



Memorandum

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

Date: March 23, 2011

To: Wayne T. Lemor, ^{WTL} Director, Office of Pipeline Safety, Southern Region

From: Chris Taylor, Program Manager, Accident Investigations ^{CT}

Subject: Accident Report - Southern Natural Gas Pipeline Rupture of January 23, 2007, Elmore, Alabama, NRC Report # 824407

SUMMARY

On January 23, 2007, at approximately 7:58 am Central Standard Time (CST), an in-service rupture occurred on Southern Natural Gas' (SNG) 16-inch South Main natural gas pipeline in Elmore County, Alabama (Appendix A). SNG Gas Control (Gas Control) observed a pressure drop in the Elmore Compressor Station discharge pressure. A local resident called Gas Control 14 minutes later to report the rupture.

The pipeline ruptured in a cotton field, west of the Sanford Lane road crossing and east of the Callaway Creek crossing, and resulted in an ignition and fire. The source of the ignition was unknown. There were no fatalities, injuries or evacuations.

Fire and rescue services within Elmore County deployed to the area to control the fire; SNG personnel responded to this event by closing all valves necessary to shut-in the pipeline segment. This immediately extinguished the fire whose intensity had been fueled by high pressure natural gas from the completely separated upstream and downstream pipe ends.

The cause of the incident was a failed girth weld. The failure originated in weld defects measuring approximately 3.9-inches long. The weld defects were from the original 1951 South Main pipeline construction. Excessive axial loads on the pipeline resulted in the girth weld failure. The source of these loads could not be identified.

1.0 OPERATOR, LOCATION AND CONSEQUENCES

Operator/OpID: Southern Natural Gas/18516,
Unit Name/Unit #: AL-1, GA/1322; SMART Activity ID 118817
Date & time of failure: January 23, 2007 at 7:58 am CST
City/County & State: Elmore/Elmore County, Alabama
Milepost: 224.3
Commodity: Natural Gas
Type of failure – Rupture
Fatalities: 0
Injuries: 0

Description of area impacted: The pipeline ruptured in a cotton field, west of the Sanford Lane road crossing and east of the Callaway Creek crossing and resulted in an ignition and fire (Appendix B). The source of the ignition was unknown.

2.0 SYSTEM DETAILS

SNG operates 8,000 miles of natural gas pipeline with 1,960 miles in Alabama. The South Main pipeline system consists of approximately 504 right-of-way miles of 18-inch and 16-inch natural gas pipe and multiple large diameter loop lines traversing from Gwinville, Mississippi to Aiken, South Carolina. Approximately 379 miles of the 16-inch and 18-inch South Main line were placed in service in 1951, including the failed pipe.

The 16-inch South Main Line passes through mostly rural areas in Alabama, with some Class 2 and 3 location in addition to High Consequence Areas (HCAs). The pipeline crosses state and interstate highways, rivers, and streams.

The failure occurred in a Class 1 location (a cotton field) on line pipe consisting of:

- 0.312-inch wall thickness
- Grade X52
- Electric Flash-welded (EFW) longitudinal seam
- Coal tar enamel coating
- Manufactured by A.O. Smith Corporation in 1951
- Installed 1951

The pipeline was pressure tested with gas to 1,240 psig for 24 hours with no documented failures. The resultant maximum allowable operating pressure (MAOP) was 1,200 psig which corresponded to 59.2% of the pipe's specified minimum yield strength (SMYS). The MAOP at the time of failure remained at 1,200 psig and the pressure at the failure location was estimated to be 1,129 psig. At the time of failure, Elmore compressor station, 2.8 miles upstream of the rupture was being bypassed. The nearest upstream compressor station in operation was the Selma Compressor Station in Dallas County, Alabama, approximately 40 miles upstream.

3.0 EVENTS LEADING UP TO FAILURE

PHMSA inspectors reviewed the Elmore Compressor Station pressure log, SNG's cathodic protection annual surveys for 2004-2006 and conducted interviews with operator personnel to

determine the existence of conditions, abnormal or otherwise, that may have contributed to the pipeline rupture.

At the time of the incident, the Elmore Compressor Station was being bypassed, resulting in no change in suction and discharge pressures. There were no pressure excursions above MAOP for the 24-hour period reviewed. The annual pipe-to-soil survey potentials were all more negative than -1000 mV. SNG used -850mV (on) cathodic protection criterion.

Operator personnel indicated the only pipeline modifications or repairs in the area were performed downstream of the failure location in 2005 in preparation for a 2006 in-line inspection. No recent repairs or modifications had been performed in the vicinity of the pipe failure.

4.0 EMERGENCY RESPONSE

January 27, 2007 Time Line (all times are CST)

7:58 am: SNG Gas Control saw pressure drop

8:12 am: Mr. Barrett (citizen in the area) called SNG gas control

8:15 am: SNG Gas Control notified Billy Pickard (SNG Area Manager)

8:16 am: Billy Pickard called Mr. Barrett to get information on location

Billy Pickard called Mike Burgess (SNG Cross Function Technician¹) immediately after talking to Mr. Barrett. Mike Burgess was already working in the area and went to Valve #6 MP 223.972 and closed the valve at approximately 8:30-8:40 am. Billy Pickard and Mike Burgess also verified crossover Valve-9 was closed .

9:05 am: Mike Cooper (CFT) closed crossover Valve #1 (MP not given)

9:15 am Chris Lamberth(CFT) closed Valve #4 MP 225.465

~9:15 am the line was shut in.

The major flame was extinguished almost immediately after shutting in the line. Small flame flickered for about an hour.

10:39 am: SNG called the National Response Center to report the incident (Appendix C)

5.0 SUMMARY OF RESTART PLAN AND RETURN TO SERVICE

Due to the age of this pipeline, the proximity to high consequence areas, the uncertainties regarding the cause of the failure, and other factors, PHMSA issued a Corrective Action Order (CAO) to SNG on January 26, 2007; three days after the incident. The CAO was applied to the 16-inch South Main pipeline segment from MP 223.9 (Callaway Creek valve setting) to MP 225.4 (Coosa River valve setting). The failure location was MP 224.3.

Below is a condensed description of significant CAO requirements. PHMSA Compliance Progress File (CPF) 2-2007-1004H addresses additional CAO operator performance requirements:

¹ SNG's Cross Function Technicians perform an array of pipeline operations and maintenance functions (maintenance, cathodic protection, measurement, etc).

1. Maintain out of service status of the 16-inch South Main Line between valves #6 and #4 at MPs 223.9 and MP 225.4, respectively, until hydrostatic pressure testing is complete in accordance with the requirements below.
2. Hydrostatically pressure test the affected segment to a minimum of 90% SMYS of the pipe (1825 psig) for no less than 8 hours, within 30 days of receipt of the CAO.
3. After a successful hydrostatic pressure test, the operating pressure on the affected segment shall not exceed 903 psig, which is 80% of the failure pressure (1,129 psig). Written approval required for pressure increase or removing restriction all together.
4. Commission a third party laboratory to conduct a detailed mechanical and metallurgical analysis of the failed pipe, within 30 days of receipt of the CAO. Remove one unaffected (by fire) girth weld from each side of the failure and destructively and nondestructively test these two girth welds to ascertain weld strength and integrity.
5. Review the 2006 Geometry and Magnetic Flux Leakage (MFL) in-line inspection (ILI) data for indication of an anomaly at the failure location, within 30 days of receipt of the CAO.
6. Perform a study to determine if conditions similar to those contributing to the January 23, 2007, failure are likely to exist elsewhere on pipelines placed in service in 1951 on the 16-inch and 18-inch South Main System. This study shall be based on the results of information acquired from performance of items 2, 4 and 5 (above), as well as company knowledge, and construction, operation and leak records, within 30 days of receipt of the CAO.

The CAO required SNG to remove "unaffected" pipe and welds for metallurgical analysis. The failed weld and adjacent upstream and downstream pipe sections were also preserved for analysis.

SNG removed approximately 164 feet of pipe; 82 feet each from the upstream and downstream sides of the failed girth welds and installed approximately 164 ft of API 5L X42 line pipe of 0.50-inch wall thickness and fusion bonded epoxy coated. PHMSA's onsite inspectors remained onsite until SNG completed the final tie-in.

SNG hydrostatically pressure tested the failed segment, but chose not to operate the segment until the pressure restriction was lifted. PHMSA removed the pressure restriction via a letter to Patrick Carey of SNG dated April 9, 2007.

6.0 INVESTIGATION FINDINGS AND CONTRIBUTING FACTORS

The findings and contributing factors described below were excerpted from two sources: *Final Report on Investigation of an In-Service Girth Weld Failure at MP 224.3 Downstream of the Elmore Compressor Station*, published by Kiefner and Associates dated

April 6, 2007 (Kiefner final report no. 07-39) (Appendix D) and *SNG Corrective Action Order Response* in SNG's letter to PHMSA Southern Region dated March 19, 2007.

1) The girth weld failed due to excessive axial tensile loading on the pipeline. The source of the load(s) could not be identified.

Pipeline repair/modifications projects were performed on this segment in 2005, in preparation for a 2006 in-line inspection. The projects were downstream of the failure and ranged from 1400 ft to over 1 mile away. The metallurgical analysis considered these activities too far away from the failure location for stresses to have been transferred through the soil.

2) Weld defects existed in the girth weld from original construction.

The construction of the pipeline was performed in accordance with prevailing pipeline construction practices used in the natural gas transmission industry in 1950 and 1951. At the time of construction, *API Standard 1104, Welding of Pipelines and Related Facilities* (API 1104), had not yet been published.

The metallurgical analysis indicated the sample welds would not have been acceptable according to the workmanship criteria in the 19th Edition of API 1104 as the failed weld contained two burn-throughs and indications of slag and porosity. The 19th Edition of API 1104 was the current API welding standard in use at the time of the incident.

3) Girth weld at failure location may have undermatched the pipe.

Weld tensile tests performed on adjacent girth welds indicated the weld was stronger than the pipe on three of four tests. The X52 grade pipe section immediately upstream of the failed weld exhibited mechanical properties greater than X70 pipe. Using hardness test results as an indicator of tensile strength, the hardness tests performed on the upstream pipe base metal and heat affected zone indicated hardness values greater than the deposited weld metal.

4) MFL vendor report identified a weld indication at the failed girth weld location.

A magnetic flux leakage (MFL) in-line inspection (ILI) was performed on several South Main line segments since 2002, including the failure segment. Additional reviews MFL signal on the failure segment by SNG, showed evidence of a magnetic indication at the failure location that extended approximately 67% around the circumference of the weld, possibly representing an anomaly.

Conclusion

This incident occurred due to a failed girth weld. PHMSA inspectors found no evidence SNG's pipeline operations caused or contributed to this incident. However, SNG did not investigate an ILI call-out at this location, prior to this incident, which may have been a missed opportunity to inspect and repair the weld before it failed.

7.0 APPENDICES

Appendix A: NPMS Map of 16-inch South Main Failure Segment

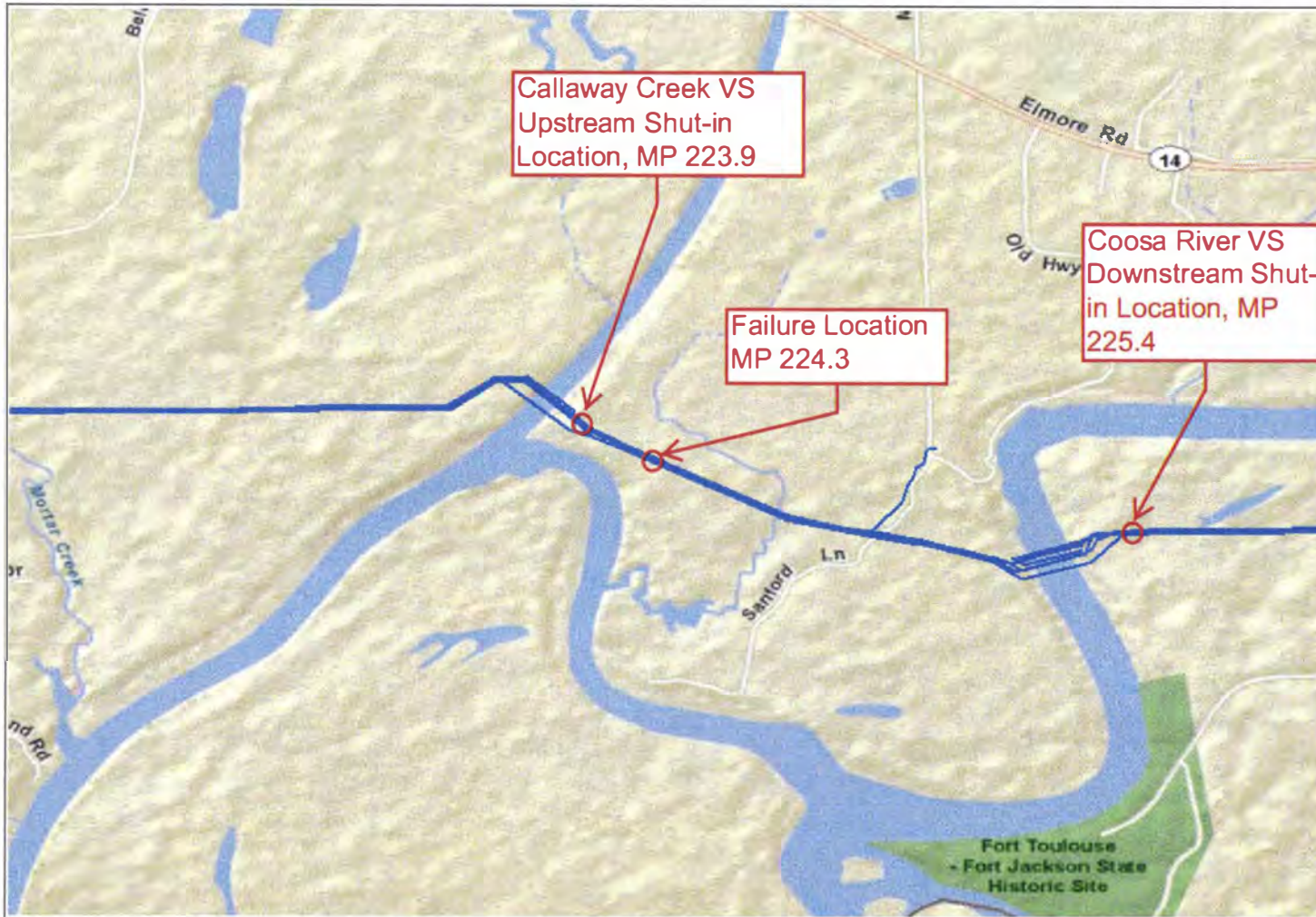
Appendix B: Photographs

Appendix C: NRC Report #824407

Appendix D: Copy of Metallurgical Report

APPENDIX A

NATIONAL PIPELINE MAPPING SYSTEM



Legend

— Gas Transmission 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 npms-nr@mbakercorp.com.

Projection: Geographic

Datum: NAD83

Map produced by the PIMMA application at www.npms.phmsa.dot.gov

Date Printed: Mar 01, 2011



APPENDIX B

PHOTOGRAPHS



16-in South Main Pipeline after rupture and ignition



16-in South Main Pipeline after shut-in. Cover completely displaced by high natural gas pressure



Aerial view of raging fire.



Aerial view of incident site after shut-in

PHOTOGRAPHS



Failed 16-in South Main Line. Abandoned 12-in Montgomery to Columbus pipeline in background (partially exposed)



Failed 16-in South Main Line looking downstream



Close-up of clean break



Weldcap intact on failed pipe.

APPENDIX C

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 # 824407

INCIDENT DESCRIPTION

*Report taken at 10:39 on 23-JAN-07

Incident Type: PIPELINE

Incident Cause: EQUIPMENT FAILURE

Affected Area:

The incident occurred on 23-JAN-07 at 08:05 local time.

Affected Medium: AIR TO THE ATMOSPHERE

SUSPECTED RESPONSIBLE PARTY

Organization: SOUTHERN NATURAL GAS COMPANY
BIRMINGHAM, AL 35203

Type of Organization: PRIVATE ENTERPRISE

INCIDENT LOCATION

SOUTH MAIN PIPELINE County: ELMORE

City: WETUMPKA State: AL

Distance from City: 4 MILES

Direction from City: E

LAT 32.517043 NORTH LONG 86.260203

RELEASED MATERIAL(S)

CHRIS Code: ONG Official Material Name: NATURAL GAS

Also Known As:

Qty Released: 0 UNKNOWN AMOUNT

DESCRIPTION OF INCIDENT

CALLER STATED DUE TO A PIPELINE RUPTURE ON A SIXTEEN INCH STEEL PIPELINE THERE WAS A RELEASE OF MATERIALS.

INCIDENT DETAILS

Pipeline Type: TRANSMISSION

DOT Regulated: YES

Pipeline Above/Below Ground: BELOW

Exposed or Under Water: NO

Pipeline Covered: UNKNOWN

DAMAGES

Fire Involved: YES Fire Extinguished: YES

INJURIES: NO Hospitalized: Empl/Crew: Passenger:

FATALITIES: NO Empl/Crew: Passenger: Occupant:

EVACUATIONS: NO Who Evacuated: Radius/Area:

Damages: NO

<u>Closure Type</u>	<u>Description of Closure</u>	<u>Length of Closure</u>	<u>Direction of Closure</u>
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Air: N
Road: N
Waterway: N
Track: N

Major Artery: N

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

REMEDIAL ACTIONS

CALLER STATED THE VALVES CLOSED, THE PIPELINE IS ISOLATED AND A REPAIR CREW IS EN ROUTE.
Release Secured: YES
Release Rate:
Estimated Release Duration: 1.5 HOUR

WEATHER

Weather: OVERCAST, 50°F

ADDITIONAL AGENCIES NOTIFIED

Federal: NONE
State/Local: ELMORE CNTY EMA, CNTY FIRE DEPT, 911
State/Local On Scene: LOCAL FIRE DEPARTMENT
State Agency Number: NONE

NOTIFICATIONS BY NRC

ALABAMA DEPT OF ENV MGMT (PRIMARY)
23-JAN-07 10:48
AL U.S. ATTORNEY'S OFFICE (COMMAND CENTER)
23-JAN-07 10:48
DOT CRISIS MANAGEMENT CENTER (PRIMARY)
23-JAN-07 10:48
U.S. EPA IV (PRIMARY)
23-JAN-07 10:48
JFO-LA (COMMAND CENTER)
23-JAN-07 10:48
NATIONAL INFRASTRUCTURE COORD CTR (PRIMARY)
23-JAN-07 10:48
NOAA RPTS FOR AL (PRIMARY)
23-JAN-07 10:48
NATIONAL RESPONSE CENTER HQ (PRIMARY)
23-JAN-07 10:48

ADDITIONAL INFORMATION

CALLER STATED THE PUBLIC WAS NOT AFFECTED AS THIS INCIDENT TOOK PLACE IN THE MIDDLE OF A COTTON FIELD. CALLER STATED THEY HAVE THE SITUATION UNDER CONTROL.

*** END INCIDENT REPORT # 824407 ***

Appendix D Copy of Metallurgical Report

Kiefner and Associates Inc, Final Report

April 6, 2007

This document is on file at PHMSA