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

Principal Investigators	Gene Roberson; Victor Lopez
Region Director	R. M. Seeley
Date of Report	10/17/2011
Subject	Failure Investigation Report – Tennessee Gas Pipeline Co. – Wrinkle Bend Failure

Operator, Location, & Consequences

Date of Failure	11/30/2010
Commodity Released	Natural Gas
City/County & State	Natchitoches/ Natchitoches Parish, LA
OpID & Operator Name	19160 Tennessee Gas Pipeline Co
Unit # & Unit Name	4044 Natchitoches District
SMART Activity #	132096
Milepost / Location	Tennessee Gas Pipeline Co., Station 40, Natchitoches, LA
Type of Failure	Circumferential rupture within a wrinkle bend
Fatalities	0
Injuries	0
Description of area impacted	Operators ROW and semi-rural area.
Property Damage	$ 116,000

Executive Summary

On November 30, 2010 Tennessee Gas Pipeline Company made a notification to the National Response Center reporting a natural gas release on their Tennessee Gas Pipeline (TGP) 100 system. Upon review of the information two investigators from the Southwest Region were dispatched to the accident site the following day.

At approximately 2:40 pm CST, November 30, 2010, TGP identified a release of natural gas for unknown causes downstream of their TGP Station 40, System 100-2, at Natchitoches, La. The failed pipe consisted of 30" diameter, 0.312" wall, X-52 (52,000 SMYS), DSAW seam, located approximately 1.4 miles downstream of the compressor station. The rupture occurred in a wrinkle bend, from original construction, located on the top of the pipe. The TGP system is monitored by gas control in Houston, Texas. The pipeline system consists of 4 lines, in 2 ROWs as they leave the Natchitoches Station.

There was no fire or injuries associated with this failure, but Highway 1 was closed by the Louisiana Sheriff's Department and local emergency personnel, with several residences evacuated as precautionary measures until site was secured. The section of pipeline was isolated and the system was blown down by approximately 4:40 pm, after which the road was re-opened and the residents returned to their homes.

The pipeline MAOP is 750 psig and was operating normally at approximately 671 psig when the failure occurred. A 50 inch long, straight circumferential crack had occurred in a wrinkle bend on the 30 inch OD pipeline. Wrinkle bends were common in construction when the pipeline was installed in 1948.

System Details

Tennessee Gas Pipeline Company is a subsidiary of El Paso Corporation. Its primary function is transportation of natural gas for industrial and commercial deliveries. TGP provides natural gas from South Texas to the East Coast through various systems that they operate. The 100 System consist of 4600 miles of multiple pipelines (24" thru 30") running from Texas to West Virginia.

The Natchitoches Area (Unit 4044) operates the 100 system from MLV 36 on the west side of the Toledo Bend reservoir to MLV 44 near Hillsboro, LA. The main line system is comprised of 3 looped pipelines from MLV 37 to Station 40 and 4 looped lines from Station 40 to MLV 47 for 372 total miles of pipeline in the unit. The unit includes the Natchitoches Compressor Station 40 and 12 laterals in sizes ranging from 4 to 20 inch diameter from producing fields that feed gas into the mainline system.

The failure did not occur in an area identified as an HCA.

Events Leading up to the Failure

The Natchitoches Station was operating normally at 671 psig (MAOP 750 psig) on Tuesday, November 30, 2010 when a report was received of gas releasing from the TGP system. Personnel from the station responded immediately to shut in the systems and identify the location. At this point TGP has 4 pipelines leaving Station 40 operating as a single unit. No ROW or maintenance work was being performed (or had been) in the area of the incident when the incident occurred. No warning or abnormal situation occurred prior to the failure.

TGP reported the release to the NRC at approximately 5:08 pm CST on November 10, 2010. (See Appendix A)

Emergency Response

TGP's Station 40 was shut down and TGP's Control Center monitored the 100 System from Natchitoches, LA to West Monroe, LA pending confirmation of the release location by technicians in the field. The location was established to be between HWY 1 and SR 3191, and line 100-2 was isolated and allowed to blow down. The Natchitoches Fire Department and LA State Police had closed HWY 1 and evacuated approximately 100 homes as a precautionary measure during the incident. There was no fire, injuries or explosion associated with this incident. Once the pipeline had blown down and area was tested for residual vapors, all residents were allowed back in their homes by 10:00 PM CST and the road was re-opened.

Summary of Return-to-service

Following the emergency response, TGP isolated Line 100-2 from MLV 40-2 to MLV 41-2. Site evaluation was performed of the failure and a plan for repair, pending environmental evaluation, was developed. TGP then cut out the failed section and installed approximately 30 feet of pretested pipe, pre bent to match the existing sag bend.

A CAO was issued on December 3, 2010 with requirements for returning the pipeline to service. The pipeline was allowed to return to operation with a pressure restriction. Due to the line's configuration and interconnection with other pipelines, TGP took a longer section of line 100 out of service to maintain throughput on the other lines. Following the amended CAO, some sections were returned to normal operation but the area involving the failure (MLV 40-2 to MLV 41-2) remains out of service. Action items are still being performed on this section of pipe per the CAO.

Investigation Details

At approximately 5:08 pm CST, November 30, 2010, Tennessee Gas Pipeline Co. (TGP) reported to the National Response Center a release of natural gas due an unknown cause on their pipeline downstream of Station 40, Natchitoches, Louisiana. PHMSA's Southwest Region received the incident notification and made plans to have two investigators on site the next day. The investigators arrived on site at 3:00 pm on December 1st. Site drawings, safety orientation, pipeline specifications and initial findings were reviewed while the operator was still preparing to make site safe for entry. Once cleared, the site was entered and the extent of damage was assessed. The operator's written report can be seen in Appendix B.

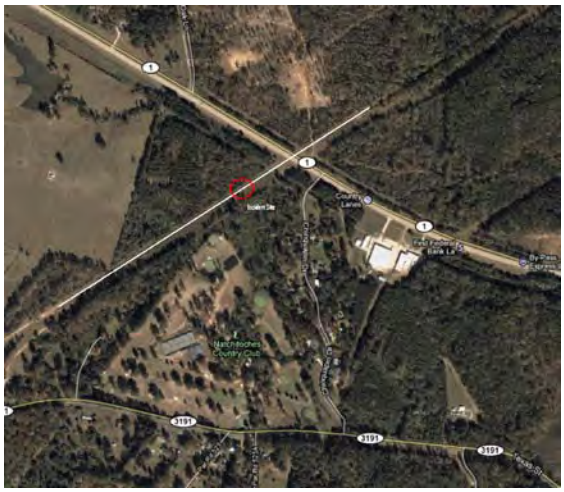

Figure 1: Location of Failure

The MAOP of the pipeline is 750 psig and the operating pressure when the incident occurred was 671 psig. The incident was a sudden failure, leaving a 15' hole around the pipeline. No personal injuries or fire was associated with the incident and all damage was within the limits of the ROW. The PHMSA investigators were able to view the site with the operator. The origin of the release was from a circumferential crack within a wrinkle bend established during construction of the pipeline in 1948. No cause for failure was apparent from visual examination. Photos of the failed section can be seen in Appendix C.

The operator removed the section of pipe containing the failed wrinkle bend and 2 additional wrinkle bends used to establish the sag bend on the pipeline. The section of pipe was sent to a metallurgical lab for testing.

The pipeline has remained out of service pending outcome of investigation and requirements of CPF 4-2010-1007H.

Metallurgical Analysis

The section of pipe was sent to the operator's El Paso, Texas metallurgical lab for analysis. The full report can be seen in Appendix D.

The conclusions from the report are:

- The failure consisted of a 50.5" long circumferential, tensile overload fracture along the apex of the most downstream convolution of a three wrinkle, under bend that resulted from the cumulative effects of stresses acting on the line. The stresses concentrated in the wrinkle bend were from:
  a. External stresses from probable shifting of the surrounding soil endured by the line,
  b. The tri-axial state of stresses inherent to the configuration of in-service wrinkle bends (geometric stress concentrations),
  c. Internal line pressure from normal pipeline operations.
- Visual, stereomicroscopic, metallographic, and SEM analyses confirmed the failure originated near the 12 o'clock position in a tensile overload manner.
- No Stress Corrosion Cracking (SCC) or other time dependant crack-like indications were

discovered by magnetic particle inspection (MPI) of the under bend.
- No measurable external and/or internal corrosion was observed on the pipe segment.
- The chemical composition and mechanical properties of the pipe base metal near the origin, but outside of any wrinkled areas, met typical requirements for line pipe steels of the era.

Hydrogeological Analysis

Local hydrogeological conditions at the site were evaluated to determine if the hydrogeological conditions contributed to the failure. The full report can be seen in Appendix E.

The conclusion is that local hydrogeological conditions did not significantly alter the load on the pipe or support of the pipe, or contribute to the leak because:

- Observations made on 12-2 and 12-3, 2010, in the excavation for removal and repair of the pipe, indicated that the lithology in the interval in which the pipeline leaked was predominantly silty clay, with minor amounts of silt and argillaceous sand. While some of the clay was plastic, the material was predominately dry during both days of observation.
- Land surface at the leak area was well vegetated and there was no evidence of surface erosion or any concentration of surface water runoff.
- The leak site was in a gently sloping change in topography which was not part of a significant natural surface water drainage feature.
- The land surface was well drained and ponding was likely to occur, reducing the potential for saturation and problems relating to shrinking and swelling clays.
- Lithology at this site consist primarily of relatively impermeable clay and silty clay, which is not conducive to transmittal of ground water.
- The walls of the excavation were dry on 12-2 and 12-3, 2010; no ground water was observed seeping through the walls of or pooling at the bottom of the trench.
- The depth of burial of the pipe (≈5 ft.) decreases the potential effects of infiltration of surface water, including providing moisture for changes in volume of clays around the pipe.
- There was no evidence of decreased support by or movement of subsurface materials near the failure.

These results are being reviewed by El Paso's Root Cause Analysis (RCA) Team for the development of a remedial action plan.

Findings and Contributing Factors

The fracture occurred at approximately 2:40 pm CST on November 10, 2010. TGP's Control Center took immediate actions to shut-in Station 40 pending confirmation of location of reported release by area personnel. The discovery and isolation was prompt and operator's actions appear to be appropriate.

The failure initiated with a circumferential crack within a wrinkle bend on the top half of TGP's 30", 100-2 system approximately 1.5 miles downstream of Station 40.

There were no indications of external or internal corrosion to contribute to the crack. Also, there was no evidence of mechanical damage to the pipe to contribute to the failure.

Testing of additional wrinkle bends removed from the pipeline have not identified any additional threats of failure associated with wrinkle bends from original construction.

Appendices

A Telephonic Notice Report – NRC #961059
B Written Accident Report – ODES #20100106
C Failure Site Photos
D Metallurgical Report
E Hydrogeological Report

Appendix A

NATIONAL RESPONSE CENTER 1-800-424-8802
*** For Public Use ***
Information released to a third party shall comply with any
applicable federal and/or state Freedom of Information and Privacy Laws

Incident Report # 961059

INCIDENT DESCRIPTION

*Report taken at 17:08 on 30-NOV-10
Incident Type: PIPELINE
Incident Cause: UNKNOWN
Affected Area:
The incident occurred on 30-NOV-10 at 15:00 local time.
Affected Medium: AIR ATMOSPHERE

SUSPECTED RESPONSIBLE PARTY

Organization: TENNESSEE GAS PIPELINE COMPANY
KINDER, LA 70648

Type of Organization: PUBLIC UTILITY

INCIDENT LOCATION

HWY 1 County: NATCHITOCHES
City: NATCHITOSCHES State: LA
Latitude: 31° 47' 13" N

Longitude: 093° 07' 30" W

RELEASED MATERIAL(S)

CHRIS Code: ONG Official Material Name: NATURAL GAS
Also Known As:
Qty Released: 0 UNKNOWN AMOUNT

DESCRIPTION OF INCIDENT

CALLER IS REPORTING A PIPELINE RUPTURE DUE TO UNKNOWN CAUSE.

INCIDENT DETAILS

Pipeline Type: TRANSMISSION
DOT Regulated: YES
Pipeline Above/Below Ground: BELOW
Exposed or Under Water: NO
Pipeline Covered: UNKNOWN

DAMAGES

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			

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

Passengers Transferred: NO
Environmental Impact: NO
Media Interest: NONE Community Impact due to Material:

REMEDIAL ACTIONS

PIPELINE SHUT IN AND ISOLATED, PIPELINE PRESSURE IS AT 100LBS AND FALLING.
Release Secured: NO
Release Rate:
Estimated Release Duration:

WEATHER

Weather: CLEAR, ºF

ADDITIONAL AGENCIES NOTIFIED

Federal: PHMSA
State/Local: STATE POLICE
State/Local On Scene: STATE POLICE
State Agency Number: 10-06859

NOTIFICATIONS BY NRC

CALCASIEU PARISH SHERIFF'S DEPT (CRIMINAL INTELLIGENCE UNIT)
30-NOV-10 17:14
USCG ICC (ICC ONI)
30-NOV-10 17:14
CGIS RAO ST. LOUIS (COMMAND CENTER)
30-NOV-10 17:14
DOT CRISIS MANAGEMENT CENTER (MAIN OFFICE)
30-NOV-10 17:14
U.S. EPA VI (MAIN OFFICE)
30-NOV-10 17:14
FLD INTEL SUPPORT TEAM NEW ORLEANS (SUPERVISOR, FIST NEW ORLEANS)
30-NOV-10 17:14
FLD INTEL SUPPORT TEAM PORT ARTHUR (FIST COMMAND CENTER)
30-NOV-10 17:14
JFO-LA (COMMAND CENTER)
30-NOV-10 17:14
JFO-LA (FEMA JFO LA)
30-NOV-10 17:14
LA DEPT OF ENV QUAL (MAIN OFFICE)
30-NOV-10 17:14
LA DEPT OF WILDLIFE AND FISHERIES (ATTN: LAURA CARVER)
30-NOV-10 17:14
LA GOV OFFICE HS AND EMERGENCY PREP (MAIN OFFICE)
30-NOV-10 17:14
LA OFFICE OF GOV (MAIN OFFICE)
30-NOV-10 17:14
LA OFFICE OF PUBLIC HEALTH (MAIN OFFICE)
30-NOV-10 17:14
NATIONAL INFRASTRUCTURE COORD CTR (MAIN OFFICE)
30-NOV-10 17:14
NOAA RPTS FOR LA (MAIN OFFICE)
30-NOV-10 17:14
SECTOR LOWER MISSISSIPPI RIVER (CONDITIONAL NRC NOTIFICATIONS)
30-NOV-10 17:25
LA STATE POLICE (MAIN OFFICE)
30-NOV-10 17:14
MSU BATON ROUGE (MAIN OFFICE)
30-NOV-10 17:14

ADDITIONAL INFORMATION

CALLER HAD NO ADDITIONAL INFORMATION.

*** END INCIDENT REPORT # 961059 ***

The National Response Center is strictly an initial report taking agency

and does not participate in the investigation or incident response. The NRC receives initial reporting information only and notifies Federal and State On-Scene Coordinators for response. The NRC does not verify nor does it take follow-on incident information. Verification of data and incident response is the sole responsibility of Federal/State On-Scene Coordinators. Data contained within the FOIA Web Database is initial information only. All reports provided via this server are for informational purposes only. Data to be used in legal proceedings must be obtained via written correspondence from the NRC.

Appendix B

NOTICE: This report is required by 49 CFR Part 191. 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: 2137-0522 EXPIRATION DATE: 01/31/2013
U.S Department of Transportation Pipeline and Hazardous Materials Safety Administration	**Report Date:** 12/21/2010 **No.** 20100106 - 15341 (DOT Use Only)

INCIDENT REPORT - GAS TRANSMISSION AND GATHERING PIPELINE SYSTEMS

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: *(select all that apply)*	**Original:**	**Supplemental:**	**Final:**
		Yes	**Yes**

Last Revision Date:	09/28/2011
1. Operator's OPS-issued Operator Identification Number (OPID):	19160
2. Name of Operator	TENNESSEE GAS PIPELINE CO (EL PASO)
3. Address of Operator:	
3a. Street Address	569 Brookwood center, Suite 501
3b. City	BIRMINGHAM
3c. State	Alabama
3d. Zip Code:	35209
4. Local time *(24-hr clock)* and date of the Incident:	11/30/2010 14:50
5. Location of Incident:	
Latitude:	31.78692
Longitude:	-93.125589
6. National Response Center Report Number (if applicable):	961059
7. Local time *(24-hr clock)* and date of initial telephonic report to the National Response Center (if applicable):	11/30/2010 16:10
8. Incident resulted from:	Unintentional release of gas
9. Gas released: (select only one, based on predominant volume released)	Natural Gas
- Other Gas Released Name:	
10. Estimated volume of commodity released unintentionally - Thousand Cubic Feet (MCF):	14,980.00
11. Estimated volume of intentional and controlled release/blowdown - Thousand Cubic Feet (MCF)	
12. Estimated volume of accompanying liquid release (Barrels):	
13. Were there fatalities?	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 fatalities (sum of above)	
14. Were there injuries requiring inpatient hospitalization?	No
- If Yes, specify the number in each category:	
14a. Operator employees	
14b. Contractor employees working for the Operator	
14c. Non-Operator emergency responders	
14d. Workers working on the right-of-way, but NOT associated with this Operator	
14e. General public	
14f. Total injuries (sum of above)	
15. Was the pipeline/facility shut down due to the incident?	Yes
- If No, Explain:	

- If Yes, complete Questions 15a and 15b: *(use local time, 24-hr clock)*	
15a. Local time and date of shutdown	11/30/2010 16:00
15b. Local time pipeline/facility restarted	
- Still shut down? (* Supplemental Report Required)	Yes
16. Did the gas ignite?	No
17. Did the gas explode?	No
18. Number of general public evacuated:	
19. Time sequence *(use local time, 24-hour clock)*:	
19a. Local time operator identified Incident	11/30/2010 14:50
19b. Local time operator resources arrived on site	11/30/2010 16:00

PART B - ADDITIONAL LOCATION INFORMATION

1. Was the origin of the Incident onshore?	Yes
- Yes (Complete Questions 2-12)	
- No (Complete Questions 13-15)	
If Onshore:	
2. State:	Louisiana
3. Zip Code:	71457
4. City	Natchitoches
5. County or Parish	Natchitoches
6. Operator designated location	Milepost/Valve Station
Specify:	40-2D + 1.39
7. Pipeline/Facility name:	Line 100-2
8. Segment name/ID:	40-2D
9. Was Incident on Federal land, other than the Outer Continental Shelf (OCS)?	No
10. Location of Incident :	Operator-controlled property
11. Area of Incident (as found) :	Underground
Specify:	Under soil
Other – Describe:	
Depth-of-Cover (in):	56
12. Did Incident 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 Incident:	
Select:	
If Offshore:	
13. Approx. water depth (ft) at the point of the Incident:	
14. Origin of Incident:	
- If "In State waters":	
- State:	
- Area:	
- Block/Tract #:	
- Nearest County/Parish:	
- If "On the Outer Continental Shelf (OCS)":	
- Area:	
- Block #:	
15. Area of Incident:	

PART C - ADDITIONAL FACILITY INFORMATION

1. Is the pipeline or facility: - Interstate - Intrastate	Interstate
2. Part of system involved in Incident:	Onshore Pipeline, Including Valve Sites
3. Item involved in Incident:	Pipe
- If Pipe – Specify:	Pipe Body
3a. Nominal diameter of pipe (in):	30
3b. Wall thickness (in):	.312
3c. SMYS (Specified Minimum Yield Strength) of pipe (psi):	52,000
3d. Pipe specification:	API 5L or equivalent
3e. Pipe Seam – Specify:	DSAW

- If Other, Describe:	
3f. Pipe manufacturer:	Consolidated
3g. Year of manufacture:	1948
3h. Pipeline coating type at point of Incident – Specify:	Coal Tar
- If Other, Describe:	
- If Weld, including heat-affected zone – Specify:	
- If Other, Describe:	
- If Valve – Specify:	
- If Mainline – Specify:	
- If Other, Describe:	
3i. Mainline valve manufacturer:	
3j. Year of manufacture:	
- If Other, Describe:	
4. Year item involved in Incident was installed:	1948
5. Material involved in Incident:	Carbon Steel
- If Material other than Steel or Plastic – Specify:	
6. Type of Incident involved:	Leak
- If Mechanical Puncture – Specify Approx. size:	
Approx. size: in. (in axial) by	
in. (circumferential)	
- If Leak - Select Type:	Crack
- If Other – Describe:	
- If Rupture - Select Orientation:	
- If Other – Describe:	
Approx. size: in. (widest opening):	
by in. (length circumferentially or axially):	
- If Other – Describe:	

PART D - ADDITIONAL CONSEQUENCE INFORMATION

1. Class Location of Incident:	Class 1 Location
2. Did this Incident occur in a High Consequence Area (HCA)?	No
- If Yes:	
2a. Specify the Method used to identify the HCA:	
3. What is the PIR (Potential Impact Radius) for the location of this Incident? Feet:	567
4. Were any structures outside the PIR impacted or otherwise damaged due to heat/fire resulting from the Incident?	No
5. Were any structures outside the PIR impacted or otherwise damaged NOT by heat/fire resulting from the Incident?	No
6. Were any of the fatalities or injuries reported for persons located outside the PIR?	No
7. Estimated cost to Operator :	
7a. Estimated cost of public and non-Operator private property damage paid/reimbursed by the Operator	$ 0
7b. Estimated cost of gas released unintentionally	$ 54,000
7c. Estimated cost of gas released during intentional and controlled blowdown	$ 0
7d. Estimated cost of Operator's property damage & repairs	$ 52,000
7e. Estimated cost of Operator's emergency response	$ 10,000
7f. Estimated other costs	$ 0
Describe:	Other costs relative to a CAO yet to be determined.
7g. Estimated total costs (sum of above)	$ 116,000

PART E - ADDITIONAL OPERATING INFORMATION

1. Estimated pressure at the point and time of the Incident (psig):_	671.00
2. Maximum Allowable Operating Pressure (MAOP) at the point and time of the Incident (psig):	750.00
3. Describe the pressure on the system or facility relating to the Incident:	Pressure did not exceed MAOP
4. Not including pressure reductions required by PHMSA regulations (such as for repairs and pipe movement), was the system or facility relating to the Incident operating under an established pressure restriction with pressure limits below those normally allowed by the MAOP?	No
- If Yes - (*Complete 4a and 4b 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?	Yes
- If Yes - (*Complete 5a. - 5f. below):*	
5a. Type of upstream valve used to initially isolate release source:	Manual
5b. Type of downstream valve used to initially isolate release source:	Manual
5c. Length of segment isolated between valves (ft):	29,257
5d. Is the pipeline configured to accommodate internal inspection tools?	Yes
- 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?	No
- If Yes, which operational factors complicate execution? *(select all that apply)*	
- Excessive debris or scale, wax, or other wall build-up	
- Low operating pressure(s)	
- Low flow or absence of flow	
- Incompatible commodity	
- Other	
- If Other, Describe:	
5f. Function of pipeline system:	Transmission System
6. Was a Supervisory Control and Data Acquisition (SCADA)-based system in place on the pipeline or facility involved in the Incident?	Yes
- If Yes:	
6a. Was it operating at the time of the Incident?	Yes
6b. Was it fully functional at the time of the Incident?	Yes
6c. Did SCADA-based information (such as alarm(s), alert(s), event(s), and/or volume or pack calculations) assist with the detection of the Incident?	No
6d. Did SCADA-based information (such as alarm(s), alert(s), event(s), and/or volume calculations) assist with the confirmation of the Incident?	No
7. How was the Incident initially identified for the Operator?	Notification From Public
- If Other – Describe:	
7a. If "Controller", "Local Operating Personnel, including contractors", "Air Patrol", or "Ground Patrol by Operator or its contractor" is selected in Question 7, specify the following:	
8. 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 Incident?	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)*	No overpressure condition was present.
- If Yes, Describe 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 Incident, 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. Describe how many were tested:	
1b. Describe how many failed:	
2. As a result of this Incident, 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. Describe how many were tested:	
2b. Describe how many failed:	

PART G - APPARENT CAUSE

Select only one box from PART G in the shaded column on the left representing the APPARENT Cause of the Incident, and answer the questions on the right. Describe secondary, contributing, or root causes of the Incident in the narrative (PART H).

Apparent Cause:	G5 - Material Failure of Pipe or Weld

G1 - Corrosion Failure - *only one **sub-cause** can be picked from shaded left-hand column*

Corrosion Failure – Sub-cause:	
- 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 incident?	
- If Yes, Year protection started:	
4b. Was shielding, tenting, or disbonding of coating evident at the point of the incident?	
4c. Has one or more Cathodic Protection Survey been conducted at the point of the incident?	
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:	
- If Other, Describe:	
7. Cause of corrosion *(select all that apply)*:	

- 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 *(select all that apply)*:	
- Field examination	
- Determined by metallurgical analysis	
- Other	
- If Other, Describe:	
9. Location of corrosion *(select all that apply)*:	
- Low point in pipe	
- Elbow	
- Drop-out	
- Other	
- If Other, Describe:	
10. Was the gas/fluid 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 Incident" (from PART C, Question 3) is Pipe or Weld.	
14. Has one or more internal inspection tool collected data at the point of the Incident?	
14a. 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 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:	
If Other, Describe:	
15. Has one or more hydrotest or other pressure test been conducted since original construction at the point of the Incident?	
- If Yes,	
Most recent year tested:	
Test pressure (psig):	
16. Has one or more Direct Assessment been conducted on this segment?	
- If Yes, and an investigative dig was conducted at the point of the Incident:	
Most recent year conducted:	
- If Yes, but the point of the Incident was not identified as a dig site:	
Most recent year conducted:	
17. Has one or more non-destructive examination been conducted at the point of the Incident since January 1, 2002?	
17a. 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 examined:	
- Guided Wave Ultrasonic	
Most recent year examined:	
- Handheld Ultrasonic Tool	
Most recent year examined:	
- Wet Magnetic Particle Test	
Most recent year examined:	

- Dry Magnetic Particle Test	
Most recent year examined:	
- Other	
Most recent year examined:	
If Other, 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 Incident generated in conjunction with an extreme weather event?	
6a. If yes, specify: *(select all that apply)*:	
- 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 Incident" (From Part C, Question 3) is Pipe or Weld.	
1. Has one or more internal inspection tool collected data at the point of the Incident?	
1a. If Yes, for each tool used, select type of internal inspection tool and indicate most recent year run:	
- Magnetic Flux Leakage	
Year:	
- Ultrasonic	
Year:	
- Geometry	
Year:	
- Caliper	
Year:	
- Crack	
Year:	
- Hard Spot	
Year:	
- Combination Tool	
Year:	
- Transverse Field/Triaxial	
Year:	
- Other:	
Year:	
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 Incident?	
- 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 Incident:	
Most recent year conducted:	
- If Yes, but the point of the Incident 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 Incident 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	
Year:	
- Guided Wave Ultrasonic	
Year:	
- Handheld Ultrasonic Tool	
Year:	
- Wet Magnetic Particle Test	
Year:	
- Dry Magnetic Particle Test	
Year:	
- Other	
Year:	
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	
- 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 *(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? - Yes - No	
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, then one predominant second level CGA-DIRT Root Cause as well*):	
- Predominant first level CGA-DIRT 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 Incident" (from PART C, Question 3) is Pipe or Weld.	
3. Has one or more internal inspection tool collected data at the point of the Incident?	
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 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:	
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 Incident?	
- 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 Incident :	
Most recent year conducted:	
- If Yes, but the point of the Incident 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 Incident 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

- If Intentional Damage:	
8. Specify:	
- If Other, Describe:	
- If Other Outside Force Damage:	
9. Describe:	

G5 - Pipe, Weld, or Joint Failure	**Use this section to report material failures ONLY IF the "Item Involved in Incident" (from PART C, Question 3) is "Pipe" or "Weld."**
	Only one **sub-cause** can be selected from the shaded left-hand column

Pipe, Weld or Join Failure – Sub-Cause:	Construction-, Installation-, or Fabrication-related
1. The sub-case selected below is based on the following *(select all that apply)*:	
- 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: *(select all that apply)*	
- If Fatigue or Vibration related:	
Specify:	
- If Other, Describe:	
- Mechanical Stress	Yes
- Other	
- If Other, Describe:	
- If Original Manufacturing-related (NOT girth weld or other welds formed in the field):	
2. List contributing factors: *(select all that apply)*	
- If Fatigue or Vibration related:	
Specify:	
- If Other, Describe:	
- Mechanical Stress	
- Other	
- If Other, Describe:	
- If Environmental Cracking-related:	
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	Yes
- Arc Burn	
- Crack	Yes
- Lack of Fusion	
- Lamination	
- Buckle	
- Wrinkle	Yes
- Misalignment	
- Burnt Steel	
- Other	
- If Other, Describe:	
5. Has one or more internal inspection tool collected data at the point of the Incident?	Yes

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	Yes
Most recent year run:	2010
- Geometry	
Most recent year run:	
- Caliper	Yes
Most recent year run:	2010
- 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 Incident?	Yes
- If Yes:	
Most recent year tested:	1985
Test pressure (psig):	1,024.00
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 Incident:	
Most recent year conducted:	
- If Yes, but the point of the Incident 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 Incident 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:	
- Control Valve	
- Instrumentation	
- SCADA	
- Communications	
- Block Valve	
- Check Valve	
- Relief Valve	
- Power Failure	
- Stopple/Control Fitting	
- Pressure Regulator	

- ESD System Failure	
- Other	
- If Other, Describe:	
- If Compressor or Compressor-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 Compressor), Vessel 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 *(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 gas/fluid	
- 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 Damage by Operator or Operator's Contractor NOT Related to Excavation and NOT due to Motorized Vehicle/Equipment Damage:	
- If Underground Gas Storage, Pressure Vessel, or Cavern Allowed or Caused to Overpressure:	
1. Specify:	
- If Other, Describe:	
- If Valve Left or Placed in Wrong Position, but NOT Resulting in an Overpressure:	
- If Pipeline or Equipment Overpressured:	
- If Equipment Not Installed Properly:	
- If Wrong Equipment Specified or Installed:	
- If Other Incorrect Operation:	
2. Describe:	
Complete the following if any Incorrect Operation sub-cause is selected.	
3. Was this Incident 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 Incident:	
5. Was the task(s) that led to the Incident 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 Incident Cause - only one **sub-cause** can be selected from the shaded left-hand column

Other Incident Cause – **Sub-Cause:**	
- If Miscellaneous:	
1. Describe:	
- If Unknown:	
2. Specify:	

PART - H NARRATIVE DESCRIPTION OF THE INCIDENT

A loud noise was reported to Tennessee Gas Pipeline (TGP) by a member of the general public in the vicinity of TGP pipeline facilities in Natchitoches, Louisiana. Upon initial investigation, TGP operations personnel found a natural gas leak in the 100-2 pipeline. Visual examination revealed that the leak was coming from a crack in a wrinkle bend. The crack was 1/2" wide and propagated for a length of 50.5" around the circumference of the pipeline. Metallugical analysis revealed that the crack in the wrinkle bend was likely due to concentrated mechanical stresses coming from external stresses from probable shifting of the surrounding soil, triaxial state of stresses inherent to in-service wrinkle bends (geometric), and internal line pressure from normal pipeline operations.

File Full Name

PART I - PREPARER AND AUTHORIZED SIGNATURE

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Date	09/28/2011

Appendix C

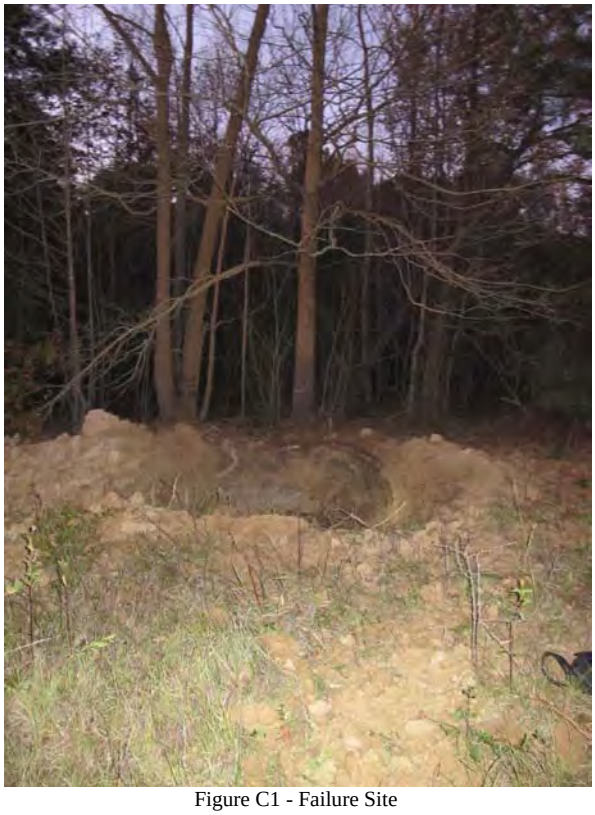

Figure C1 - Failure Site

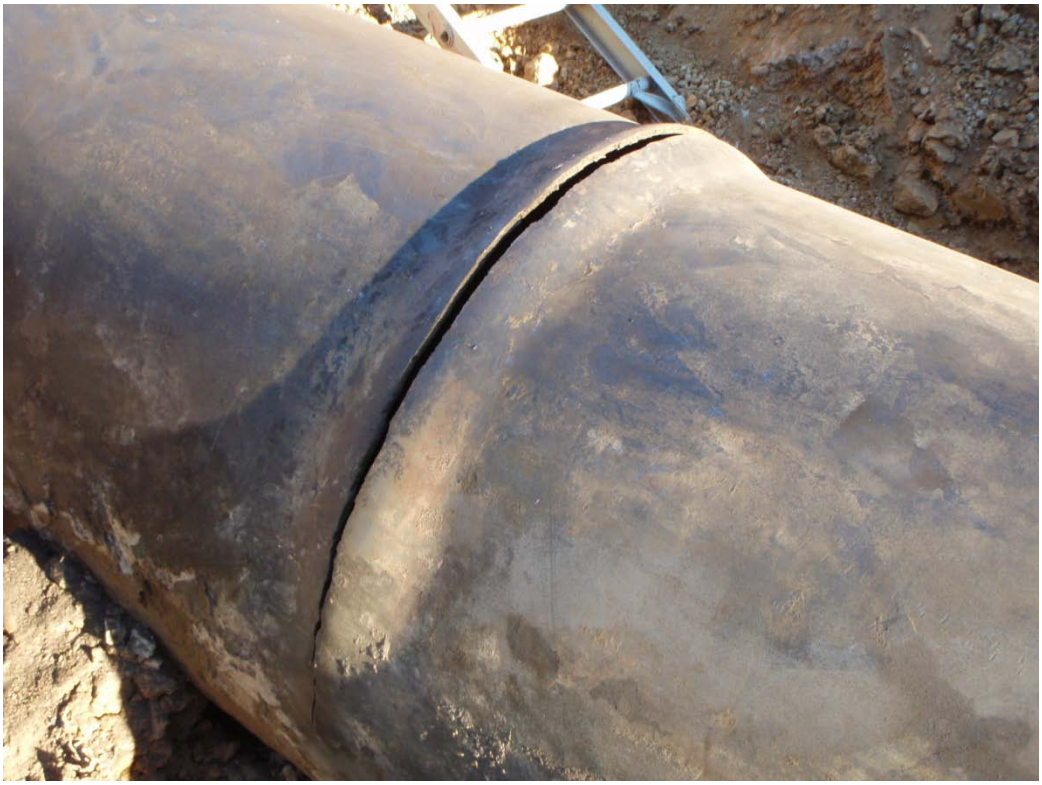

Figure C2 - Failed Wrinkle Bend

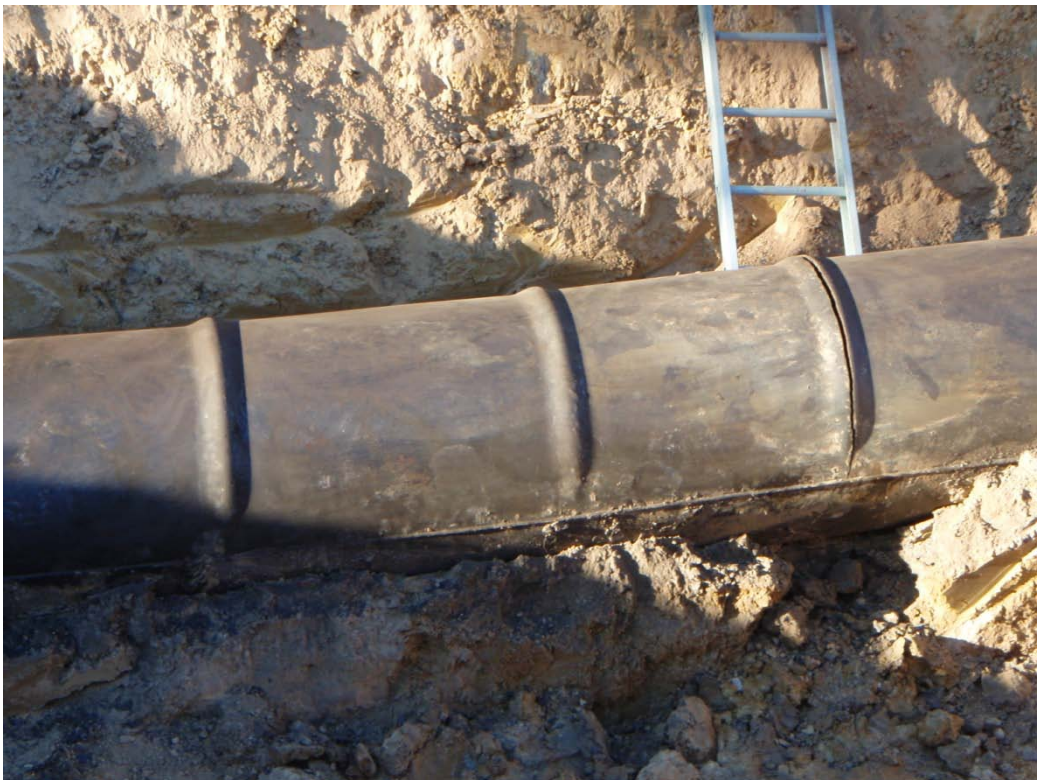

Figure C3 - Exposed Bend

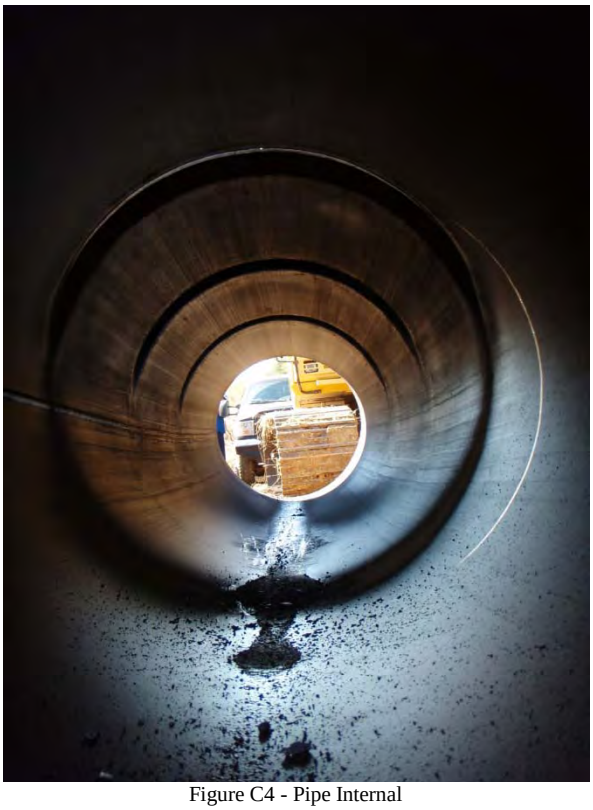

Figure C4 - Pipe Internal

Appendix D Metallurgical Report

This document is on file at PHMSA

Appendix E Hydrogeological Report

This document is on file at PHMSA