

DOT	US Department of Transportation
PHMSA	Pipelines and Hazardous Materials Safety Administration
OPS	Office of Pipeline Safety Eastern Region
Principal Investigator	Al Schoen
Region Director	Byron Coy
Date of Report	04/28/2011
Subject	Failure Investigation Report – Sunoco R&M Flange Gasket

Operator, Location, & Consequences

Date of Failure	03/25/2010
Commodity Released	Vacuum Gas Oil and Light Cycle Oil
City/County & State	Philadelphia, PA
OpID & Operator Name	18779 Sunoco Inc, R&M
Unit # & Unit Name	65981 Northeast Refinery Complex, PA
SMART Activity #	129572
Milepost / Location	Latitude 39.91934, Longitude -75.20447
Type of Failure	Flange Leak caused by deteriorated gasket. The loss of pipe support and leakage through a closed valve contributed to the failure.
Fatalities	None
Injuries	None
Description of area impacted	Area designated as High Population Area in proximity to a Commercially Navigable Waterway (Schuylkill River, Philadelphia). The area was under the control of the Operator in a fenced off area that is off-limits to the public.
Property Damage	\$100,000

Failure Investigation Report – Sunoco R&M Flange Gasket

03/25/2010

Executive Summary

On March 25, 2010, there was a release of 1700 barrels of Vacuum Gas Oil (VGO) from the FM-1 pipeline into an open in-ground valve pit and the surrounding area in the West Yard of the Sunoco, R&M Philadelphia refinery in Philadelphia, PA. The cause of the release was a failure of a flange gasket downstream of a main line valve in a dead leg of pipe leading to the FM-1 pig trap. Loss of pipe support and leakage through a closed valve contributed to the failure. There were no fatalities or injuries, and the incident did not result in a fire, explosion or evacuation.

The flange gasket failed during a shipment of VGO between the Schuylkill River Tank Farm (SRTF) and the North Yard (NYOM) of the Refinery. The flange and pipe headers were located in a holding pit which overflowed during the release but was contained within the West Yard facility.

System Details

The FM-1 pipeline is approximately 2 miles long and connects two Sunoco Inc, R&M (Sunoco) tank farms. Appendix C is a schematic of the flow path at the West Yard. Product flows through the FM-1 MOV against the Mainline Valve to the FM-1 trap through C Header and down to the N-8 piping in the pit, through valve 1-22 and on to the North Yard. The Mainline Valve to the FM-1 trap is normally closed.

The MOP of the pipeline system was 250 psig based on the ASME Class 150 valve and flanges operating at 200 degrees Fahrenheit. The pipe was 16" OD ASTM A53 Grade B Carbon Steel Seamless pipe, 0.312" wall thickness with Somastic coating. The pipeline was constructed in 1941. There is no reported history of failures on this line. There were no supply impacts as a new bypass piping was installed on 3/28/2010 and Sunoco was able to resume shipments three days after the incident.

Events Leading up to the Failure (Appendix D)

3/18/2010: A Hydrochem (contract vacuum truck) employee who routinely monitored and managed residual oil accumulation in refinery sumps and the West Yard manifold pit reported heavy oil accumulation in the West Yard pit. This was believed to have been caused by ground water seepage into the valve pit.

03/21/2010, at 23:20 hrs: A shipment of VGO was started at 1000 bph from the Schuylkill River Tank Farm (SRTF) to the North Yard (NYOM) area of Sunoco's Philadelphia Refinery (Appendix A) displacing Light Cycle Oil (LCO) from the pipeline.

3/22/2010 at 03:30 hrs: The LCO was totally displaced from the line and the pressure at NYOM climbed to 58 psig. All pressure readings referred to in this report were recorded at NYOM which is 2500 feet downstream of the valve pit at the West Yard (Appendix A).

3/24/2010 08:00 hrs: Pressure stayed constant till 08:00 hrs when the flow was cut back to 1000 BPH. At this point the pressure dropped to about 35 psi.

3/24/2010 at 20:25 hrs: The flow rate was increased to 2000 BPH and pressure rose to 80 psig.

3/25/2010 At 13:45 hrs: A contractor employee entered the West Yard and discovered a release of heavy oil in the valve pit. The pressure was noted at 35 psig.

3/25/2010 14:00 hrs: The pressure rose slightly to 38 psig and the pipeline was shutdown to change the valve lineup to allow flushing of the line with LCO.

3/25/2010 18:00 hrs: Flush was complete and the line was shut down and the piping manifold was isolated using the FM1 MOV and N-8 main line valves.

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Emergency Response

The leak was discovered at 13:45 and the line was shut down at 18:00 hrs, after the heavier VGO had been removed from the pipeline. Sunoco used a response contractor and its own resources to control and mitigate the leak. The area immediately around the valve pit was boomed off to contain the leaked product and prevent it from entering the surrounding water logged ground (Appendix B).

The area was under the control of Sunoco in a fenced off area that is off-limits to the public.

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

The failed section of pipe was isolated. New piping was installed. The pipe was returned to service on 03/28/2010.

Investigation Findings & Contributing Factors

Sunoco conducted a pressure integrity test on the failed piping to determine source of the leak. This test identified the flange as the source.

The loss of pipe support and leakage through a closed valve contributed to the failure (Appendix B).

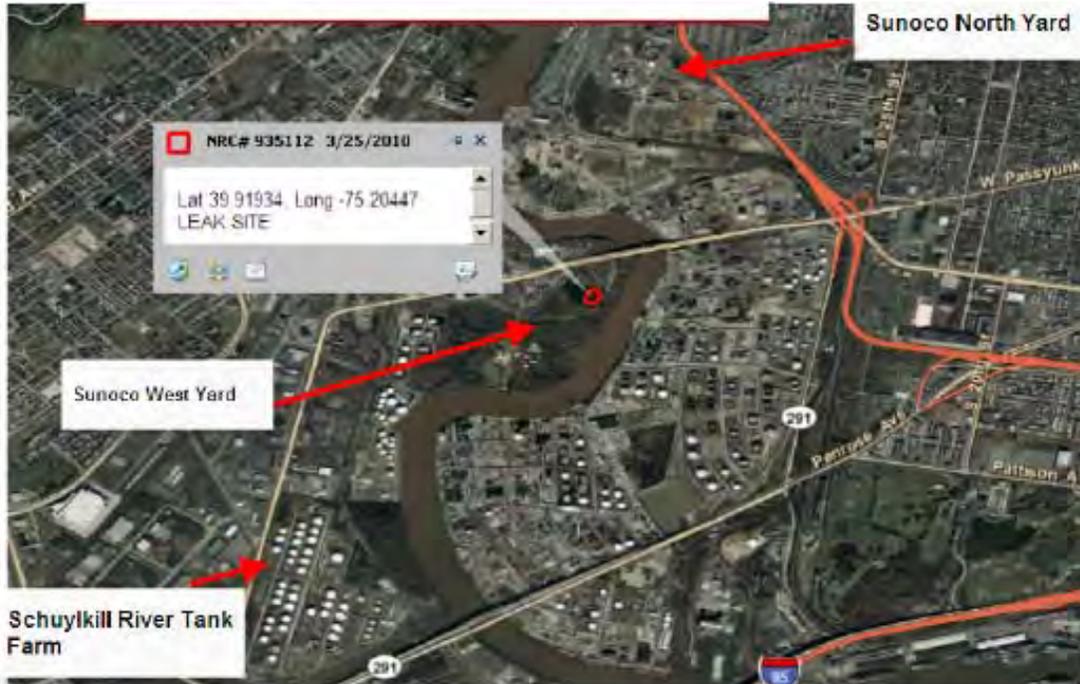
The mechanical failure of the Mainline valve seat and gate allowed product to pass into the section of piping including the failed flange. Failure of the paper gasket in the flange caused the flange to leak.

Appendices

- A Sunoco Facility Maps
- B Photos
- C Flow Diagrams
- D Event Log Plot
- E PHMSA F7000-1 Report - Supplemental
- F NRC Report 935112

Appendix A – Sunoco Facility Maps

Sunoco Facility



West Yard Piping



Appendix A – Sunoco Facility Maps

Sunoco Facility



Appendix B - Photos

Photo 1 - Valve Pit Piping

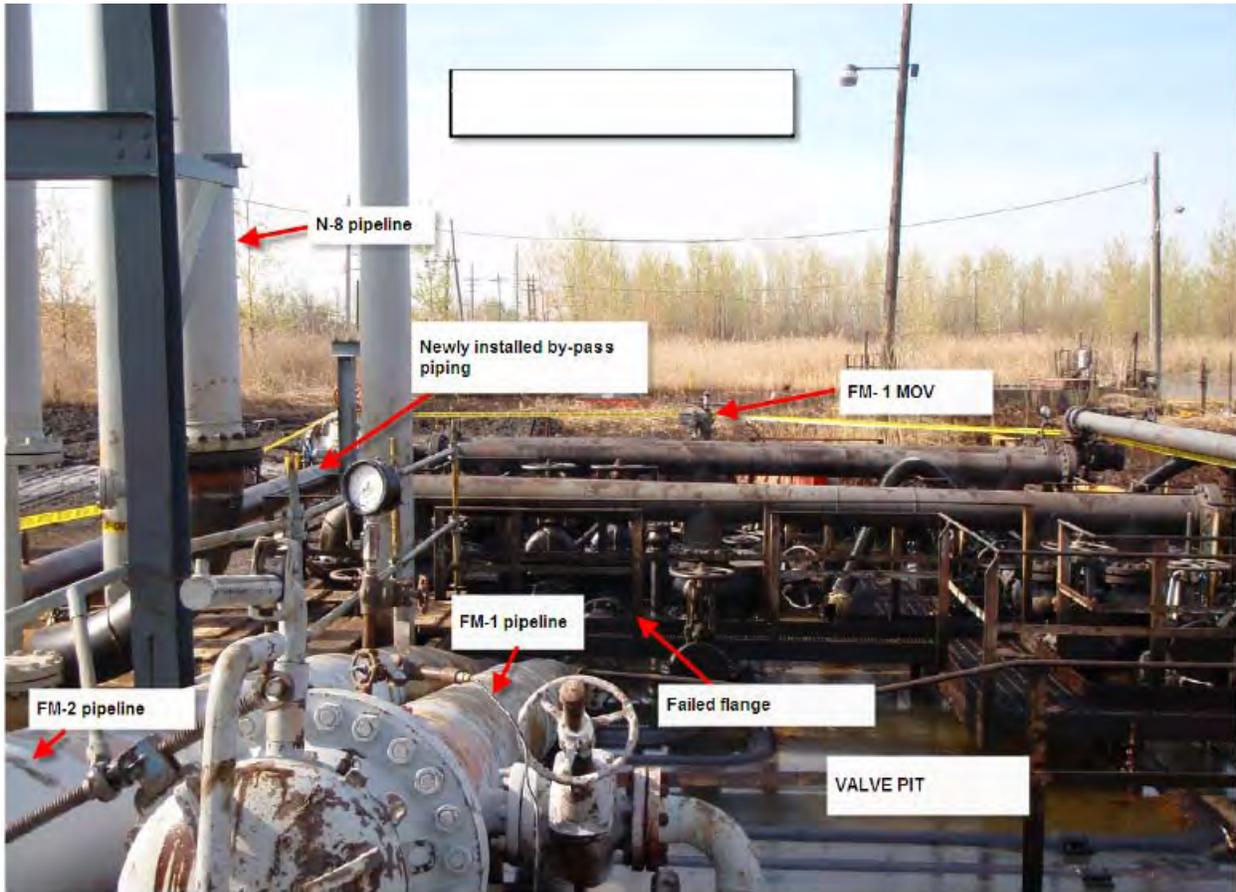


Photo 2 - Bypass piping

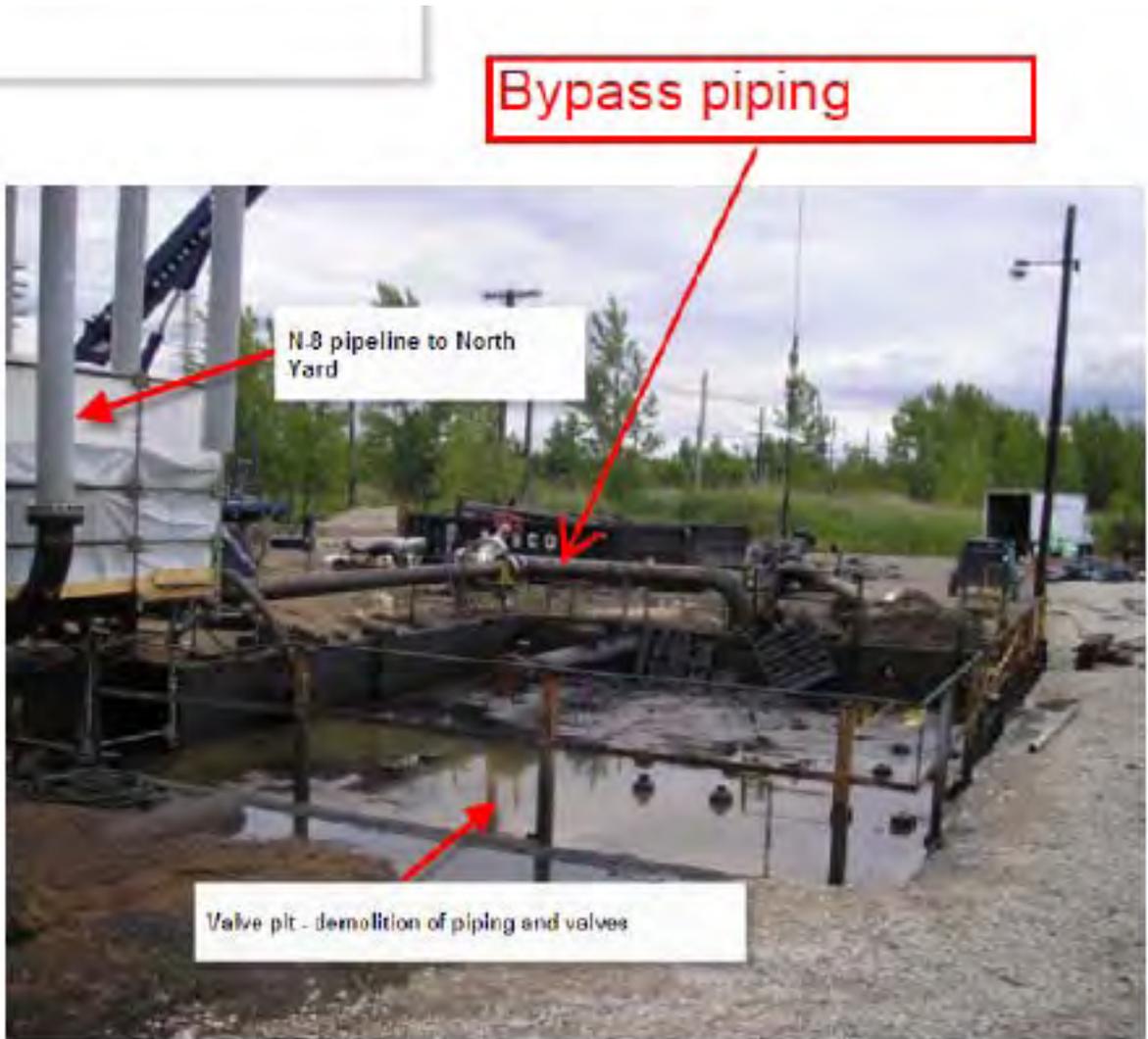


Photo 3 – Flange Gasket



Paper gasket eroded at leak location (orientation about 8:30)

Photo 4 – Flange Face



Photo 5 – New Bypass Piping



Photo 6 – Spool Piece Support

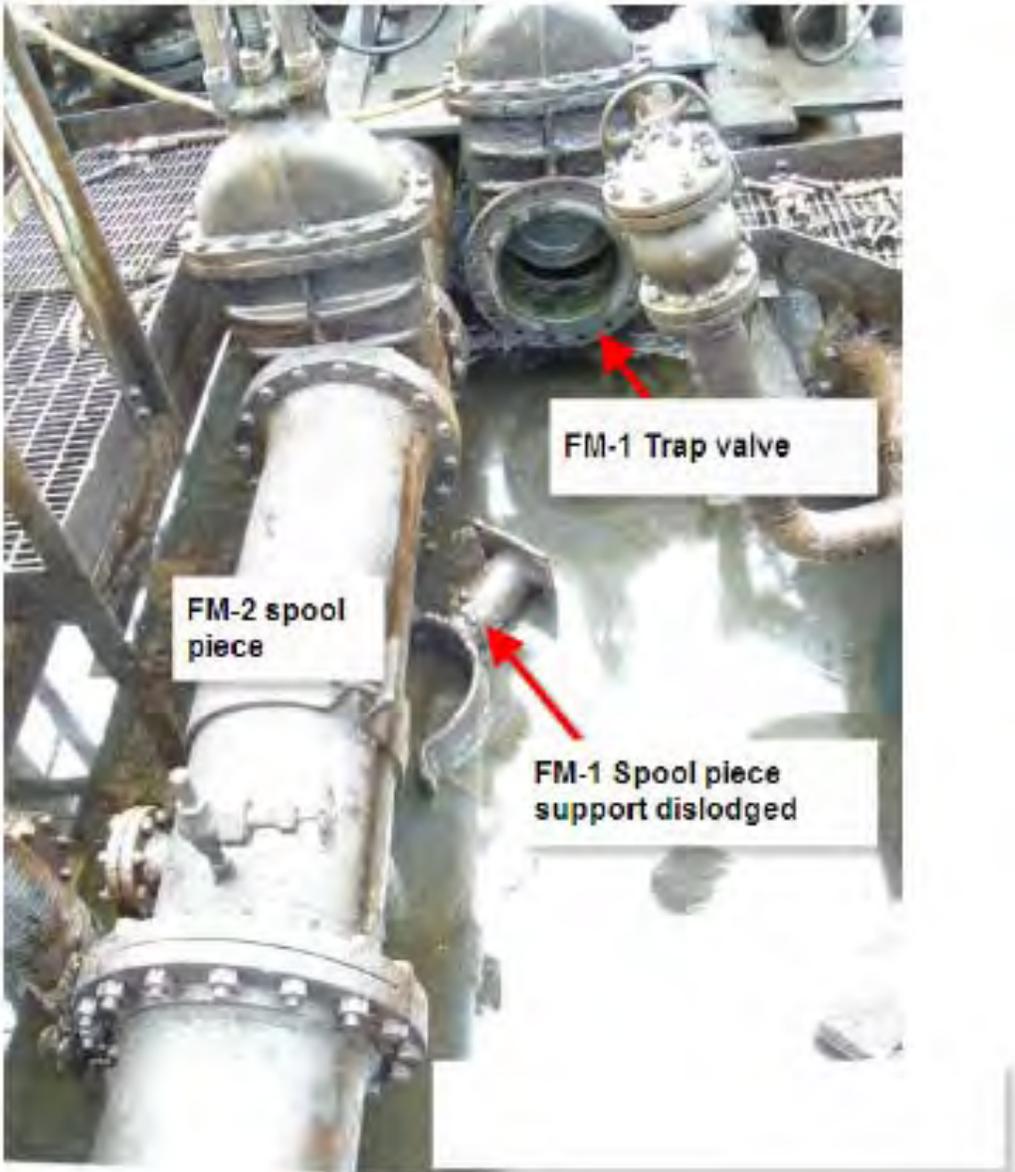


Photo 7 – Trap Valves



to stop short of full closure.

16" Trap Inlet/Outlet Valve appeared



scale was removed from gate cavity...

Residual heavy oil containing metal

Photo 8 – Trap Valve Test



FM-1 Trap valve found to have a mechanical defect preventing a tight shut-off during seat test.

Appendix B - Photos

Photo 9 – Spill Area 03272010

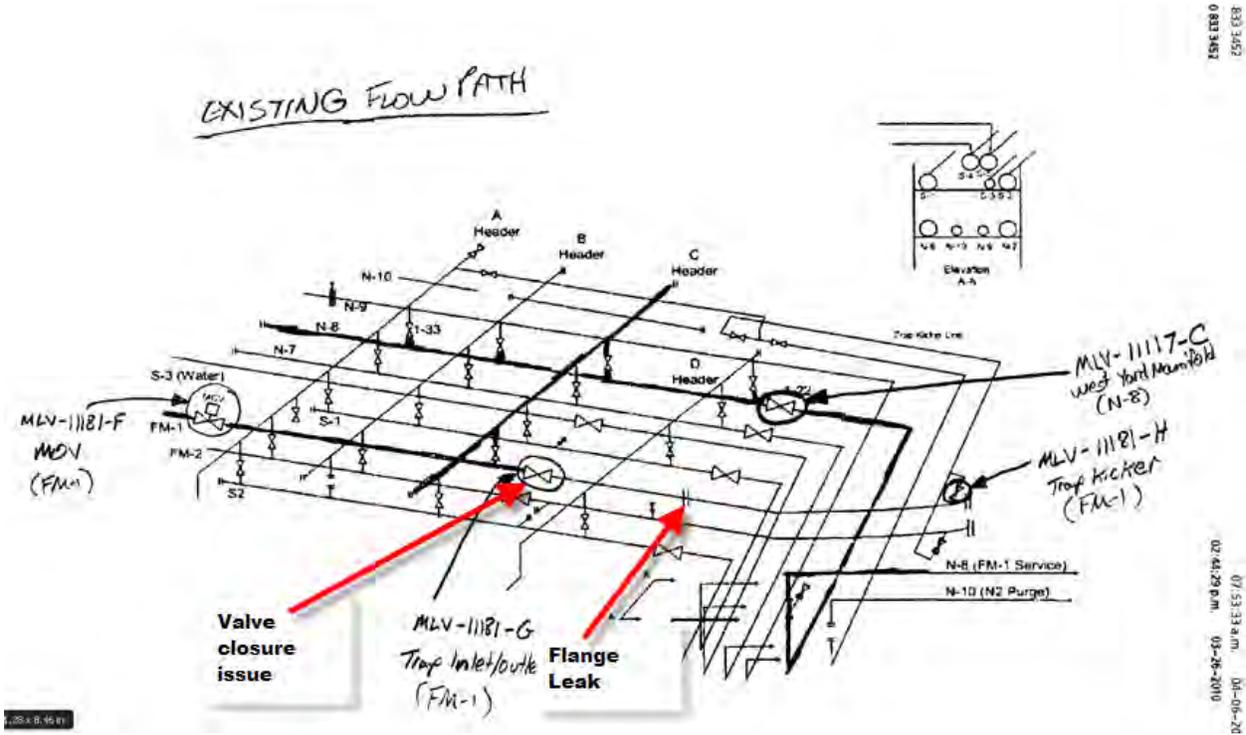


Photo 10– Spill Area 05192010



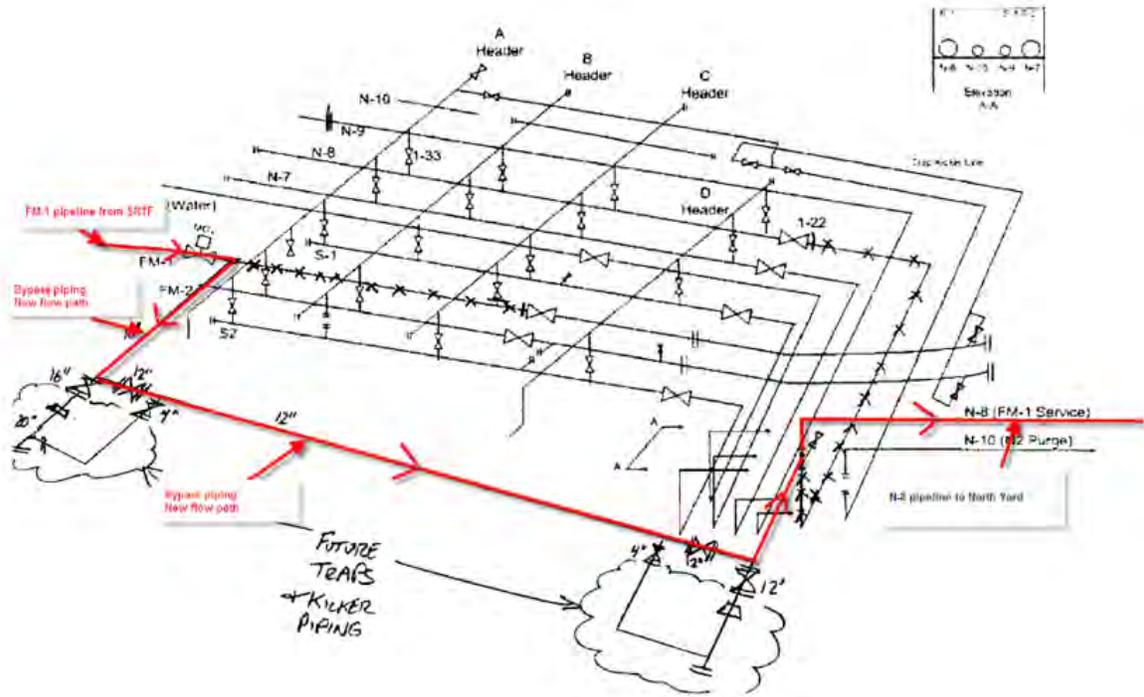
Appendix C – Flow Diagrams

Existing Flow Diagram

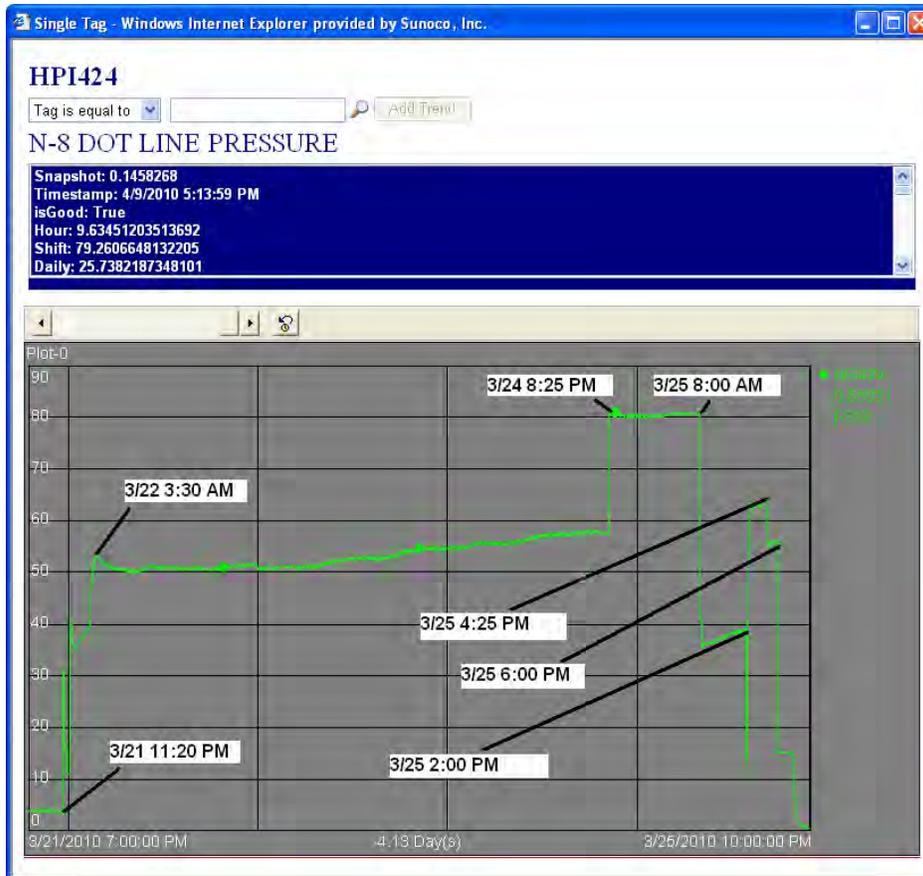


Appendix C – Flow Diagrams

New Flow Diagram



129572 Appendix D - Event Log Plot



Date	Time	Event
3/21/2010	11:20 PM	Started North Tank Field (NTF) Pump P-226 from GP TK284 VGO, pushing FM-1 / N-8 line fill of LCO to North Yard Oil Movements (NYOM) TK668.
3/22/2010	3:30 AM	Opened VGO from GP TK284 into NYOM TK672 and cut away from TK668.
3/24/2010	8:25 PM	Opened P-226 discharge valve, increased rate from 1000 bph (min) to 2200 bph (max).
3/25/2010	8:00 AM	Adjusted (closed) P-226 discharge valve, decreased rate from 2200 bph (max) to 1000 bph (min).
3/25/2010	1:45 PM	Discovered release from FM-1 / N-8 Manifold in West Yard.
3/25/2010	2:00 PM	Shutdown P-226, manifold wash to ONT Line to GP TK284, started P-201A/B from GP South Tank Field (STF) TK219 LCO, to complete VGO flush of FM-1 / N-8 to NYOM TK672 at 1700 bph.
3/25/2010	4:25 PM	Line wash rate reduced.
3/25/2010	6:00 PM	P-201A/B shutdown. FM-1 / N-8 Lines displaced with LCO. FM-1 / N-8 Main Line Valve isolated.

129572 Appendix E - PHMSA F 7000-1 Report Supplemental

NOTICE: This report is required by 49 CFR Part 195. 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: 2137-0047 EXPIRATION DATE: 01/31/2013	
 U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration	Report Date:	05/24/2010	
	No.	20100054 - 15114 ----- (DOT Use Only)	
ACCIDENT REPORT - HAZARDOUS LIQUID PIPELINE SYSTEMS			
A federal agency may not conduct or sponsor, and a person is not required to respond to, nor shall a person be subject to a penalty for failure to comply with a collection of information subject to the requirements of the Paperwork Reduction Act unless that collection of information displays a current valid OMB Control Number. The OMB Control Number for this information collection is 2137-0047. Public reporting for this collection of information is estimated to be approximately 10 hours per response (5 hours for a small release), including the time for reviewing instructions, gathering the data needed, and completing and reviewing the collection of information. All responses to this collection of information are mandatory. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to: Information Collection Clearance Officer, PHMSA, Office of Pipeline Safety (PHP-30) 1200 New Jersey Avenue, SE, Washington, D.C. 20590.			
INSTRUCTIONS			
Important: Please read the separate instructions for completing this form before you begin. They clarify the information requested and provide specific examples. If you do not have a copy of the instructions, you can obtain one from the PHMSA Pipeline Safety Community Web Page at http://www.phmsa.dot.gov/pipeline .			
PART A - KEY REPORT INFORMATION			
Report Type: <i>(select all that apply)</i>	Original:	Supplemental:	Final:
Report Status	Submitted	Yes	
Create Date	05/24/2010		
Operator Name and Address			
1. Operator's OPS-issued Operator Identification Number (OPID):	18779		
2. Name of Operator	SUNOCO, INC (R&M)		
3. Address of Operator:			
3a. Street Address	BOX 426		
3b. City	MARCUS HOOK		
3c. State	Pennsylvania		
3d. Zip Code	19061		
4. Local time (24-hr clock) and date of the Accident:	Date/Time	03/25/2010 13:42	
5. Location of Accident:			
Latitude:	39.91934		
Longitude:	-75.20447		
6. National Response Center Report Number (if applicable):	935112		
7. Local time (24-hr clock) and date of initial telephonic report to the National Response Center (if applicable):	Date/Time	03/25/2010 15:20	
8. Commodity released: <i>(select only one, based on predominant volume released)</i>	Refined and/or Petroleum Product (non-HVL) which is a Liquid at Ambient Conditions		
Specify Commodity Subtype:	Other		
If "Other" Subtype, Describe:	Vacuum Gas Oil (VGO)		
- If Biofuel/Alternative Fuel and Commodity Subtype is Ethanol Blend, then % Ethanol Blend:	%		
- If Biofuel/Alternative Fuel and Commodity Subtype is Biodiesel, then Biodiesel Blend (e.g. B2, B20, B100):	B		
9. Estimated volume of commodity released unintentionally:	Barrels:	1,700.00	
10. Estimated volume of intentional and/or controlled release/blowdown:	Barrels:		
11. Estimated volume of commodity recovered:	Barrels:	1,699.00	
12. Were there fatalities?	No		
- If Yes, specify the number in each category:			
12a. Operator employees			
12b. Contractor employees working for the Operator			
12c. Non-Operator emergency responders			
12d. Workers working on the right-of-way, but NOT associated with this Operator			
12e. General public			
12f. Total fatalities (sum of above)			
13. Were there injuries requiring inpatient hospitalization?	No		
- If Yes, specify the number in each category:			

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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 injuries (sum of above)	
14. Was the pipeline/facility shut down due to the Accident?	Yes
If No, Explain:	
- If Yes, complete Questions 14a and 14b: (use local time, 24-hr clock)	
14a. Local time and date of shutdown:	
Date/Time	03/25/2010 18:00
14b. Local time pipeline/facility restarted:	
Date/Time	03/28/2010 16:00
- Still shut down? (* Supplemental Report Required)	
15. Did the commodity ignite?	No
16. Did the commodity explode?	No
17. Number of general public evacuated:	0
18. Time sequence (use local time, 24-hour clock):	
18a. Local time Operator identified Accident:	
Date/Time	03/25/2010 13:42
18b. Local time Operator resources arrived on site:	
Date/Time	03/25/2010 13:49
PART B - ADDITIONAL LOCATION INFORMATION	
1. Was the origin of Accident onshore?	Yes
If Yes, Complete Questions (2-12)	
If No, Complete Questions (13-15)	
- If Onshore:	
2. State:	Pennsylvania
3. Zip Code:	19145
4. City:	Philadelphia
5. County or Parish:	Philadelphia
6. Operator-designated location: (select only one)	Milepost/Valve Station
Specify:	Philadelphia
7. Pipeline/Facility name:	Philadelphia Refinery - West Yard
8. Segment name/ID:	FM-1 Pipeline, ID# 11181
9. Was Accident on Federal land, other than the Outer Continental Shelf (OCS)?	No
10. Location of Accident: (select only one)	Totally contained on Operator-controlled property
11. Area of Accident (as found): (select only one)	Aboveground
If Underground, Aboveground or Transition Area, specify:	Other
- If Other, Describe:	Inside an open vault below grade
If Underground specify, Depth-of-Cover (in):	
12. Did Accident occur in a crossing?	No
If Yes, specify below:	
- If "Bridge crossing"	
- Specify	
- If "Railroad crossing"	
- Specify	
- If "Road crossing"	
- Specify	
- If "Water crossing"	
- Specify	
- Name of body of water, if commonly known:	
- Approx. water depth (ft) at the point of the Accident:	
- Select:	
- If Offshore:	
13. Approximate water depth (ft) at the point of the Accident:	
14. Origin of Accident:	
- In State waters - Specify:	
State:	
Area:	
Block/Tract #:	
Nearest County/Parish:	
- On the Outer Continental Shelf (OCS) - Specify:	
Area:	
Block #:	
15. Area of Accident: (select only one)	
PART C - ADDITIONAL FACILITY INFORMATION	

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1. Is the pipeline or facility:	Intrastate
2. Part of system involved in Accident: <i>(select only one)</i>	Onshore Pipeline, Including Valve Sites
- If Onshore Breakout Tank or Storage Vessel, Including Attached Appurtenances, specify:	
3. Item involved in Accident: <i>(select only one)</i>	Flange
- If Pipe, specify:	
3a. Nominal diameter of pipe (in):	
3b. Wall thickness (in):	
3c. SMYS (Specified Minimum Yield Strength) of pipe (psi):	
3d. Pipe specification:	
3e. Pipe Seam, specify:	
- If Other, Describe:	
3f. Pipe manufacturer:	
3g. Year of manufacture:	
3h. Pipeline coating type at point of Accident, specify:	
- If Other, Describe:	
- If Weld, including heat-affected zone, specify:	
- If Other, Describe:	
- If Valve, specify:	
- If Mainline, specify:	
- If Other, Describe:	
3i. Manufactured by:	
3j. Year of manufacture:	
- If Tank/Vessel, specify:	
- If Other - Describe:	
- If Other, describe:	
4. Year item involved in Accident was installed:	
5. Material involved in Accident:	Carbon Steel
- If Material other than Carbon Steel, specify:	
6. Type of Accident Involved: <i>(select only one)</i>	Leak
- If Mechanical Puncture,	
Approx. size: in. (axial) by	
in. (circumferential)	
- If Leak - Select Type	Seal or Packing
- If Other, Describe:	
- If Rupture - Select Orientation	
Other/Describe:	
Approx. size: in. (widest opening) by	
in. (length circumferentially or axially)	
- If Other,	
Describe:	
PART D - ADDITIONAL CONSEQUENCE INFORMATION	
1. Wildlife impact:	Yes
1a. If Yes, specify all that apply:	
- Fish/aquatic	Yes
- Birds	
- Terrestrial	
2. Soil contamination:	Yes
3. Long term impact assessment performed or planned:	Yes
4. Anticipated remediation:	Yes
4a. If Yes, specify all that apply:	
- Surface water	
- Groundwater	
- Soil	Yes
- Vegetation	Yes
- Wildlife	
5. Water contamination:	No
5a. If Yes, specify all that apply:	
- Ocean/Seawater	
- Surface	
- Groundwater	
- Drinking water: <i>(Select one or both)</i>	
- Private Well	
- Public Water Intake	
5b. Estimated amount released in or reaching water:	
Barrels:	
5c. Name of body of water, if commonly known:	
6. At the location of this Accident, had the pipeline segment or facility	Yes

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been identified as one that "could affect" a High Consequence Area (HCA) as determined in the Operator's Integrity Management Program?	
7. Did the released commodity reach or occur in one or more High Consequence Area (HCA)?	Yes
7a. If Yes, specify HCA type(s): <i>(Select all that apply)</i>	
- Commercially Navigable Waterway:	
Was this HCA identified in the "could affect" determination for this Accident site in the Operator's Integrity Management Program?	
- High Population Area:	Yes
Was this HCA identified in the "could affect" determination for this Accident site in the Operator's Integrity Management Program?	Yes
- Other Populated Area	
Was this HCA identified in the "could affect" determination for this Accident site in the Operator's Integrity Management Program?	
- Unusually Sensitive Area (USA) - Drinking Water	Yes
Was this HCA identified in the "could affect" determination for this Accident site in the Operator's Integrity Management Program?	No
- Unusually Sensitive Area (USA) - Ecological	
Was this HCA identified in the "could affect" determination for this Accident site in the Operator's Integrity Management Program?	
8. Estimated cost to Operator :	
8a. Estimated cost of public and non-Operator private property damage paid/reimbursed by the Operator	\$ 0
8b. Estimated cost of commodity lost	\$ 0
8c. Estimated cost of Operator's property damage & repairs	\$ 0
8d. Estimated cost of Operator's emergency response	\$ 0
8e. Estimated cost of Operator's environmental remediation	\$ 100,000
8f. Estimated other costs	\$ 0
Describe:	
8g. Estimated total costs (sum of above)	\$
PART E - ADDITIONAL OPERATING INFORMATION	
1. Estimated pressure at the point and time of the Accident (psig):	80.00
2. Maximum Operating Pressure (MOP) at the point and time of the Accident: (psig):	250.00
3. Describe the pressure on the system or facility relating to the Accident: <i>(select only one)</i> (psig):	Pressure did not exceed MOP
4. Not including pressure reductions required by PHMSA regulations (such as for repairs and pipe movement), was the system or facility relating to the Accident operating under an established pressure restriction with pressure limits below those normally allowed by the MOP?	No
- If Yes, Complete 4.a and 4.b 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 - <i>(Complete 5a. – 5f. below)</i>	
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):	2,340
5d. Is the pipeline configured to accommodate internal inspection tools?	Yes
- If No, Which physical features limit tool accommodation? <i>(select all that apply)</i>	
- 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.)	

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- 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? (<i>select all that apply</i>)	
- Excessive debris or scale, wax, or other wall buildup	
- Low operating pressure(s)	
- Low flow or absence of flow	
- Incompatible commodity	
- Other -	
- If Other, Describe:	
5f. Function of pipeline system: (<i>select only one</i>)	=< 20% SMYS Regulated Trunkline/Transmission
6. Was a Supervisory Control and Data Acquisition (SCADA)-based system in place on the pipeline or facility involved in the Accident?	No
If Yes -	
6a. Was it operating at the time of the Accident?	
6b. Was it fully functional at the time of the Accident?	
6c. Did SCADA-based information (such as alarm(s), alert(s), event(s), and/or volume calculations) assist with the detection of the Accident?	
6d. Did SCADA-based information (such as alarm(s), alert(s), event(s), and/or volume calculations) assist with the confirmation of the Accident?	
7. Was a CPM leak detection system in place on the pipeline or facility involved in the Accident?	No
- If Yes:	
7a. Was it operating at the time of the Accident?	
7b. Was it fully functional at the time of the Accident?	
7c. Did CPM leak detection system information (such as alarm(s), alert(s), event(s), and/or volume calculations) assist with the detection of the Accident?	
7d. Did CPM leak detection system information (such as alarm(s), alert(s), event(s), and/or volume calculations) assist with the confirmation of the Accident?	
8. How was the Accident initially identified for the Operator? (<i>select only one</i>)	Local Operating Personnel, including contractors
- If Other, Specify:	
8a. If "Controller", "Local Operating Personnel", including contractors", "Air Patrol", or "Guard Patrol by Operator or its contractor" is selected in Question 8, specify the following: (<i>select only one</i>)	Contractor working for the Operator
9. Was an investigation initiated into whether or not the controller(s) or control room issues were the cause of or a contributing factor to the Accident? (<i>Select only one</i>)	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: (<i>provide an explanation for why the operator did not investigate</i>)	Review of operating data did not indicate an Abnormal Operating Condition (AOC) existed and was apparent to the controller prior to discovery of the release.
- If Yes, specify investigation result(s): (<i>select all that apply</i>)	
- 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 (<i>provide an explanation for why not</i>)	
(<i>provide an explanation for why not</i>)	
- 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	

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- 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 Accident, were any Operator employees tested under the post-accident drug and alcohol testing requirements of DOT's Drug & Alcohol Testing regulations? - If Yes:	No
1a. Specify how many were tested:	
1b. Specify how many failed:	
2. As a result of this Accident, were any Operator contractor employees tested under the post-accident drug and alcohol testing requirements of DOT's Drug & Alcohol Testing regulations? - If Yes:	No
2a. Specify how many were tested:	
2b. Specify how many failed:	
PART G – APPARENT CAUSE	
<i>Select only one box from PART G in shaded column on left representing the APPARENT Cause of the Accident, and answer the questions on the right. Describe secondary, contributing or root causes of the Accident in the narrative (PART H).</i>	
Apparent Cause:	G6 - Equipment Failure
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: <i>(select all that apply)</i>	
- 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: <i>(select all that apply)</i>	
- Field examination	
- Determined by metallurgical analysis	
- Other: - If Other, Describe:	
4. Was the failed item buried under the ground? - If Yes :	
<input type="checkbox"/> 4a. Was failed item considered to be under cathodic protection at the time of the Accident? If Yes - Year protection started:	
4b. Was shielding, tenting, or disbonding of coating evident at the point of the Accident?	
4c. Has one or more Cathodic Protection Survey been conducted at the point of the Accident? - If Yes, CP Annual Survey ---> Most recent year conducted: - If Yes, Close Interval Survey ---> Most recent year conducted: - If Yes, Other CP Survey ---> Most recent year conducted:	
- If No:	
4d. Was the failed item externally coated or painted?	
5. Was there observable damage to the coating or paint in the vicinity of the corrosion?	
- If Internal Corrosion:	
6. Results of visual examination: - Other:	
7. Type of corrosion <i>(select all that apply):</i> -	

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- 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	
- Other:	
- If Other, Describe:	
10. Was the commodity 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 Accident" (from PART C, Question 3) is Tank/Vessel.	
14. List the year of the most recent inspections:	
14a. API Std 653 Out-of-Service Inspection	
- No Out-of-Service Inspection completed	
14b. API Std 653 In-Service Inspection	
- No In-Service Inspection completed	
Complete the following if any Corrosion Failure sub-cause is selected AND the "Item Involved in Accident" (from PART C, Question 3) is Pipe or Weld.	
15. Has one or more internal inspection tool collected data at the point of the Accident?	
15a. If Yes, for each tool used, select type of internal inspection tool and indicate most recent year run: -	
- Magnetic Flux Leakage Tool	
Most recent year:	
- Ultrasonic	
Most recent year:	
- Geometry	
Most recent year:	
- Caliper	
Most recent year:	
- Crack	
Most recent year:	
- Hard Spot	
Most recent year:	
- Combination Tool	
Most recent year:	
- Transverse Field/Triaxial	
Most recent year:	
- Other	
Most recent year:	
Describe:	
16. Has one or more hydrotest or other pressure test been conducted since original construction at the point of the Accident?	
If Yes -	
Most recent year tested:	
Test pressure:	
17. Has one or more Direct Assessment been conducted on this segment?	
- If Yes, and an investigative dig was conducted at the point of the Accident::	
Most recent year conducted:	
- If Yes, but the point of the Accident was not identified as a dig site:	
Most recent year conducted:	
18. Has one or more non-destructive examination been conducted at the point of the Accident since January 1, 2002?	
18a. If Yes, for each examination conducted since January 1, 2002, select type of non-destructive examination and indicate most recent year the examination was conducted:	
- Radiography	
Most recent year conducted:	
- Guided Wave Ultrasonic	
Most recent year conducted:	

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- Handheld Ultrasonic Tool	Most recent year conducted:	
- Wet Magnetic Particle Test	Most recent year conducted:	
- Dry Magnetic Particle Test	Most recent year conducted:	
- Other	Most recent year conducted:	
Describe:		
G2 - Natural Force Damage - only one sub-cause can be picked from shaded left-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 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 Accident generated in conjunction with an extreme weather event?		
6a. If Yes, specify: <i>(select all that apply)</i> -		
- Hurricane		
- Tropical Storm		
- Tornado		
- Other		
	- If Other, Describe:	
G3 - Excavation Damage - only one sub-cause can be picked from shaded left-hand column		
Excavation Damage – Sub-Cause:		
- If Previous Damage due to Excavation Activity:		
Complete Questions 1-5 ONLY IF the "Item Involved in Accident" (from PART C, Question 3) is Pipe or Weld.		
1. Has one or more internal inspection tool collected data at the point of the Accident?		
1a. If Yes, for each tool used, select type of internal inspection tool and indicate most recent year run: -		
- Magnetic Flux Leakage	Most recent year conducted:	
- Ultrasonic	Most recent year conducted:	
- Geometry	Most recent year conducted:	
- Caliper	Most recent year conducted:	
- Crack	Most recent year conducted:	
- Hard Spot	Most recent year conducted:	
- Combination Tool	Most recent year conducted:	
- Transverse Field/Triaxial	Most recent year conducted:	
- Other	Most recent year conducted:	
Describe:		
2. Do you have reason to believe that the internal inspection was completed BEFORE the damage was sustained?		
3. Has one or more hydrotest or other pressure test been conducted since original construction at the point of the Accident?		
- If Yes:		

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Most recent year tested:	
Test pressure (psig):	
4. Has one or more Direct Assessment been conducted on the pipeline segment?	
- If Yes, and an investigative dig was conducted at the point of the Accident:	
Most recent year conducted:	
- If Yes, but the point of the Accident was not identified as a dig site:	
Most recent year conducted:	
5. Has one or more non-destructive examination been conducted at the point of the Accident since January 1, 2002?	
5a. If Yes, for each examination, conducted since January 1, 2002, select type of non-destructive examination and indicate most recent year the examination was conducted:	
- Radiography	
Most recent year conducted:	
- Guided Wave Ultrasonic	
Most recent year conducted:	
- 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:	
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: <i>(select all that apply)</i> -	
- 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: <i>(select all that apply)</i> -	
- 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: <i>(select only one)</i>	
10. Type of excavation equipment: <i>(select only one)</i>	
11. Type of work performed: <i>(select only one)</i>	
12. Was the One-Call Center notified?	
12a. If Yes, specify ticket number:	
12b. If this is a State where more than a single One-Call Center exists, list the name of the One-Call Center notified:	
13. Type of Locator:	
14. Were facility locate marks visible in the area of excavation?	
15. Were facilities marked correctly?	
16. Did the damage cause an interruption in service?	
16a. If Yes, specify duration of the interruption (hours)	
17. Description of the CGA-DIRT Root Cause <i>(select only the one predominant first level CGA-DIRT Root Cause and then, where available as a choice, the one predominant second level CGA-DIRT Root Cause as well):</i>	
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	

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Other Outside Force Damage – Sub-Cause:	
- If Damage by Car, Truck, or Other Motorized Vehicle/Equipment NOT Engaged in Excavation:	
1. Vehicle/Equipment operated by: <i>(select only one)</i>	
- 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	
Describe:	
- If Previous Mechanical Damage NOT Related to Excavation:	
Complete Questions 3-7 ONLY IF the "Item Involved in Accident" (from PART C, Question 3) is Pipe or Weld.	
3. Has one or more internal inspection tool collected data at the point of the Accident?	
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 conducted:	
- Ultrasonic	
Most recent year conducted:	
- Geometry	
Most recent year conducted:	
- Caliper	
Most recent year conducted:	
- Crack	
Most recent year conducted:	
- Hard Spot	
Most recent year conducted:	
- Combination Tool	
Most recent year conducted:	
- Transverse Field/Triaxial	
Most recent year conducted:	
- Other	
Most recent year conducted:	
Describe:	
4. Do you have reason to believe that the internal inspection was completed BEFORE the damage was sustained?	
5. Has one or more hydrotest or other pressure test been conducted since original construction at the point of the Accident?	
- If Yes:	
Most recent year tested:	
Test pressure (psig):	
6. Has one or more Direct Assessment been conducted on the pipeline segment?	
- If Yes, and an investigative dig was conducted at the point of the Accident:	
Most recent year conducted:	
- If Yes, but the point of the Accident was not identified as a dig site:	
Most recent year conducted:	
7. Has one or more non-destructive examination been conducted at the point of the Accident since January 1, 2002?	
7a. If Yes, for each examination conducted since January 1, 2002, select type of non-destructive examination and indicate most recent year the examination was conducted:	
- Radiography	
Most recent year conducted:	
- Guided Wave Ultrasonic	
Most recent year conducted:	
- Handheld Ultrasonic Tool	
Most recent year conducted:	
- Wet Magnetic Particle Test	
Most recent year conducted:	
- Dry Magnetic Particle Test	
Most recent year conducted:	
- Other	
Most recent year conducted:	
Describe:	
- If Intentional Damage:	
8. Specify:	
- Other/Describe:	

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- If Other Outside Force Damage:	
9. Describe:	
G5 - Material Failure of Pipe or Weld - only one sub-cause can be selected from the shaded left-hand column	
Use this section to report material failures ONLY IF the "Item Involved in Accident" (from PART C, Question 3) is "Pipe" or "Weld."	
Material Failure of Pipe or Weld – Sub-Cause:	
1. The sub-cause selected below is based on the following: <i>(select all that apply)</i>	
- Field Examination	
- Determined by Metallurgical Analysis	
- 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: <i>(select all that apply)</i>	
- Fatigue or Vibration-related	
Specify:	
- If Other, Describe:	
- Mechanical Stress:	
- Other	
- If Other, Describe:	
- If Original Manufacturing-related (NOT girth weld or other welds formed in the field):	
2. List contributing factors: <i>(select all that apply)</i>	
- Fatigue or Vibration-related:	
Specify:	
- If Other, Describe:	
- Mechanical Stress:	
- Other	
- If Other, Describe:	
- If Environmental Cracking-related:	
3. Specify:	
- Other - Describe:	
Complete the following if any Material Failure of Pipe or Weld sub-cause is selected.	
4. Additional factors: <i>(select all that apply)</i> :	
- Dent	
- Gouge	
- Pipe Bend	
- Arc Burn	
- Crack	
- Lack of Fusion	
- Lamination	
- Buckle	
- Wrinkle	
- Misalignment	
- Burnt Steel	
- Other:	
- If Other, Describe:	
5. Has one or more internal inspection tool collected data at the point of the Accident?	
5a. If Yes, for each tool used, select type of internal inspection tool and indicate most recent year run:	
- Magnetic Flux Leakage	Most recent year run:
- Ultrasonic	Most recent year run:
- Geometry	Most recent year run:
- Caliper	Most recent year run:
- Crack	Most recent year run:
- Hard Spot	Most recent year run:
- Combination Tool	Most recent year run:
- Transverse Field/Triaxial	Most recent year run:

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- Other	
Most recent year run:	
Describe:	
6. Has one or more hydrotest or other pressure test been conducted since original construction at the point of the Accident?	
- If Yes:	
Most recent year tested:	
Test pressure (psig):	
7. Has one or more Direct Assessment been conducted on the pipeline segment?	
- If Yes, and an investigative dig was conducted at the point of the Accident -	
Most recent year conducted:	
- If Yes, but the point of the Accident was not identified as a dig site -	
Most recent year conducted:	
8. Has one or more non-destructive examination(s) been conducted at the point of the Accident since January 1, 2002?	
8a. If Yes, for each examination conducted since January 1, 2002, select type of non-destructive examination and indicate most recent year the examination was conducted: -	
- Radiography	
Most recent year conducted:	
- Guided Wave Ultrasonic	
Most recent year conducted:	
- Handheld Ultrasonic Tool	
Most recent year conducted:	
- Wet Magnetic Particle Test	
Most recent year conducted:	
- Dry Magnetic Particle Test	
Most recent year conducted:	
- Other	
Most recent year conducted:	
Describe:	
G6 – Equipment Failure - only one sub-cause can be selected from the shaded left-hand column	
Equipment Failure – Sub-Cause:	Non-threaded Connection Failure
- If Malfunction of Control/Relief Equipment:	
1. Specify: <i>(select all that apply)</i> -	
- Control Valve	
- Instrumentation	
- SCADA	
- Communications	
- Block Valve	
- Check Valve	
- Relief Valve	
- Power Failure	
- Stopple/Control Fitting	
- ESD System Failure	
- Other	
- If Other – Describe:	
- If Pump or Pump-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:	Gasket
- 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: <i>(select all that apply)</i>	
- Excessive vibration	
- Overpressurization	
- No support or loss of support	Yes
- Manufacturing defect	
- Loss of electricity	

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- Improper installation	
- Mismatched items (different manufacturer for tubing and tubing fittings)	
- Dissimilar metals	
- Breakdown of soft goods due to compatibility issues with transported commodity	
- Valve vault or valve can contributed to the release	
- Alarm/status failure	
- Misalignment	
- Thermal stress	
- Other	
- If Other, Describe:	

G7 - Incorrect Operation - only one **sub-cause** can be selected from the shaded left-hand column

Incorrect Operation – Sub-Cause:

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

1. Specify:

- If Other, Describe:

- If Other Incorrect Operation:

2. Describe:

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

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

- Inadequate procedure
- No procedure established
- Failure to follow procedure
- Other:

- If Other, Describe:

4. What category type was the activity that caused the Accident?

5. Was the task(s) that led to the Accident identified as a covered task in your Operator Qualification Program?

5a. If Yes, were the individuals performing the task(s) qualified for the task(s)?

G8 - Other Accident Cause - only one **sub-cause** can be selected from the shaded left-hand column

Other Accident Cause – Sub-Cause:

- If Miscellaneous:

1. Describe:

- If Unknown:

2. Specify:

PART H - NARRATIVE DESCRIPTION OF THE ACCIDENT

4/23/2010 Narrative Description (Partial):

On 3/25/2010 at 13:45 hours, a contractor employee working for Sunoco, Inc. (R&M) entered the West Yard section of the Philadelphia Refinery and discovered a release of heavy oil around a valve manifold which connects the FM-1 Pipeline to the N-8 Pipeline. The contractor employee notified Sunoco personnel and a response was initiated. The Vacuum Gas Oil (VGO) transfer was shutdown at 14:00 hours and, due to the high viscosity of the product, the heavy material was immediately displaced from the pipeline with Light Cycle Oil (LCO) and isolated by 18:00 hours.

On 4/5/2010, the source of the release was determined to have been a flanged connection on the FM-1 pig trap, normally isolated, except during pigging activity. The pig trap was last used during an in-line inspection conducted on June 23, 2008. A more thorough evaluation will be performed to identify the failure mechanism that resulted in the release from the flanged connection.

A Hydrochem (vacuum truck) employee, who routinely monitored and managed residual oil that accumulated in refinery sumps, including the West Yard valve manifold vault, reported that oil accumulation appeared to intensify and was found outside the vault beginning about 3/15/2010. This was believed to be caused by typical residual ground seepage exacerbated by excessive rainfall and snow thaw. Operations turnover reports from 3/15/10 to 3/25/10 have only one report of heavy oil on water (3/18/10). This again was removed by Hydrochem vacuum trucks. On the morning of 3/16/2010, two Sunoco employees were in the West Yard for training purposes and did not notice a leak or heavy oil at that time. On 3/24/2010 at 11:00 hours, another Sunoco employee was in the West Yard and did not report a release at that time. In addition, on 3/24 at 13:37 hours, a Hydrochem employee entered the West Yard to vacuum residual oil from the valve manifold vault. The release is believed to have started in the 24 hours prior to discovery.

A total of 1,700 barrels was released and nearly all of the material has been recovered.

5/19/2010 Update:

The FM-1 pig trap was about 39 1/2' in length, measured from the flange at the inlet/outlet valve to the flange at the closure. The trap was initially supported at three locations. The trap was supported at the containment wall around the manifold, 9'-4" from the flange at the closure. The trap was also supported by its flanged connection to the inlet/outlet valve. Due to its length, it was also supported, adjacent to the failed center flange. The center flange was 5'-0" from the inlet/outlet valve. The center support is believed to have been located in the 5' spool, within 12" from the center flange. The support consisted of a structural column, a base plate at the bottom that rested on the floor of the manifold containment, and a two-part clamp-style fitting at the top which secured the support to the outside diameter of the carrier pipe. Once the FM-1 trap was removed, the center support was found in the containment, detached and separated from the FM-1 trap piping.

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It is concluded that the lack of support at the center flange, allowed pipe movement over time, including movement caused by thermal cycling, which applied a differential stress on the flange bolts and eventually caused the flange to open at the 8:00 o'clock position. The FM-1 trap inlet/outlet valve was found to have a mechanical defect which prevented a tight shut-off, which allowed product from the FM-1 pipeline transfer to pass through the valve, into the pig trap, causing the release from the center flange. No corrosion of the flange faces or other mechanical damage was observed.

PART I - PREPARER AND AUTHORIZED SIGNATURE

Preparer's Name	Brian D. Mc Tiernan
Preparer's Title	Pipeline Safety Specialist
Preparer's Telephone Number	610-833-3430
Preparer's E-mail Address	bdmctiernan@sunocoinc.com
Preparer's Facsimile Number	877-588-8590
Authorized Signature's Name	Brian D. Mc Tiernan
Authorized Signature Title	Pipeline Safety Specialist
Authorized Signature Telephone Number	610-833-3430
Authorized Signature Email	bdmctiernan@sunocoinc.com
Prepare Date	05/24/2010

129572 Appendix F - NRC Report

NATIONAL RESPONSE CENTER 1-800-424-8802

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Information released to a third party shall comply with any applicable federal and/or state Freedom of Information and Privacy Laws

Incident Report # 935112

INCIDENT DESCRIPTION

*Report taken at 15:30 on 25-MAR-10

Incident Type: FIXED

Incident Cause: UNKNOWN

Affected Area:

The incident occurred on 25-MAR-10 at 15:20 local time.

Affected Medium: LAND SOIL

SUSPECTED RESPONSIBLE PARTYOrganization: SUNOCO
PHILADELPHIA, PA

Type of Organization: PRIVATE ENTERPRISE

INCIDENT LOCATION

3144 PASSYUNK County: PHILADELPHIA

City: PHILADELPHIA State: PA

REFINERY

RELEASED MATERIAL(S)

CHRIS Code: OTH Official Material Name: OTHER OIL

Also Known As: VGO (A HEAVY GAS OIL)

Qty Released: 0 UNKNOWN AMOUNT

DESCRIPTION OF INCIDENT

CALLER STATED THAT THERE WAS A DISCHARGE OF VGO (A HEAVY GAS OIL) FROM A PIPE AT A REFINERY. CALLER STATED THAT THE AMOUNT IS ESTIMATED TO BE A COUPLE OF HUNDRED GALLONS, NO WATERWAYS AFFECTED. THE CAUSE IS UNDER INVESTIGATION.

INCIDENT DETAILSPackage: N/A
Building ID:
Type of Fixed Object: REFINERY
Power Generating Facility: NO
Generating Capacity:
Type of Fuel:
NPDES:
NPDES Compliance: UNKNOWNDAMAGES

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			

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

129572 Appendix F - NRC Report

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

REMEDIAL ACTIONS

CLEANUP UNDERWAY WITH VACUUM TRUCKS AND SORBENTS.

Release Secured: YES

Release Rate:

Estimated Release Duration:

WEATHER

Weather: OVERCAST, °F

ADDITIONAL AGENCIES NOTIFIED

Federal: NONE

State/Local: PA DEP

State/Local On Scene: NONE

State Agency Number: NONE

NOTIFICATIONS BY NRC

ATLANTIC STRIKE TEAM (MAIN OFFICE)

25-MAR-10 15:40

DOT CRISIS MANAGEMENT CENTER (MAIN OFFICE)

25-MAR-10 15:40

U.S. EPA III (MAIN OFFICE)

25-MAR-10 15:41

FLD INTEL SUPPORT TEAM PHILADELPHIA (MAIN OFFICE)

25-MAR-10 15:40

NATIONAL INFRASTRUCTURE COORD CTR (MAIN OFFICE)

25-MAR-10 15:40

NJ STATE POLICE (MARINE SERVICES BUREAU)

25-MAR-10 15:40

NOAA RPTS FOR PA (MAIN OFFICE)

25-MAR-10 15:40

SECTOR DELAWARE BAY (COMMAND CENTER)

25-MAR-10 15:42

NJ DEP POC: DUTY OFFICER (MAIN OFFICE)

25-MAR-10 15:40

PA EMERG MGMT AGCY (MAIN OFFICE)

25-MAR-10 15:40

ADDITIONAL INFORMATION

CALLER HAD NO ADDITIONAL INFORMATION.

*** END INCIDENT REPORT # 935112 ***