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

Principal Investigator	Karen Butler/James Bunn
Region Director	David Barrett
Date of Report	6/20/2012
Subject	Failure Investigation Report – Amoco Insulating Flange Leak, Granger, IN

Operator, Location, & Consequences

Date of Failure	August 18, 2005
Commodity Released	Refined Products, Gasoline
City/County & State	Granger/St. Joseph County, Indiana
OpID & Operator Name	395 Amoco Oil Co
Unit # & Unit Name	4573 MERRILLVILLE (AMOCO)
SMART Activity #	116167
Milepost / Location	MP 74.46
Type of Failure	Leak Due to Equipment Failure, Insulating Flange
Fatalities	0
Injuries	0
Description of area impacted	HCA, High Population, Residential Area
Total Costs	$49,000

Executive Summary

BP Amoco had determined that an insulating flange on the Whiting to River Rouge pipeline at MP 74.46 should be removed. In anticipation of this activity and as part of a newly developed ongoing flange monitoring program, BP Amoco had Delta Environmental complete the installation of 3 monitoring wells near this insulating flange. On August 18, 2005 at 15:00 EDT, a potential leak was detected at one of these three monitoring wells in Granger, IN near MP 74.46. A layer of free hydrocarbon product approximately 0.25 inch thick was detected. The area around the 12 inch insulating flange was excavated and while some old product was found in the soil near the flange, no liquid was initially observed to be leaking from the insulating flange. Upon excavation and after visual inspection, several loose bolts were re-torqued (1/4 to 1/2 turn). On the following morning (August 19, 2005), the insulating flange was observed to be leaking by BP Amoco employees and the pipeline was officially taken out of service. All of the studs (bolts) and nuts were replaced around the flange in an effort to mitigate any possible leak that could have been present. Approximately 21 gallons of gasoline were removed from the ground at MP 74.46.

This accident did not result in any injuries or fatalities. The release was discovered in a High Consequence Area. There was no fire or explosion and there were no service interruptions, but supply was of concern at the time of the hydrocarbon detection. The total cost of the accident reported by BP Amoco was $49,000. Contaminated soil was remediated and samples taken. An environmental contractor sampled water from several residential water wells; there was no evidence of hydrocarbon contamination. On August 25, 2005, when supply concerns diminished, the insulating flange was cut out of the pipeline with the newly installed bolts and nuts intact. A straight section of pipe was installed to replace the flange. The insulating flange with the original gasket material (fiber ring) still in place was sent to a metallurgical laboratory for analysis. The pipeline was then backfilled and placed back in service.

Samples from the release site were analyzed and the product was determined to be gasoline with high sulfur content. A product similar to that analyzed had last been moved through the pipeline in October of 2003. This information identified the product discovered as being from a historical release.

The metallurgical analysis revealed that the fiber ring joint gasket had some evidence of a prior leak. The flange faces had evidence of a possible leak at two different locations. The analysis determined that this leak would have been intermittent, of minimal volume and possibly characteristic of a fugitive emission release.

This pipeline system had four previous flange leaks, has sixteen significant water body crossings and transverses highly populated areas, was reported to have been originally constructed in 1953 with 26 buried flange valves and 17 buried insulating flanges, has not been hydrotested entirely, and at the time of this report contains only one remaining buried flange that is scheduled for removal or abandonment in 2013 due to a pipeline replacement project.

System Details

The Whiting to River Rouge Pipeline is 243 miles long and transports refined petroleum products from the refinery at Whiting, IN to the terminal at River Rouge, MI. The pipeline elevations range from 570 feet to 1,100 feet. The 120 mile portion of the line between Whiting and Colon junction is 12 inch in diameter and the 123 mile portion of the line between Colon Junction and River Rouge is 10 inch in diameter. The pipeline transverses heavily populated areas near Chicago and Detroit with farmland in between. Sixteen significant water bodies are crossed (rivers and canals mainly) on this pipeline.

The pipeline was reported to have been originally constructed in 1953, has not been hydrotested in its entirety, and initially contained 26 buried flange valves and 17 buried insulating flanges. This insulating flange release occurred in the 12 inch diameter portion of the line which BP Amoco reported to contain 17 flanged-end valves (8 above ground and 9 below ground) and 17 underground insulating flange sets. The wall thickness of the pipeline at the insulating flange location was 0.285 inch, but wall thickness ranges in the 12 inch pipeline between 0.281 inch and 0.688 inch. The 10 inch wall thickness ranges from 0.279 inch to 0.500 inch. The 12 inch is comprised of API 5L, grade X42, seamless line pipe that was manufactured by National Tube. The pipeline was joined by the shielded metal arc welding (SMAW) process and was coated with coal tar enamel. The MOP of the line was 1,440 psig and typical operating pressures were reported by BP for the area of the failure to be 270-300 psig. The line was inspected with a high-resolution in-line magnetic flux metal loss tool in 2002 and reassessed in March of 2007.

Events Leading up to the Failure

BP Amoco informed PHMSA of a buried flange monitoring program on the Whiting to River Rouge pipeline in March of 2005 and provided basic information about the program to PHMSA at a meeting in April of 2005. The flange monitoring program was the result of several historical flange leaks (1987 at Constantine, MI; 1995 at MP 1.09 amounting to 20 barrels; 1997 at MP 4.56 of 6 barrels; 2000 in Chesterton, IN amounting to 0.5 barrels). The flange monitoring program was to include monitoring wells, soil checks for hydrocarbons using a Photo Ionization Detector (PID), immediate excavation of any location that was suspect regarding an active leak, and continued monitoring on a 6 month basis. The operator was in the process of constructing monitoring wells and removing flanges at several locations in fall of 2005 as part of this monitoring program. The program involved flanges associated with 26 buried valves and 17 buried insulating flanges. PHMSA had identified this program initially as insufficient and requested revisions.

BP Amoco had already implemented several monitoring wells along the pipeline in August of 2005 prior to the leak. Three monitoring wells had already detected hydrocarbons initially. The first site was excavated, but no hydrocarbons were found. The second site was evaluated and contained evidence of a non-reportable historical leak. The third site was at the buried insulating flange at MP 74.46, and BP Amoco determined that this buried insulating flange should be removed. In anticipation of this activity and as part of an ongoing flange monitoring program, BP Amoco had Delta Environmental complete installation of 3 monitoring wells near this insulating flange. The two north monitoring wells were determined to be free of product.

Emergency Response

On August 18, 2005 at 3:00 p.m. EDT, a potential leak was detected at one of three monitoring wells in Granger, IN near MP 74.46. The monitoring well was located on the south side of the buried, ring joint, insulating flange. A layer of free hydrocarbon product approximately 0.25 inch thick was found at this third monitoring well. The area around the 12 inch insulating flange was excavated. Product was thought to be present in the soil near the flange, but nothing was visually observed to be leaking from the insulating flange. BP Amoco made all of the necessary agency notifications including a call to PHMSA. BP indicated upon their initial phone call with PHMSA that this was a release of historical nature. The NRC was notified at 5:48 p.m. EDT on August 18, 2005.

BP Amoco offered bottled water to residents in the area as originally it was thought that many of the wells in the area were used as drinking water sources for local residents. Delta Environmental Consultants, Inc. (Delta) was commissioned by BP to determine the extent of any soil and groundwater

contamination. Delta collected samples from seven residential water wells that were located within 500 feet of the flanged connection. It was later determined that water from these wells was actually non-potable water and was used for ponds and sprinkler systems. The results of the tests indicated that there was no contamination in the water from the wells.

The contaminated soil was removed and placed in a dump truck for disposal (approximately one dump truck load believed to be 10-27 cubic yards), and samples were taken.

Summary of Return-to-Service

BP Amoco first tightened several bolts on the existing insulating flange even though it did not appear to be leaking at the time of excavation. Since no leaks were observed when the flanged connection was excavated, BP Amoco and their environmental contractor believed that this was high test gasoline from an old leak. On the morning of August 19, 2005, the flange was observed to be leaking by BP Amoco employees and the pipeline was officially taken out of service. All of the studs and nuts were replaced around the flange in an effort to mitigate any possible leak that would have been present. An additional monitoring well had been put in place by this time and no product was found at this new location. BP Amoco re-started flow in the line on August 19, 2005 due to reported supply concerns in the Detroit area. On August 25, 2005, the insulating flange at MP 74.46 was cut out of the pipeline with the original gasket material and newly installed bolts and nuts intact. A straight section of pipe was installed to replace the flange. The insulating flange accompanied by original bolts and nuts and gasket configuration were sent to a metallurgical laboratory for analysis. The line was then backfilled and placed back in service.

Investigation Details

Immediately after the gasoline was detected at MP 74.46, BP Amoco checked all other underground flange locations for the presence of hydrocarbons. No additional leaks were found.

Approximately 21 gallons of gasoline was removed from the ground at MP 74.46. This accident did not result in any injuries or fatalities. The release was discovered in a High Consequence Area. There was no fire or explosion and there were no service interruptions. Supply was of concern at the time of the hydrocarbon detection. BP Amoco completed a short form (due to spill volume) 7000-1 on September 12 of 2005. This was within the required 30 days. The total cost of the accident as reported on this form was $49,000.

PHMSA experience indicates that the use of fiber gaskets in the ring joint type flanges is atypical. The use of fiber gaskets versus metal ring gaskets was not explored during the analysis to eliminate any contribution this may have had to leakage. This type of gasket choice may have contributed to other flange connection leaks that occurred prior to 2005.

This investigation concentrated in three areas: 1) The development of an enhanced Buried Flange Monitoring Program; 2) Liquid Sample Analysis to determine the age of the release; and 3) Metallurgical Analysis.

Buried Flange Monitoring Program

The buried flange monitoring program was further refined with PHMSA input and was determined to

have several Phases. Phase I would be similar to what had originally been submitted by BP Amoco with the additional clarification that monitoring wells would be installed on each side of each valve or insulating flange that was stand-alone. PHMSA also requested that upon immediate excavation of any site suspected of active leakage, repair and/or remediation would occur. Phase II of this program was then developed and planned to be implemented over a 2-3 year period. Phase II would require that all buried mainline and takeoff valves would be excavated and information regarding the physical data would be obtained, recorded and reviewed (type of gasket, insulating sleeves and washer details associated with all bolts or just some, etc.); proper torque would be confirmed on all flange bolts; all bolts, metal washers, or nuts would be replaced with new hardware and then torqued with the appropriate tightening sequence; insulating aspects of the flanges would be addressed as necessary; continued hydrocarbon monitoring would take place and any leaking flanges would be investigated and identified by semi-annual surveillance; all data gathered would be reviewed to determine whether a correlation could be documented regarding flange face type, gasket material, or bolt tightness regarding the likelihood of leaks; and that this information would be used to determine "high risk" valve flanges. This program was further developed over time (total time of 7 years starting in 2005) to include the removal of these flanges or buried valves. BP Amoco monitored all underground flange sites on a monthly basis until December 2005. Quarterly monitoring of the sites was initiated in 2006.

As of the time of this report, there is one flanged valve that still remains in the system. This flanged valve is located at a Marathon facility in a tank dike and is scheduled for pipeline replacement in 2013 (either the flanged valve will be removed or abandoned in place with a new section of pipeline installed). If a flange is required to be added to the system today for any reason, it is installed as a raised face flange.

Liquid Sample Analysis

A sample of liquid from the release site was sent by BP to the Whiting Refinery lab and was also analyzed independently by Torkelson Geochemistry. The Whiting Refinery lab looked into component analysis and Torkelson completed a chromatogram and characterized the degree of degradation.

The Whiting Refinery lab looked at the concentrations of 1,967 samples that had been in the River Rouge pipeline from 1997 to August 2005. From these samples and that from the release site, it was determined that the sulfur content was the most significant component to determine potential age of the product released. The sulfur content of the sample from the leak site was determined to be 347 parts per million (ppm). A review of sulfur components from the history of the River Rouge pipeline products determined that nothing in the samples had as high of a sulfur concentration since October of 2003.

The chromatogram was analyzed to first determine types of products in the sample and then to estimate the time it may have been in the water. The sample itself had lost the "light end" due to weathering processes (examples are evaporation and biodegradation). The gasoline fraction of the sample was determined to be classified as "moderately degraded". After factoring in the depth of the water in which it was found, Torkelson determined that the degree of degradation was consistent with a product that had been in the subsurface at least several years.

Metallurgical Analysis

The metallurgical analysis involved visual inspection of the flange with the gasket in original position,

hydro testing of the flange in original configuration (minus original bolts and nuts), a visual review of both sets of nuts and bolts and insulating flange pieces, and a detailed review of the gasket and flange faces.

The metallurgical analysis had the following findings:

No clear visible evidence was found of a leak when initially reviewed at the laboratory.

No evidence of a hydrocarbon leak was found on the studs or nuts (either the original set or the replaced new set).

The pipe ends had caps welded on and the flange assembly was pressure tested with water to 1,000 psig and held for a 60 minute test. No evidence of leakage was found.

Visual examination of the internal surface of the pipe and flange did not indicate or show evidence of internal corrosion.

No internal obstruction was identified that could have caused the ring joint or the spacer to have interfered with an in-line inspection smart pig.

When the flange was disassembled, there was some residual evidence of a leak on the flange faces.

The staining on the flange faces did not line up which could indicate at least two possible leak areas.

If the flange was leaking, it was most likely intermittent, very minimal and would be like a fugitive emission.

No oil-like deposits were found on either flange face or either groove of the ring joint.

The ring joint fiber ring gasket showed evidence of a possible leak.

There was a small deposit at the bottom of the outside surface of the gasket ring (6 o'clock) that had a hydrocarbon smell.

Findings and Contributing Factors

Four previous leaks from buried flanges were identified.

Historical releases may be found through buried flange monitoring programs and monitoring wells placed on either side of a buried flange can be helpful in identifying leakage locations.

Fiber gaskets may have contributed to the leak history on this pipeline but this was examined.

This pipeline has not been hydrotested throughout all segments. Per 49CFR 195.303, hazardous liquid pipeline operators may elect to follow a risk-based alternative to pressure testing of older pipelines.

The liquid sample analysis identified that degradation and sulfur component amounts indicate the leak

was from October 2003 or before.

PHMSA rejected BP Amoco's initial flange monitoring program but cooperation between parties resulted in the removal of all but one buried flange over 7 years. This was accomplished in two phases.

At the time of this report, 1 buried flange remains in the system and should be eliminated from service in 2013. It is located in a tank dike and is anticipated to require pipe replacement.

The flange leak was eliminated during the bolt replacement or initially upon the torqueing of several bolts.

If a flange is required on the River Rouge system today, a raised faced flange is used.

The flange connection with new flange bolts and nuts passed a pressure test at 1,000 psi for 60 minutes without leakage.

The flange faces had indications of a leak in two different locations.

The ring joint fiber ring gasket showed evidence of a possible leak.

There was a small deposit at the bottom of the outside surface of the ring gasket (6 o'clock) that had a hydrocarbon smell.

If the flange was leaking, it was most likely intermittent, very minimal and would be similar to a fugitive emission.

This investigation identifies the need for operators to include in their risk assessment programs elements associated with buried flange valves and buried flanges, insulated or other. It also establishes that insulating buried flange monitoring programs should be employed when pipeline assets have this as an identified risk element. Risk assessment programs should also include an understanding of the original condition of the asset construction such as fiber gaskets and hydrotest conditions.

Appendices

A Maps and Photographs

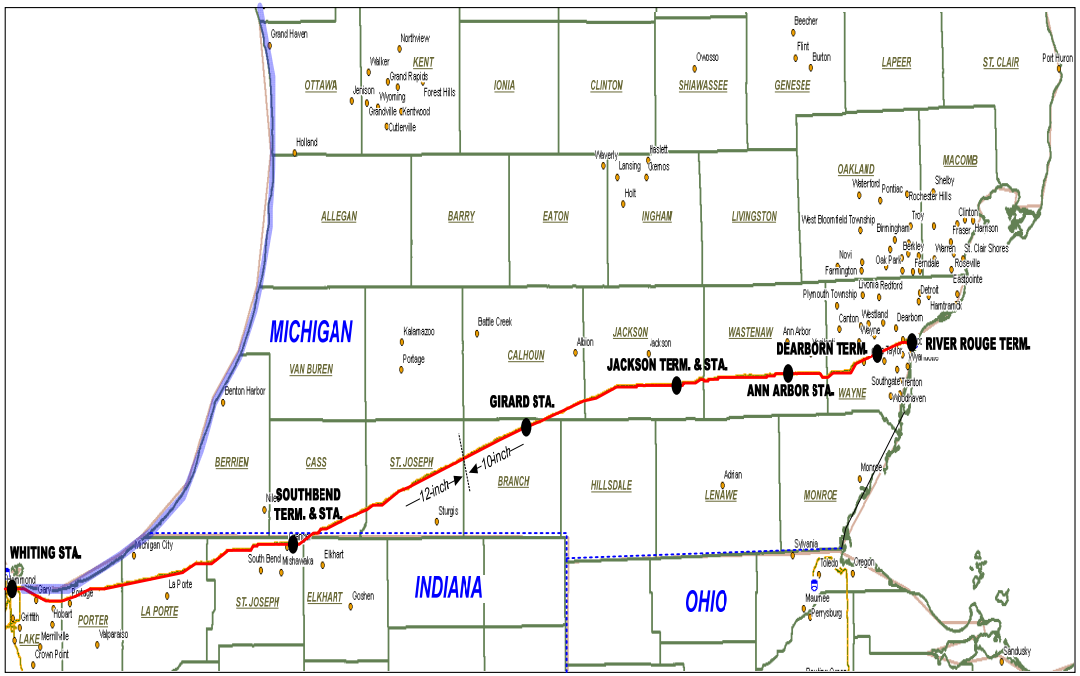
B NRC Report

C Operator Accident Report

D Metallurgical Report

Overview Map

Whiting to River Rouge Pipeline



At Fir Road, Looking West

The Leaking Flange Excavated

The Leaking Flange Facing West

Residential Area Looking West
Leaking Flange Is Located Bottom Right

Looking East to the Leak Site

Failure Location (Northwest)

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 # 769581

INCIDENT DESCRIPTION

***Report taken at 17:48 on 18-AUG-05**
Incident Type: PIPELINE
Incident Cause: EQUIPMENT FAILURE
Affected Area: GROUND WATER
The incident was discovered on 18-AUG-05 at 15:00 local time.
Affected Medium: WATER GROUND WATER

SUSPECTED RESPONSIBLE PARTY

Organization: BP PIPELINES
MERRILLVILLE, IN

Type of Organization: PRIVATE ENTERPRISE

INCIDENT LOCATION

15050 HUNTING RIDGE RD County: ST. JOSEPH
City: GRANGER State: IN

RELEASED MATERIAL(S)

CHRIS Code: GAS Official Material Name: GASOLINE: AUTOMOTIVE (UNLEADED)
Also Known As:
Qty Released: 0 UNKNOWN AMOUNT Qty in Water: 0 UNKNOWN AMOUNT

DESCRIPTION OF INCIDENT

THE CALLER IS REPORTING THE DISCOVERY OF A GASOLINE RELEASE INTO GROUND WATER COMING FROM A LEAK IN AN UNDERGROUND PIPELINE.

INCIDENT DETAILS

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

---WATER INFORMATION---
Body of Water: GROUND WATER
Tributary of:
Nearest River Mile Marker:
Water Supply Contaminated: NO

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			
Waterway:	N			

Major Artery: N

Track: N

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

REMEDIAL ACTIONS

EXCAVATED THE LINE / AN INVESTIGATION IS UNDERWAY

Release Secured: UNKNOWN
Release Rate:
Estimated Release Duration:

WEATHER

Weather: CLEAR, ºF

ADDITIONAL AGENCIES NOTIFIED

Federal:

State/Local:
State/Local On Scene:

State Agency Number:

NOTIFICATIONS BY NRC

CG INVESTIGATIVE SVC CHICAGO (CGIS ROA CHICAGO)
18-AUG-05 17:52

DOT CRISIS MANAGEMENT CENTER (PRIMARY)
18-AUG-05 17:52

U.S. EPA V (PRIMARY)
18-AUG-05 17:54

NATIONAL INFRASTRUCTURE COORD CTR (PRIMARY)
18-AUG-05 17:52

NOAA 1ST CLASS BB RPTS FOR IN (PRIMARY)
18-AUG-05 17:52

RSPA OFFICE OF PIPELINE SAFETY (PRIMARY)
18-AUG-05 17:54

IN DEPT ENV MNGMT ATTN: BEAUCHAMP (PRIMARY)
18-AUG-05 17:52

MICHIGAN DEQ ATTN: THOR STRONG (PRIMARY)
18-AUG-05 17:52

ADDITIONAL INFORMATION

NONE

***** END INCIDENT REPORT # 769581 *****

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.

NOTICE: This report is required by 49 CFR Part 195. 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 60122

Form Approved
OMB No. 2137-0047

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

ACCIDENT REPORT - HAZARDOUS LIQUID PIPELINE SYSTEMS

Report Date SEP 12,2005

No. 20050257 -- 3875
(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: ☐ Original Report ☒ Supplemental Report ☒ Final Report

1. a. Operator's OPS 5-digit Identification Number (if know) / 395 /
2. b. If Operator does not own the pipeline, enter Owner's OPS 5-digit Identification Number (if know) / /
   c. Name of Operator AMOCO OIL
   d. Operator street address 28100 TORCH PARKWAY
   e. Operator address WARRENVILLE DUPAGE IL 60555
   City, County, State and ZIP Code

IMPORTANT: IF THE SPILL IS SMALL, THAT IS, THE AMOUNT IS AT LEAST 5 GALLONS BUT IS LESS THAN 5 BARRELS, COMPLETE THIS PAGE ONLY, UNLESS THE SPILL IS TO WATER AS DESCRIBED IN 49 CFR §195.52(A)(4) OR IS OTHERWISE REPORTABLE UNDER §195.50 AS REVISED IN CY 2001.

2. Time and date of the accident

/ 1500 / / 08 / / 18 / /2005 /
hr. month day year

3. Location of accident
(If offshore, do not complete a through d See Part C.1)

a. Latitude: Longitude:
(If not available, see instructions for how to provide specific location)

b. GRANGER ST. JOSEPH
City and County or Parish

c. IN
State and Zip Code

d. Mile post/valve station ○ or Survey Station no. ○
(whichever gives more accurate location)

4. Telephone report

/ 769581 / / 08 / / 18 / / 2005 /
NRC Report Number month day year

5. Losses (Estimated)

Public/Community Losses reimbursed by operator:

Public/private property damage	$ 0
Cost of emergency response phase	$ 0
Cost of environmental remediation	$ 49,000
Other Costs	$ 0
(describe)	

Operator Losses:

Value of product lost	$ 0
Value of operator property damage	$ 0
Other Costs	$ 0
(describe)	
Total Costs:	$ 49,000

6. Commodity Spilled ● Yes ○ No
(If Yes, complete Parts a through c where applicable)

a. Name of commodity spilled **GASOLINE**

b. Classification of commodity spilled:
- ○ HVLs/other flammable or toxic fluid which is a gas at ambient conditions
- ○ CO_2 or other non-flammable, non-toxic fluid which is a gas at ambient conditons
- ● Gasoline, diesel, fuel oil or other petroleum product which is a liquid at ambient conditions
- ○ Crude oil

c. Estimated amount of commodity involved :
- ○ **Barrels**
- ● **Gallons (check only if spill is less than one barrel)**

Amounts :
Spilled : 21
Recovered:

CAUSES FOR SMALL SPILLS ONLY *(5 gallons to under 5 barrels) :*

(For large spills [5 barrels or greater] see Part H)

- ○ **Corrosion**
- ○ **Natural Forces**
- ○ **Excavation Damage**
- ○ **Other Ouside Force Damage**
- ○ **Materal and/or Weld Failures**
- ● **Equipment**
- ○ **Incorrect Operation**
- ○ **Other**

PART B - PREPARER AND AUTHORIZED SIGNATURE

LARRY S. ABRAHAM
(type or print) Preparer's Name and Title

(630) 836-3491
Area Code and Telephone Number

ABRAHALS@BP.COM
Preparer's E-mail Address

(630) 836-3582
Area Code and Facsimile Number

Authorized Signature | (type or print) Name and Title | Date | Area Cod and Telephone Number

PART C - ORIGIN OF THE ACCIDENT *(Check all that apply)*

1. Additional location information
   a. Line segment name or ID
   b. Accident on Federal land other than Outer Continental Shelf ○ Yes ● No
   c. Is pipeline interstate? ○ Yes ○ No

Offshore: ○ Yes ● No (*comple d if offshore*)
d. Area Block #
State / / or Outer Continental Shelf ☐

2. Location of system involved (check all that apply)
   ☐ Operator's Property
   ☐ Pipeline Right of Way
   ☐ High Consequence Area (HCA)?
   Describe HCA _____

3. Part of system involved in accident
   ○ Above Ground Storage Tank
   ○ Cavern or other below ground storage facility
   ○ Pump/meter station; terminal/tank farm piping and equipment, including sumps
   ○ Other Specify: _____

   ○ Onshore **pipeline**, including valve sites
   ○ Offshore **pipeline**, including platforms

*if failure occurred on **pipeline**, complete items a - g:*

4. Failure occurred on
   ○ Body of Pipe ○ Pipe Seam ○ Scraper Trap
   ○ Pump ○ Sump ○ Joint
   ○ Component ○ Valve ○ Metering Facility
   ○ Repair Sleeve ○ Welded Fitting ○ Bolted Fitting
   ○ Girth Weld
   ○ Other *(specify)* _____

   Year the component that failed was installed: / /

5. Maximum operating pressure (MOP)
   a. Estimated pressure at point and time of accident: *PSIG*
   b. MOP at time of accident: *PSIG*
   c. Did an overpressurization occur relating to the accident?
   ○ Yes ○ No

a. Type of leak or rupture
   ○ Leak: ○ Pinhole ○ Connection Failure *(complete sec. H5)*
   ○ Puncture, diameter *(inches)*
   ○ Rupture: ○ Circumferential - Separation
   ○ Longitudinal - Tear/Crack, length *(inches)*
   Propagation Length, total, both sides *(feet)*
   ○ N/A
   ○ Other _____

b. Type of block valve used for isolation of immediate section:
   Upstream: ☐ Manual ☐ Automatic ☐ Remote Control ☐ Check Valve
   Downstream: ☐ Manual ☐ Automatic ☐ Remote Control ☐ Check Valve

c. Length of segment isolated ft
d. Distance between valves ft
e. Is segment configured for internal inspection tools? ○ Yes ○ No
f. Had there been an in-line inspection device run at the point of failure? ○ Yes ○ No ○ Don't Know
   ○ Not Possible due to physical constraints in the system
g. If Yes, type of device run *(check all that apply)*
   ☐ High Resolution Magnetic Flux tool Year run:
   ☐ Low Resolution Magnetic Flux tool Year run:
   ☐ UT tool Year run:
   ☐ Geometry tool Year run:
   ☐ Caliper tool Year run:
   ☐ Crack tool Year run:
   ☐ Hard Spot tool Year run:
   ☐ Other tool Year run:

PART D - MATERIAL SPECIFICATION

1. Nominal pipe size *(NPS)* / / in.
2. Wall thickness / / in.
3. Specification SMYS / /
4. Seam type
5. valve type
6. *Manufactured by* *in year* / /

PART E - ENVIRONMENT

1. *Area of accident*
   ○ In open ditch
   ○ Under pavement
   ○ Above ground
   ○ Underground
   ○ Under water
   ○ Inside/under building
   ○ Other _____

2. *Depth of cover:* *inches*

PART F - CONSEQUENCES

1. Consequences *(check and complete all that apply)*

a.	Fatalities	Injuries
Number of operator employees:	0	0
Contractor employees working for operator:	0	0
General public:	0	0
Totals:	0	0

b. Was pipeline/segment shutdown due to leak? ○ Yes ○ No
If Yes, how long? days hours minutes

c. Product ignited ○ Yes ○ No d. Explosion ○ Yes ○ No
e. ☐ **Evacuation** *(general public only)* / _____ / people
Reason for Evacuation:
○ Precautionary by company
○ Evacuation required or initiated by public official

f. Elapsed time until area was made safe:
/ / hr. / / min.

2. Environmental Impact

a. Wildlife Impact: Fish/aquatic ○ Yes ○ No; Bird ○ Yes ○ No; Terrestrial ○ Yes ○ No
b. Soil Contamination ○ Yes ○ No
If Yes, estimated number of cubic yards:
c. Long term impact assessment performed: ○ Yes ○ No
d. Anticipated remediation ○ Yes ○ No
If Yes, Check all that apply: ☐ Surface water ☐ Groundwater ☐ Soil ☐ Vegetation ☐ Wildlife

e. Water Contamination: ○ Yes ○ No *(If Yes, provide the following)*
Amount in water barrels
Ocean/Seawater ○ No ○ Yes
Surface ○ No ○ Yes
Groundwater ○ No ○ Yes
Drinking water ○ No ○ Yes *(If Yes, check below.)*
○ Private well ○ Public water intake

PART G - LEAK DETECTION INFORMATION

1. Computer based leak detection capability in place? O Yes O No
2. Was the release intially detected by? (check one):
   - O CPM/SCADA-based system with leak detection
   - O Static shut-in test or other pressure or leak test
   - O Local operating personnel, procedures or equipment
   - O Remote operating personnel, including controllers
   - O Air patrol or ground surveillance
   - O A third party
   - O Other (specify) _____
3. Estimated leak duration days hours

PART H - APPARENT CAUSE

Important: There are 25 numbered causes in this Part H. Check the box corresponding to the primary cause of the accident. Check one circle in each of the supplemental categories corresponding to the cause you indicate. Secc the instructions for guidance.

H1 - CORROSION

1. O External Corrosion
2. O Internal Corrosion

(Complete items a - e where applicable.)

a. Pipe Coating
- O Bare
- O Coated

b. Visual Examination
- O Localized Pitting
- O General Corrosion
- O Other _____

c. Cause of Corrosion
- O Galvanic
- O Atmospheric
- O Stray Current
- O Microbiological
- O Cathodic Protection Disrupted
- O Stress Corrosion Cracking
- O Selective Seam Corrosion
- O Other _____

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

e. Was pipe previously damaged in the area of corrosion?
O No O Yes => Estimated time prior to accident: / / years / / months Unknown ☐

H2 - NATURAL FORCES

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

H3 - EXCAVATION DAMAGE

8. O Operator Excavation Damage (including their contractors/Not Third Party)
9. O Third Party *(complete a-f)*

a. Excavator group
- O General Public O Government O Excavator other than Operator/subcontractor

b. Type:
- O Road Work O Pipeline O Water O Electric O Sewer O Phone/Cable
- O Landowner-not farming related O Farming O Raildroad
- O Other liquid or gas transmission pipeline-operator or their contractor
- O Nautical Operations O Other

c. Excavation was: O Open Trench O Sub-strata (boring, directional drilling, etc...)

d. Excavation was an ongoing activity (Month or longer) O Yes O No If Yes, Date of last contact / /

e. Did operator get prior notification of excavation activity?
- O Yes; Date received: / / mo. / / day / / yr. O No
- Notification received from: O One Call System O Excavator O Contractor O Landowner

f. Was pipeline marked as result of location request for excavation? O No O Yes (If Yes, check applicable items i - iv)
- i. Temporary markings: O Flags O Stakes O Paint
- ii. Permanent markings: O Yes O No
- iii. Marks were (check one) : O Accurate O Not Accurate
- iv. Were marks made within required time? O Yes O No

H4 - OTHER OUTSIDE FORCE DAMAGE

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

H5 - MATERIAL AND/OR WELD FAILURES

Material

14. O Body of Pipe => O Dent O Gouge O Bend O Arc Burn O Other _____

15. O Component => O Valve O Fitting O Vessel O Extruded Outlet O Other _____

16. O Joint => O Gasket O O-Ring O Threads O Other _____

Weld

17. O Butt => O Pipe O Fabrication O Other _____

18. O Fillet => O Branch O Hot Tap O Fitting O Repair Sleeve O Other _____

19. O Pipe Seam => O LF ERW O DSAW O Seamless O Flash Weld
O HF ERW O SAW O Spiral O Other _____

Complete a-g if you indicate **any** *cause in part H5.*

a. Type of failure:
O Construction Defect => O Poor Workmanship O Procedure not followed O Poor Construction Procedures
O Material Defect

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

c. Was part which leaked pressure tested before accident occurred? O Yes, complete d-g O No

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

e. Test medium: O Water O Inert Gas O Other

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

g. Estimated test pressure at point of accident: *PSIG*

H6 - EQUIPMENT

20. O Malfunction of Control/Relief Equipment => O Control valve O Instrumentation O SCADA O Communications
O Block valve O Relief valve O Power failure
O Other

21. O Threads Stripped Broken Pipe Coupling => O Nipples O Valve Threads O Dresser Couplings
O Other

22. O Seal Failure => O Gasket O O-Ring O Seal/Pump Packing
O Other

H7 - INCORRECT OPERATION

23. O Incorrect Operation

a. Type O Inadequate Procedures O Inadequate Safety Practices O Failure to Follow Procedures
O Other

b. Number of employees involved who failed a post-accident test: drug test: / / alcohol test / /

H8 - OTHER

24. O Miscellaneous, *describe:*

25. O Unknown
O Investigation Complete O Still Under Investigation (*Submit a supplemental report when investigation is complete*)

PART I - NARRATIVE DESCRIPTION OF FACTORS CONTRIBUTING TO THE EVENT

(Attach additional sheets as necessary)

Appendix D

Amoco Oil Company

Metallurgical Report

This document is on file at PHMSA