded Connection/Coupling Failure:
  3. Specify:

- If Non-threaded Connection Failure:
  4. Specify:

- 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: (select all that apply)
   - 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:**

- If Tank, Vessel, or Sump/Separator Allowed or Caused to Overfill or Overflow
  1. Specify:

- If Other Incorrect Operation

Form PHMSA F 7000.1
2. Describe:

Complete the following if any Incorrect Operation sub-cause is selected.

3. Was this Accident related to (select all that apply):
   - 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

On 12/31/2015 at approximately 22:16 local operating personnel discovered crude oil coming from the ground near the tank 23 flush line. All incoming and outgoing movements were shutdown until the source could be identified. Hydro-excavation was completed and verified the source to be tank 23 flush line. A clamp was installed and all movements restarted.

After metallurgical analysis was completed it was determined that the pinhole was caused by carbon dioxide attack of the pipe.

Tank 23 flush line has been abandoned. This is the final repair to close the report.

PART I - PREPARE AND AUTHORIZED SIGNATURE

<table>
<thead>
<tr>
<th>Preparer's Name</th>
<th>Chase Andress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparer's Title</td>
<td>Pipeline Compliance Specialist</td>
</tr>
<tr>
<td>Preparer's Telephone Number</td>
<td>713-381-6426</td>
</tr>
<tr>
<td>Preparer's E-mail Address</td>
<td><a href="mailto:candress@eprod.com">candress@eprod.com</a></td>
</tr>
<tr>
<td>Preparer's Facsimile Number</td>
<td></td>
</tr>
<tr>
<td>Authorized Signer Name</td>
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<tr>
<td>Authorized Signer Title</td>
<td>Pipeline Compliance Specialist</td>
</tr>
<tr>
<td>Authorized Signer Telephone Number</td>
<td>713-381-6426</td>
</tr>
<tr>
<td>Authorized Signer Email</td>
<td><a href="mailto:candress@eprod.com">candress@eprod.com</a></td>
</tr>
<tr>
<td>Date</td>
<td>06/06/2016</td>
</tr>
</tbody>
</table>
Appendix D

Laboratory Analysis

This document is on file at PHMSA