Failure Investigation Report – Columbia Gas Transmission Rupture – Activity ID 122980

Principal Investigator	Dave McMillan, PHMSA ER
Regional Director	Byron Coy
Date of Report	2/18/2011
Subject	Failure Investigation Report – Columbia Gas Transmission Pipeline Rupture

Summary:

On November 5, 2008, at approximately 2:10 p.m., Columbia Line 1278 failed near Milford, PA, during an uprating procedure to increase the pressure in the line from a reduced 800 psig operating pressure back to the original 1000 psig MAOP of the pipeline. Columbia had recently been given authorization by PHMSA to increase the pressure in the pipeline back to the original MAOP after demonstrating that the integrity of the pipeline was adequate. The pipeline failure resulted in a rupture that involved three lengths of pipe in a wetland area. The failure occurred in the northern portion of the pipeline between Weber Road, Pike County, PA and Millrift, PA, 46 miles from the upstream compressor station at Easton, PA.

Pressure in the pipeline had been increased from 800 psig to 1000 psig in 50 psig increments. The operator then began to reduce the pressure, and at 986 psig the pipeline failed. There were no injuries. There was no ignition of gas. Valves were shut in both directions. No customers had service interrupted as a result of the pipeline failure. The failure occurred in a rural area.

After the failed section was isolated, Columbia began its investigation of the incident and its remediation to restore the line to service. Columbia installed 510 feet of new 14-inch, coated, steel pipeline in the wetland area to replace the pipe that failed. On December 6, 2008, service was restored in the pipeline.

The failed section of pipe separated into four pieces. These pieces along with several other segment of the pipeline were visually examined and analyzed by Kiefner and Associates, Inc. The lab tests results indicated that the failure was caused by near-neutral-pH stress corrosion cracking (SCC). This has been noted in the company reported apparent cause in Part G of Appendix 3.

Columbia pipeline 1278 runs from the Maryland/Pennsylvania state border to the Pennsylvania/NewYork state border. The pipeline was constructed in 1948. Over several years beginning in 2002, the pipeline went through a rehabilitation and replacement project due to a Corrective Action Order issued by the Department of Transportation due to a previous incident with the pipeline and the discovery of extensive external corrosion. The CAO required that the pressure in the pipeline be reduced from its original MAOP of 1000 psig to 600. The pressure was subsequently approved by PHMSA to be increased to 800 psig based on the findings of an inspection of the pipeline using an in-line inspection device.

Operator, Location, & Consequences

Date & Time of Failure:	11/5/2008
Commodity Released:	Natural Gas
City/County & State:	Milford Township, PA
OpID & Operator Name	2616 Columbia Gas Transmission Corporation
Unit # & Unit Name	2901 Easton Field Office-PA
SMART Activity #:	122980
Milepost / Location	½ mile at the intersection North of I84 and Route 6
	Lat: 41.33269870
	Long: 74.84080223
Type of Failure:	Rupture
Fatalities:	0
Injuries	0
Description of area impacted	Rural
Property damage	Gas loss $164,000
	Property Damage $1,685,692

System Details

The Line 1278 System traverses the eastern counties of Pennsylvania beginning in Lancaster County and ending in Pike County. The Line 1278 system totals 146.5 miles, consisting of 14" and 20" pipe. Gas flow is predominantly south to north.

Events Leading up to the Failure

Over several years beginning in 2002, the pipeline went through a rehabilitation and replacement project due to a Corrective Action Order issued by the Department of Transportation due to a previous incident with the pipeline and the discovery of extensive external corrosion. The CAO required that the pressure in the pipeline be reduced from its original MAOP of 1000 psig to 600. The pressure was subsequently approved by PHMSA to be increased to 800 psig based on the findings of an inspection of the pipeline using an in-line inspection device. On November 5, 2008, at approximately 2:10 p.m., Columbia Line 1278 failed near Milford, PA, during an uprating procedure to increase the pressure in the line from a reduced 800 psig operating pressure back to the original 1000 psig MAOP of the pipeline.

Emergency Response

Time	Event
11:45 AM, 11/04/08	Began leak patrols of pipeline segment, with a total of four patrols at 800, 850, 900, and 950 psig.
4:10 PM, 11/04/08	Attained 950 psig increment with pressure held overnight.
10:30 AM, 11/05/08	Began leak patrol of pipeline segment
1:58 PM	Telemetry Record Rupture
2:14 PM	Gas Controller notices pressure drop on SCADA
2:15 PM	Smith dispatched to Weber Road facility
2:19 PM	Weitzel contacted by Gas Control
2:23 PM	Palmer returns call to Gas Control and reports personnel are responding
2:40 PM	Telemetry indicates closure of Milford mainline valve
3:37 PM	Compliance & Technical Training; incident reported to NRC (Report No. 889241).
3:48 PM	Telemetry indicates closure of Weber Road mainline valve (launcher)
4:06 PM	Palmer reports to Gas Control the site is secure and reports rupture location
5:45 PM	Personnel leave the rupture site for the night
6:00 PM	Gas Control conducts conference call to review events and status
5:45 AM, 11/06/08	Burnley arrives at site to preserve evidence and begin preliminary investigative process pending arrival of Federal and third party investigators.

Note: **Investigative process and repair activities continued 12 hours per day through to 11/24/08.**

Summary of initial start-up plan and return-to-service, including preliminary safety measures

Columbia installed 510 feet of new 14-inch, coated, steel pipeline in the wetland area to replace the pipe that failed. On December 6, 2008, service was restored in the pipeline.

Investigation Findings & Contributing Factors

The failed section of pipe separated into four pieces. These pieces along with several other segment of the pipeline were visually examined and analyzed by Kiefner and Associates, Inc. The lab tests results indicated that the failure was caused by near-neutral-pH stress corrosion cracking (SCC). This has been noted in the company reported apparent cause in Part G of Appendix 3.

Appendices

1	Photo Documentation
2	NRC Report
3	CGT Incident Report
4	CGT Pressure Test Chart
5	CGT Rupture Map
6	Line 1278 and Line K

Figure 1: **Severed 14.9 foot section of pipeline**

Figure 2: **Severed 37.1 foot section of pipeline**

Figure 3: **Severed 9 foot section of pipeline**

Figure 4: **Severed 4.7 foot section of pipeline, piece 4**

Figure 5: **End of severed 37.1 foot section of pipeline**

Figure 6: **End of 21.7 foot section of pipe in swamp**

Figure 7: **Bent 21.7 foot section of pipe in swamp**

Figure 8: **Ruptured pipe in swamp**

Figure 9: Piece 4 exhibiting corrosion

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 # 889241

INCIDENT DESCRIPTION

*Report taken at 15:46 on 05-NOV-08
Incident Type: PIPELINE
Incident Cause: UNKNOWN
Affected Area:
The incident occurred on 05-NOV-08 at 14:10 local time.
Affected Medium: AIR ATMOSPHERE

SUSPECTED RESPONSIBLE PARTY

Organization: COLUMBIA GAS TRANSMISSION
CHARLESTON, WV 25314

Type of Organization: PRIVATE ENTERPRISE

INCIDENT LOCATION

RT. 6 AND INTERSTATE I-84 County: PIKE
State: PA

Section: N/A Township: N/A Range: N/A

RELEASED MATERIAL(S)

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

DESCRIPTION OF INCIDENT

THE CALLER STATED THAT A PIPELINE (#1278) WAS IN THE PROCESS RAISING THE PSI AND A LEAK WAS DETECTED CAUSING A FIRE TO SHOOT UP FROM THE PIPELINE. NO INJURIES OR FATALITIES HAVE BEEN REPORTED. THE FIRE HAS BEEN EXTINGUISHED AND THE VALVES WERE SHUT OFF SECURING THE RELEASE. NO CUSTOMER SERVICE WAS LOST IN THE INCIDENT. THE CAUSE OF THE LEAK IS STILL UNDER INVESTIGATION.

INCIDENT DETAILS

Pipeline Type: TRANSMISSION
DOT Regulated: YES
Pipeline Above/Below Ground: ABOVE
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				

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

RELEASE SECURED, FIRE EXTINGUISHED WHEN VALVE WAS CLOSED
Release Secured: YES
Release Rate:
Estimated Release Duration:

WEATHER

Weather: PARTLY CLOUDY, ºF Wind speed: 5 MPH

ADDITIONAL AGENCIES NOTIFIED

Federal: NONE
State/Local: FIRE, POLICE
State/Local On Scene: FIRE, POLICE
State Agency Number: NONE

NOTIFICATIONS BY NRC

ATLANTIC STRIKE TEAM (MAIN OFFICE)
05-NOV-08 15:54
USCG ICC (ICC ONI)
05-NOV-08 15:54
DOT CRISIS MANAGEMENT CENTER (MAIN OFFICE)
05-NOV-08 15:54
U.S. EPA III (MAIN OFFICE)
05-NOV-08 15:56
FLD INTEL SUPPORT TEAM PHILADELPHIA (MAIN OFFICE)
05-NOV-08 15:54
USCG COMMAND CENTER (MAIN OFFICE)
05-NOV-08 15:55
NATIONAL INFRASTRUCTURE COORD CTR (MAIN OFFICE)
05-NOV-08 15:54
NJ STATE POLICE (MARINE SERVICES BUREAU)
05-NOV-08 15:54
NOAA RPTS FOR PA (MAIN OFFICE)
05-NOV-08 15:54
NATIONAL RESPONSE CENTER HQ (MAIN OFFICE)
05-NOV-08 15:55
BUREAU TOXIC SUBSTANCE R. WILBURN (MAIN OFFICE)
05-NOV-08 15:54
NJ DEP POC: DUTY OFFICER (MAIN OFFICE)
05-NOV-08 15:54
PA EMERG MGMT AGCY (MAIN OFFICE)
05-NOV-08 15:54

ADDITIONAL INFORMATION

THE CALLER HAD NO ADDITIONAL INFORMATION.

*** END INCIDENT REPORT # 889241 ***

122980 Appendix 3 Incident Report

NOTICE: This report is required by 49 CFR Part 191. Failure to report can result in a civil penalty not to exceed $25,000 for each violation for each day that such violation persists except that the maximum civil penalty shall not exceed $500,000 as provided in 49 USC 1678. Form Approved OMB No. 2137-0522

Print

U.S. Department of Transportation
Research and Special Programs Administration

INCIDENT REPORT - GAS TRANSMISSION AND GATHERING SYSTEMS

Report Date Dec 02, 2008

No. 20080143 -- 8382
(DOT Use Only)

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 Office Of Pipeline Safety Web Page at http://ops.dot.gov .*

PART A – GENERAL REPORT INFORMATION

Check one or more boxes as appropriate:
☐ **Original Report** ☒ **Supplemental Report** ☒ **Final Report**

Operator Name and Address

a. Operator's 5-digit Identification Number (when known) / 2616 /

b. If Operator does not own the pipeline, enter Owner's 5-digit Identification Number (when known) / /

c. Name of Operator COLUMBIA GAS TRANSMISSION CORP

d. Operator street address 1700 MACORKLE AVENUE SE

e. Operator address CHARLESTON KANAWHA WV 25314
City, County or Parrish, State and Zip Code

2. Time and date of the incident

/ 1414 / hr. / 11 / month / 05 / day /2008/ year

3. Location of incident

a. 1/2 MILE AT THE INTERSECTION NC
Nearest street or road

b. PIKE
City and County or Parrish

c. PA
State and Zip Code

d. Mile Post/Valve Station

e. Survey Station No. 7382+82

f. Latitude: 41.33269870 Longitude: 74.84080223
(if not available, see instructions for how to provide specific location)

g. Class location description
Onshore: ● Class 1 ○ Class 2 ○ Class 3 ○ Class 4
Offshore: ○ Class 1 *(complete rest of this item)*
Area _____ Block # _____
State / / or Outer Continental Shelf ☐

h. Incident on Federal Land other than Outer Continental Shelf
○ Yes ● No

i. Is pipeline Interstate ● Yes ○ No

4. Type of leak or rupture
○ Leak: ○ Pinhole ○ Connection Failure *(complete sec. F5)*
○ Puncture, diameter *(inches)* _____
● Rupture: ● Circumferential – Separation
○ Longitudinal – Tear/Crack, length (inches) _____
Propagation Length, total, both sides (feet) _____
○ N/A
○ Other: _____

5. Consequences *(check and complete all that apply)*
a. ☐ Fatality Total number of people: / 0 /
Employees: / 0 / *General Public:* / 0 /
Non-employee Contractors: / 0 /

b. ☐ Injury requiring inpatient hospitalization Total number of people: / 0 /
Employees: / 0 / *General Public:* / 0 /
Non-employee Contractors: / 0 /

c. ☒ Property damage/loss *(estimated)* Total $ 1849692
Gas loss $ 164000 Operator damage $ 1685692
Public/private property damage $ 0

d. ☐ Release Occurred in a 'High Consequence Area'

e. ☐ Gas ignited – No explosion f. ☐ Explosion

g. ☒ Evacuation *(general public only)* / 0 / people
Reason for Evacuation:
● Emergency worker or public official ordered, precautionary
○ Threat to the public ○ Company policy

6. Elapsed time until area was made safe:
/ 0 / hr. / 30 / min.

7. Telephone Report
/ 889241 / NRC Report Number / 11 / month / 05 / day /2008/ year

8. a. Estimated pressure at point and time of incident:
986 *PSIG*

b. Max. allowable operating pressure *(MAOP):* 1000 *PSIG*

c. MAOP established by 49 CFR section:
☐ 192.619 (a)(1) ☐ 192. 619 (a)(2) ☐ 192. 619 (a)(3)
☐ 192.619 (a)(4) ☒ 192. 619 (c)

d. Did an overpressurization occur relating to the incident? ○ Yes ● No

PART B – PREPARER AND AUTHORIZED SIGNATURE

GEORGE HAMATY
(type or print) Preparer's Name and Title

(304) 357-3728
Area Code and Telephone Number

GHAMATY@NISOURCE.COM
Preparer's E-mail Address

(304) 357-3804
Area Code and Facsimile Number

Authorized Signature (type or print) Name and Title

Date

Area Code and Telephone Number

PART C - ORIGIN OF THE INCIDENT

1. Incident occurred on
   - ● Transmission System
   - ○ Gathering System
   - ○ Transmission Line of Distribution System

2. Failure occurred on
   - ● Body of pipe ○ Pipe Seam
   - ○ Joint
   - ○ Component
   - ○ Other: _____

3. Material involved *(pipe, fitting, or other component)*
   - ● Steel
   - ○ Plastic (If plastic, complete all items that apply in a-c)
     Plastic failure was: ☐ a.ductile ☐ b.brittle ☐ c.joint failure
   - ○ Material other than plastic or steel: _____

4. Part of system involved in incident
   - ● Pipeline ○ Regulator/Metering System
   - ○ Compressor Station ○ Other: _____

5. Year the pipe or component which failed was installed: / 1948 /

PART D – MATERIAL SPECIFICATION (if applicable)

1. Nominal pipe size *(NPS)* / 14 / in.
2. Wall thickness / .31 / in.
3. Specification X42 SMYS / 45000 /
4. Seam type _____
5. Valve type _____
6. Pipe or valve manufactured by _____ in year / _____ /

PART E – ENVIRONMENT

1. Area of incident
   - ○ In open ditch
   - ○ Under pavement
   - ○ Above ground
   - ○ Under ground
   - ● Under water
   - ○ Inside/under building
   - ○ Other: _____
2. Depth of cover: 6 inches

PART F – APPARENT CAUSE

Important: *There are 25 numbered causes in this section. Check the box to the left of the **primary** cause of the incident. Check one circle in each of the supplemental items to the right of or below the cause you indicate. See the instructions for this form for guidance.*

F1 – CORROSION

If either F1 (1) External Corrosion, or F1 (2) Internal Corrosion is checked, complete all subparts a – e.

1. ● External Corrosion

a. Pipe Coating
- ● Bare
- ○ Coated

b. Visual Examination
- ○ Localized Pitting
- ○ General Corrosion
- ● Other: STRESS CORROSION C

c. Cause of Corrosion
- ○ Galvanic ○ Stray Current
- ○ Improper Cathodic Protection
- ○ Microbiological
- ● Stress Corrosion Cracking
- ○ Other: _____

d. Was corroded part of pipeline considered to be under cathodic protection prior to discovering incident?
○ No ● Yes, Year Protection Started: / 1970 /

e. Was pipe previously damaged in the area of corrosion?
● No ○ Yes, How long prior to incident: /_____/ *years* /_____/ *months*

2. ○ Internal Corrosion

F2 – NATURAL FORCES

3. ○ Earth Movement => ○ Earthquake ○ Subsidence ○ Landslide ○ Other: _____
4. ○ Lightning
5. ○ Heavy Rains/Floods => ○ Washouts ○ Flotation ○ Mudslide ○ Scouring ○ Other: _____
6. ○ Temperature => ○ Thermal stress ○ Frost heave ○ Frozen components ○ Other: _____
7. ○ High Winds

F3 - EXCAVATION

8. ○ Operator Excavation Damage *(including their contractors)* / Not Third Party

9. ○ Third Party Excavation Damage *(complete a-d)*
   a. Excavator group
      ○ General Public ○ Government ○ Excavator other than Operator/subcontractor
   b. Type: ○ Road Work ○ Pipeline ○ Water ○ Electric ○ Sewer ○ Phone/Cable ○ Landowner ○ Railroad
      ○ Other: _____
   c. Did operator get prior notification of excavation activity?
      ○ No ○ Yes: Date received: /_____/ mo. /_____/ day /_____/ yr.
      Notification received from: ○ One Call System ○ Excavator ○ Contractor ○ Landowner
   d. Was pipeline marked?
      ○ No ○ Yes *(If Yes, check applicable items i – iv)*
      i. Temporary markings: ○ Flags ○ Stakes ○ Paint
      ii. Permanent markings: ○ Yes ○ No
      iii. Marks were *(check one)* ○ Accurate ○ Not Accurate
      iv. Were marks made within required time? ○ Yes ○ No

F4 – OTHER OUTSIDE FORCE DAMAGE

10. ○ Fire/Explosion as primary cause of failure => Fire/Explosion cause: ○ Man made ○ Natural
11. ○ Car, truck or other vehicle not relating to excavation activity damaging pipe
12. ○ Rupture of Previously Damaged Pipe
13. ○ Vandalism

F5 – MATERIAL AND WELDS

Material

14. ○ Body of Pipe => ○ Dent ○ Gouge ○ Wrinkle Bend ○ Arc Burn ○ Other: _____
15. ○ Component => ○ Valve ○ Fitting ○ Vessel ○ Extruded Outlet ○ Other: _____
16. ○ Joint => ○ Gasket ○ O-Ring ○ Threads ○ Other: _____

Weld

17. ○ Butt => ○ Pipe ○ Fabrication ○ Other: _____
18. ○ Fillet => ○ Branch ○ Hot Tap ○ Fitting ○ Repair Sleeve ○ Other: _____
19. ○ Pipe Seam => ○ LF ERW ○ DSAW ○ Seamless ○ Flash Weld
○ HF ERW ○ SAW ○ Spiral ○ Other: _____

*Complete a-g if you indicate **any** cause in part F5.*

a. Type of failure:

○ Construction Defect => ○ Poor Workmanship ○ Procedure not followed ○ Poor Construction Procedures

○ Material Defect

b. Was failure due to pipe damage sustained in transportation to the construction or fabrication site? ○ Yes ○ No

c. Was part which leaked pressure tested before incident occurred? ○ Yes, *complete d-g* ○ No

d. Date of test: /_____/ mo. /_____/ day /_____/ yr.

e. Test medium: ○ Water ○ Natural Gas ○ Inert Gas ○ Other: _____

f. Time held at test pressure: /_____/ hr.

g. Estimated test pressure at point of incident: _____ *PSIG*

F6 – EQUIPMENT AND OPERATIONS

20. ○ Malfunction of Control/Relief Equipment => ○ Valve ○ Instrumentation ○ Pressure Regulator ○ Other: _____
21. ○ Threads Stripped, Broken Pipe Coupling => ○ Nipples ○ Valve Threads ○ Mechanical Couplings ○ Other: _____
22. ○ Ruptured or Leaking Seal/Pump Packing

23. ○ Incorrect Operation
a. Type: ○ Inadequate Procedures ○ Inadequate Safety Practices ○ Failure to Follow Procedures ○ Other: _____
b. Number of employees involved who failed post-incident drug test: /_____/ Alcohol test: /_____/
c. Were most senior employee(s) involved qualified? ○ Yes ○ No d. Hours on duty: /_____/

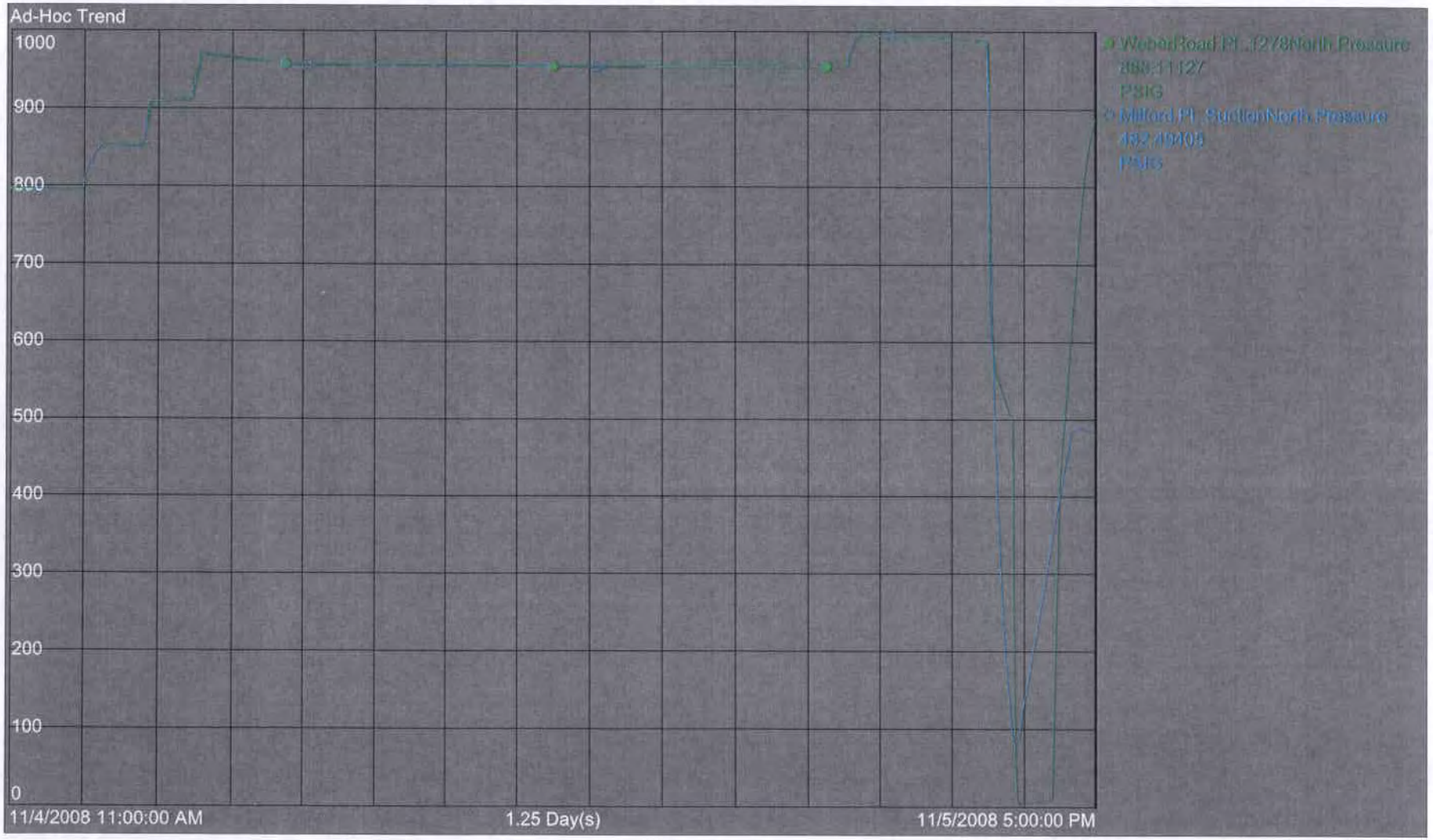
F7 – OTHER

24. ○ Miscellaneous, *describe:* _____
25. ○ Unknown
○ Investigation Complete ○ Still Under Investigation *(submit a supplemental report when investigation is complete)*

PART G – NARRATIVE DESCRIPTION OF FACTORS CONTRIBUTING TO THE EVENT *(Attach additional sheets as necessary)*

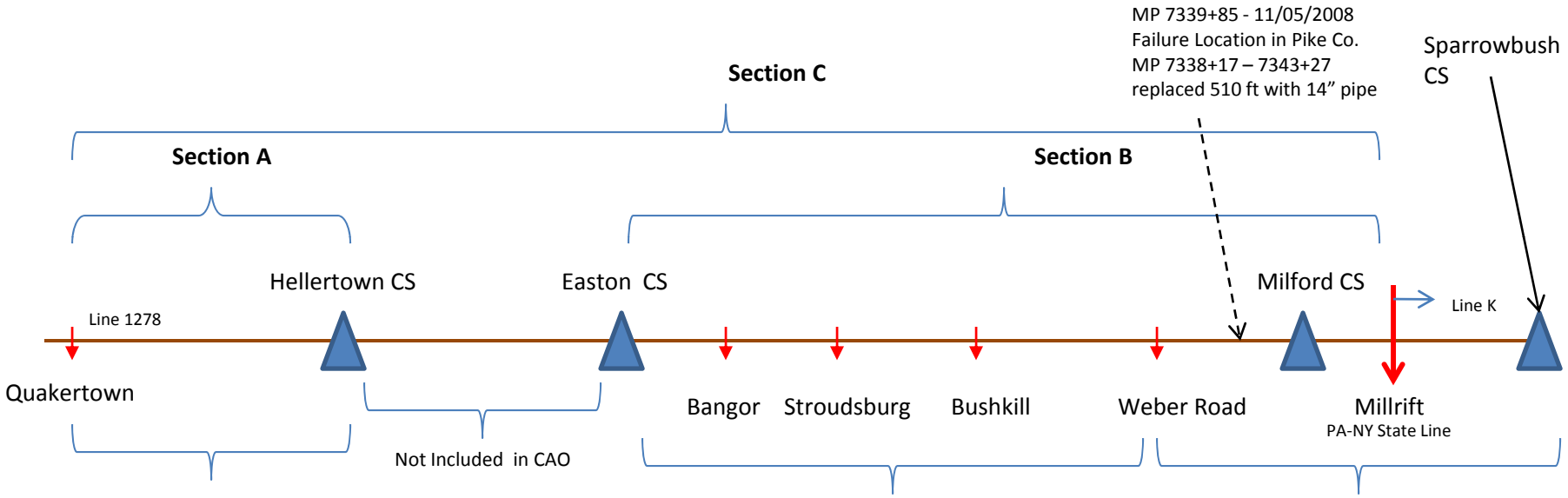
PIPELINE 1278 WAS UNDERGOING A RESTORATION OF THE PREVIOUSLY ESTABLISHED MAOP. THE PRESSURE RESTORATION PLAN WAS COMPLETED SUCCESSFULLY WHERE TEH PIPELINE WAS BEING PATROLLED UPON EACH INCREMENTAL INCREASE OF 50 PSIG FROM 800 PSIG TO 1000 PSIG. UPON CONDUCITNG NECESSARY SAFETY CHECKS, NO LEAKS WERE DETECTED BY THE LEAK DETECTION INSTRUMENTS.
AFTER SEVERAL HOURS FROM THE COMPLETION TO THE PRESSURE RESTORATION PROCEDURE, THE PIPELINE EXPERIENCED A RUPTURE DUE TO AN UNIDENTIFIED REASON. A THOROUGH INVESTIGATION IS TAKING PLACE TO IDENTIFY THE ROOT CAUSE TO THIS INCIDENT.
==========
THE FAILURE WAS CAUSED BY NEAR-NEUTRAL-PH STRESS CORROSION CRACKING IDENTIFIED BY AN INVESTIGATIVE CONSULTANT. A TOTAL OF 510 FEET REPLACED THE RUPTURED SECTION.

122980 Appendix 4 Columbia Pipeline Pressure test Graph



122980 Appendix 5 - Columbia Gas Line 1278 Rupture map

Columbia Gas Transmission Line 1278 and Line K
02/09/2011



"CGT Anticipates construction to replace this section starting in May 2011 and ending in September 2011. NGT&S commits to maintaining the operating pressure at a restricted level of 800 psig, as established by the CAO, from Weber Road in PA to the Sparrowbush Compressor Station in NY. This section contains the remaining 14" bare pipe along Lines 1278 and Line K. NGT&S commits to replace the remaining bare pipe in PA; approximately 12 miles." According to Columbia letter dated November 30, 2010.

CAO Section A Quakertown M&R Station to the Hellertown M&R Station
CAO Section B Easton Compressor Station to the Delaware River Crossing at the PA-NY State Line
CAO Section C All Uncoated Segments from Quakertown to Hellertown and from Easton to the PA-NY State Line

CPF# 1-2002-1004H