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Washington Utilities and Transportation Commission

Tidewater Tank Farm Terminal Inbound Pipeline Leak Investigation

July 21, 2000

RMS

Summary

On July 21, 2000, the Tidewater Terminal Company telephonically reported a petroleum leak that occurred near the Tidewater Tank Farm facilities located at 2900 Sacajawea Road in Pasco, Washington. Tidewater became aware that a leak had occurred over the course of 4 months spilling approximately 35,000 to 43,000 gallons of unleaded gasoline from one of three pipelines that transports product between the Northwest Terminal Company (NWTC) manifold, which is operated by Chevron Products Company's. An approximately ¼ by ⅜ inch hole was found near the top of the pipe in the 1:00 o'clock position on the Inbound Gasoline 6-inch pipeline. The cause of the failure was found to be external corrosion due to stray current.

The leak was discovered when Tidewater crews found negative inventories of batched shipments from their routine tank measurements. When the inventories continued to show a deficit, Tidewater crews performed a series of standup test to determine if a leak had occurred on the pipeline. As each test was performed, the crews patrolled the pipeline for leaks. On the fifth trial run, Tidewater crews discovered a wet spot near NWTC's fence line. Upon discovery of hydrocarbons on the ground near the pipelines, the crewmembers ceased testing and notified the company officers of the situation. The company officer notified the National Response Center, the Department of Ecology (DOE), and the Washington Utilities and Transportation Commission (WUTC).

System Description

Tidewater Terminal Company (Tidewater) operates a petroleum, fertilizer, and agricultural chemical terminal (Terminal) to the north bank of the Snake River in Pasco, Washington. The Terminal is located 1425 feet upriver (easterly) from the Snake River Bridge on Highway 12 in Franklin County, Washington. The Snake River Terminal is a distribution center covering approximately 128 acres. The facility is terraced into three areas: (1) The Upper Tank Farm, (2) The Chemical Facility, and (3) The Lower tank Farm, which includes the maintenance building and the barge berths. There are 72 storage tanks with a total storage capacity of 698,648 barrels. The Terminal's petroleum tanks are considered breakout tanks for Chevron Pipeline Company's pipeline from Boise, Idaho to Pasco, Washington and from Pasco to Spokane, Washington.

Tidewater Terminal Company owns and operates three separate pipelines transporting fuel from Tidewater's Terminal to the Northwest Terminal Company (NWTC operated by Chevron Pipeline Company). The Outbound Products line is a delivery pipeline through which all products from Tidewater to NWTC are shipped. The other two pipelines are receiving lines that all products from NWTC are shipped to Tidewater. One pipeline is dedicated to gasoline (the Inbound Gasoline Pipeline) and the other is dedicated to distillates$_1$ (the Inbound distillate Pipeline) and the third is dedicated outbound pipeline (Outbound Products pipeline). Each pipeline from Tidewater's block valve at the west end of the petroleum tank farm to NWTC's manifold is approximately 4,903 feet.

Tidewater receives products directly from Chevron Pipeline Company's (Chevron) Salt Lake City, Utah to Boise, Idaho to Pasco, Washington. Tidewater is also designed to receive products from NWTC's Pasco terminal storage tanks. Tidewater delivers products through NWTC pumps for delivery to Spokane, Washington or to NWTC's storage tanks.

The flow rate for the pipelines varies from 450-550 barrels per hour (bbl) when receiving from the Boise to Pasco pipeline and up to 1000 bbl when receiving from NWTC's tankage. Northwest Terminal Company's manifold pressures on Tidewater's inbound pipelines are approximately 10 pound per square inch gauge (psig) when receiving from the Boise to Pasco pipeline and approximately 25-30 psig when receiving from NWTC's tankage.

Tidewater's delivery rate for their outbound pipelines varies from 750-1000 bbl when delivering to Chevron's Pasco to Spokane pipeline and up to 950 bbl when delivering to NWTC's tankage. Tidewater's pump discharge pressures on Tidewater's outbound pipeline are approximately 125-150 psig when delivering into the Pasco to Spokane pipeline and approximately 60-75 psig when delivering into Chevron's terminal tankage. The pressure will vary with product type.

The pipelines were originally installed in the 1950's. Each pipeline was buried in a parallel joint trench approximately 2 feet apart. In 1980, Tidewater replaced the original pipe with approximately 3600 linear feet of 6-inch, 0.188 inch wall thickness, API 5L Grade B, coated steel pipe from Tidewater's block valve to Highway 12. In 1981, a section of coated 6-inch, 0.188 inch, API 5L Grade B pipe was replaced under Highway 12. The remaining 1300 linear feet of each pipeline to NWTC's fence line remained bare (uncoated) steel pipe approximately 0.140-inch wall thickness, API 5L Grade A_2.

Fuel batches are transferred to and from Chevron facility use Chevron's volumetric measurement with positive displacement meters for custody transfer. Tidewater receives batches from Chevron's terminal tankage using tank gauges. Loss or gain calculations are based on Chevron's volumetric measurements and Tidewater's tank gauges.

The Utilities and Transportation Commission regulates the Tidewater Terminal Company for enforcement of the minimum safety rules and regulations pertaining to the construction, operation, and maintenance and of intrastate pipelines that transport hazardous liquids in the State of Washington. Additionally, Tidewater is regulated by the U.S. Coast Guard, U.S. Environmental Protection Agency, and Washington Department of Ecology.

1. Distillates are clean oils such as Natural gasoline, kerosene, White spirits, motor and aviation gasoline, jet fuel, naphtha, heating oil, clean diesel oil, heavy gas oil, and lubricating oil.
2. Material Analysis report 689-06 by Professional Service Industries (PSI

Introduction

On July 21, 2000, the Tidewater Terminal Company telephonically reported to the Utilities and Transportation the discovery of a petroleum leak that occurred near the Tidewater Tank Farm facilities located at 2900 Sacajawea Road in Pasco, Washington. In the course of 4 months approximately 35,000 to 43,000 gallons of unleaded gasoline had leaked from one of three pipelines that carries product to and from the Northwest Terminal Company (NWTC), which is operated by Chevron Products Company. An approximately ¼ by ⅜ inch hole was found near the top of the pipe at the 1:00 o'clock position on the 6-inch Inbound Gasoline pipeline near NWTC's fence line.

When a shipment is made from the Northwest Terminal Company to Tidewater, the operator compares the amount of product that was received against the amount that was shipped and any discrepancies are noted. A negative discrepancy is noted as a loss and positive as a gain. The fluctuations between loss and gain remained fairly constant until April when the discrepancies became steady loss calculations. The transfer of product that occurred on July 19, 2000 showed an unexplained discrepancy of 6,599 gallons of the 294,000 gallons (a 2.2% loss) of the total shipment of fuel that was transferred. The previous shipment on July 18 indicated a shortage of 3,862 gallons. Seeing these losses, Tidewater crews investigated further by conducting a series of standup tests on the pipeline.

The standup tests consisted of blocking off the product flow at the exit end of the pipeline, applying a pressure the pipeline would normally be expected to be subjected to (172 psig), then blocking off the pump discharge. The product is shut in at both ends of the pipeline and subjected to a steady pressure for a specified period of time and the pressure is noted. The pipeline is expected to maintain the pressure. The pipeline was subjected to a series of five standup test each lasting between 60 and 90 seconds. After pressurizing the pipeline to 172 pounds per square inch gauge (psig), a drop in pressure was noted within 60 seconds of shutting in the pressure. However, Tidewater crew member noted that the valve he had been controlling during the test had not completely closed. A second test, lasting approximately 60 seconds was performed which again resulted in a pressure loss. A third test, lasting approximately 60 seconds, was performed so that Tidewater staff could witness the pressure drop. Tidewater and Chevron personnel checked the pipeline manifold and the motor operated valve. The valve was opened then closed based upon Tidewater crewman's observation of product in that valve's sight glass. Since this open-close cycle of that valve resulted in the cessation of product flow in the sight indicator, the Tidewater crewman believed that the pressure drop detected in the previous test was caused by the failure of this valve to properly close. A fourth standup test was conducted. There was an unusual sound emanating from the air eliminator on the pump used to pressure the pipeline and erratic pressure fluctuations were occurring so the test was determined to be invalid. A fifth test was conducted which lasted approximately 90 seconds. On the fifth test, the pressure dropped

again except this time, when one of Tidewater's crewmen was patrolling on his way back to Tidewater, he noticed the odor of hydrocarbon coming from the area where the pipelines are located. He got out of his truck and discovered a wet spot on the ground near the Chevron property line in the same vicinity of the three pipelines. Figure 2 *Failure Site With Tidewater Crews Exposing the Pipelines* shows approximately where the wet spot was discovered. Upon discovery of the wet spot, Tidewater removed the pressure and took the pipeline out of service. Tidewater crews notified the company officer of the situation.

Chevron personnel called the State Emergency Management Division (EMD) to initially report the spill as 5 gallons of gasoline. The Tidewater company officer notified the National Response Center, the Department of Ecology (DOE), and the Washington Utilities and Transportation Commission. The WUTC was notified of the spill and notified that the excavation of the pipe would begin in the morning.

On the morning of July 22, 2000, Tidewater crews dug up around the area where the wet spot had been discovered. Tidewater crewmembers traced a darkened area near the fence post back to the pipeline. The investigation led to the discovery an approximately ¼ by ⅜ inch hole near the top of the pipe at the 1:00 o'clock position. Figure 3 *Chevron Fence Post Over the Pipeline* shows fence post in place and the soil that was removed to expose the darkened soil. The remaining two pipelines were exposed as shown in Figure 5. *Chevron Fence Post Over the Pipeline.* The hole is located on the furthest right pipe. Figure 6 *Inbound Gasoline Pipeline Showing ¼ by ⅜ inch hole* shows a detailed close-up of the failed section of pipe.

Tidewater cut out the failed section of pipe and contracted for a consulting firm to determine the material specification and mode of failure. The report *Material Analysis report 689-06 by Professional Service Industries (PSI)* can be found in the Appendix. The report shows the cause of the pipe perforation and leak is suspected to be interference or stray currents. At the time of the incident, Tidewater did not have documentation substantiating the material type and strength of the pipe therefore they employed the assistance of PSI to perform a detailed analysis of the pipe. The report is based on a sample of short section of pipe containing the failed section of pipe. PSI reported the material most closely matches API 5L, Grade A steel pipe with an outside diameter of 6 ⅝ inches and a 0.140 inch wall thickness. The report stated the outside diameter surface contained a fairly uniform layer of corrosion product. The average measure wall thickness was found to be 0.130 inches.

The responsibility for overseeing the cleanup of the spill came under the Washington State Department of Ecology. Tidewater assessed the extent of the spill and determined remedial action. The extent of the spill was determined by drilling core samples of the soil staged at specified location radiating away from the hole and testing the amount of product that each core contained. The drilling process showed free product had reached the groundwater where 1 – 2 feet was

found floating on top the groundwater. Tidewater contracted vacuum pumps and vapor extraction to remove residual product from the subsurface.

Sequence of Events

DATE	TIME	DESCRIPTION
19-Jul	13:30	Tidewater started batch number 375135 into tank 84
19-Jul	21:00	Batch completed. Elapsed time 7hr 30min. Intended batch size 7,000 bbls (294,000 gal) Batch composition: unleaded gasoline
20-Jul	AM	Reviewed paper work reconciling batch transfer for batch 375135. Calculated a shortage of 6599 gal (2.2%). July 18 transfer also showed a shortage of 3,862 gal
20-Jul	14:00	Kelly Harding of Tidewater contacted Dan Anderson (Chevron) to verify gauge readings.
20-Jul	17:00	Kim Strom of Chevron Pipe Line (Chevron) confirmed gauge readings to Harding. But, because tank 84 had already discharged product since the receipt of batch 375135, Harding elected to verify Tidewater receipt during a plant inventory control gauging session scheduled for the morning of July 21.
21-Jul	10:00	Regularly scheduled inventory session verified the shortage of 6,599 gallons. In response, Billy Thomas (Tidewater) walked the pipeline Right of Way and by 11:00 reported no sign of a leak. Dan Anderson (Chevron) was contacted again about the shortage.
21-Jul	16:15	After evaluation of the situation, a standup test was performed. After pressuring pipeline to 172 psig a drop in pressure was noted within 60 seconds. However, Ron McClary (Tidewater) noted that the valve he had been controlling during the test did not completely close. So a second test, lasting approximately 60 seconds was performed which again resulted in a pressure loss. A third test, lasting approximately 60 seconds, was performed so that Kelly Harding (Tidewater) could witness the pressure drop.
21-Jul	17:10	Harding met with Val Corier (Chevron) at the Chevron Northwest Terminal. Both individuals checked the pipeline manifold and the motor operated valve. Corier opened, then closed, this valve based upon Harding's observation of product in that valve's sight glass. Since this open-close cycle of that valve resulted in the cessation of product flow in the sight indicator, Harding believed that the pressure drop detected in the previous tests was caused by the failure of this valve to properly close.
21-Jul	17:25	A fourth standup test was conducted. Because of an unusual sound emanating from the air eliminator on the pump being used to pressure the pipeline and erratic pressure fluctuations, this test was determined to be invalid.
21-Jul	17:30	A fifth test began and lasted approximately 90 seconds. This test again indicated a drop in pressure in the system.
21-Jul	17:40	Harding (Tidewater) was positioned in the Chevron facility during this test, proceeded by truck back to the Tidewater facility. While in transit, he detected the odor of gasoline in the vicinity of the pipeline. Upon investigating the source of this odor, Harding discovered a wet spot in the soil on Chevron property but close to the Tidewater pipeline. Pressure was immediately removed from the pipeline and the subject pipeline was removed from service.

21-Jul	17:45	Harding (Tidewater) notified Val Courier (Chevron) and Fugi Pele (Chevron) of the leak he had detected. Tidewater personnel initiated a security watch of the site.
21-Jul	18:55	Dottie Buckner of Chevron called the State Emergency Management Division (EMD) to report the spill. She reports the spill as 5 gallons of gasoline.
21-Jul	19:20	Tom Mackie, Ecology Spills (CRO) received call from EMD regarding spill. Tom informs EMD that spill in Eastern Region
21-Jul	21:24	Dennis McVickers (Tidewater) reported the spill to EMD. He states the volume lost is unknown.
21-Jul	21:33	ERO notified of the spill. Brian Farmer contacted Fugi Pele (CPL) at 2146. He then contacted Dennis McVicker of Tidewater at 2159. Mr. McVicker indicated that the leak was discovered at 1730 and the pipeline was evacuated.
21-Jul	22:30	Dennis McVicker telephoned report to WUTC. Kim West available to receive the report. Tidewater did not plan to excavate the failed pipeline that evening but, would hold a planning session Saturday morning.
21-Jul	23:03	Dennis McVicker telephoned a report to the National Response Center
22-Jul	10:00	WUTC meets Tidewater personnel and discuss plans for the day. WUTC receives an update of the safety meeting held earlier that morning with the Fire Department.
22-Jul	11:00	WUTC and Tidewater personnel visit the incident site. The Fire Department was set up and available. Upon arrival to the site, Tidewater crews had partially opened Chevron's perimeter fence and dug a 4 foot by 4 foot bell hole partially exposing the pipelines. Tracing backward through the darkened sand, Tidewater crews discovered a 1/4" by 3/8" hole in the pipe.
23-Jul		Tidewater made an outgoing fuel transfer on another pipeline to Chevron at 05:15.
24-Jul		Tidewater began clean up assessment by using an auger to drill shallow (25.5 ft) cores.
26-Jul		Tidewater cut out the length of pipe with the hole and removed it for testing.
27-Jul		Brandt (ECY ERO) visits site for first time. Tidewater planned to drill 5 test holes to a depth of 45 feet with a geo-probe. There are 9 hand auger holes drilled.
28-Jul		Ecology order 00SPPRHQ-1438 and WUTC Emergency Order under Docket No. UG-001156 Ordering Tidewater to cease fuel transfers of all three pipelines.
July 29-30		On site meeting with DOE, WUTC, and Tidewater with Mark Layman (ECY CRO) arrived on scene to oversee emergency operations.
8/2/01		Representatives of Department of Ecology, WUTC, Tidewater and technical experts meet in Olympia to discuss spill response and present proposal. Additional drill equipment arrives on scene late. WUTC Staff confirmed pipelines were locked off and tagged.
8/3/01		Drilling begins. Well one completed by 0930 near spill location. Free product found floating on groundwater at a depth of 1 ft 9 in. Clean up continued.

8/24/00		On August 24 and 27, 2000,Tidewater's contractor conducted a 24-hour hydrostatic test for each of the three pipelines.
8/28/00		On August 28 and 29, 2000, Tidewater conducted an internal inspection of the three pipelines using a medium/high resolution magnetic flux leakage (MFL) tool by Magpie Systems, Inc.
7/31/00		Corrpro a contractor for Tidewater conducted a Close Interval Survey over the pipelines.
8/1/00		Corrpro conducted a coating integrity test on all three pipelines.
		Tidewater submitted and received approval for the final repair, material certification, qualified welding procedures, destructive test results, and radiographic results for the three pipeline replacements.
8/22/00		Corrpro a contractor for Tidewater conducted a Soil Resistivity test over the pipelines.
8/25/00		Enduro Pipeline Services a contractor for Tidewater conducted a geometric internal inspection of the three pipelines.
9/14/00		Pipeline Surge Analysis report
Sep-00		Tidewater replaced the bare unprotected thin wall pipe with 0.188" wall thickness coated pipe.
9/25/00		A cathodic protection system consisting of a rectifier and ground bed was installed and turned on.
10/12/01		Tidewater received approval to resume operation of only the Inbound Distillate pipeline.
1/30/01		Tidewater received approval to resume operation of the Inbound gasoline and Outbound Products pipelines

Discussion

No single factor can lead to an incident, however in the right combinations, any series of events can lead to a catastrophic event like the leak that occurred at Tidewater.

The three pipelines had been installed approximately in the 1950's. Since that time, a section of the pipeline system North of Highway 12 had been replaced with coated, thicker wall pipe in 1980. Another section under Highway 12 had been replaced with coated, thicker wall pipe in 1981. The replacement sections along with remaining thin wall bare pipe were not put under cathodic protection. Within the same vicinity of Tidewater's three transportation pipelines there were foreign facilities under cathodic protection such as pipelines, tanks, and fences. Kansas Nebraska Pipeline (Kaneb), Cascade Natural Gas Company, and Chevron Pipeline Company all had pipelines under cathodic protection in the vicinity where the three pipeline were located. The sections of thin wall bare pipe were not under cathodic protection. Where it may not be economical to cathodically protect bare pipelines, active corrosion can be mitigated with hot spot protection.

Stray currents flowing through the ground from foreign sources such as other pipelines in the area have been known to cause external corrosion to pipelines. Kaneb, Cascade Natural Gas Company, and Chevron Pipeline Company all had pipelines under cathodic protection that could influence the Tidewater's pipeline. Chevron had cathodic protection on its fence line. The metal fence post protruded beyond the concrete base, which was positioned directly above the failed pipeline shown in Figure 4. *Fence Post Showing the End Protrusion.* Without the added benefit of coating and cathodic protection Tidewater's pipeline was subject to stray current corrosion.

The section of pipeline that failed was bare without an applied coating. Coating pipe is an excellent method of providing protection from corrosion but, coating alone is not enough. Holidays that are created when ineffective coating exists can actually accelerate the corrosion process leading to pits that are severe enough to be detrimental to the pipeline.

Conclusion

On July 21, 2000 Tidewater Terminal Company discovered a ¼ by ¾ inch hole in their Inbound Gasoline pipeline that lead to a release of approximately 35,000 to 43,000 gallons of unleaded gasoline that eventually migrated into the groundwater. The cause of the hole was through-wall corrosion due to stray current leaving the pipe. The inventory records indicated the release of product had occurred over a six month period of time. There are several factors that contributed to the release of product such as inadequate product transfer accounting procedures, the lack of cathodic protection applied to the system, and training of staff to recognize and react to an abnormal operating conditions.

Tidewater maintained an accounting of the inventory of product that was transferred. The reports of product shipment fluctuated between a loss and gained amount. Although it was not unusual to see a fluctuation in the amount of product transfer because the amount was based on the ability of each operator to judge the gauge measurement. When the number of shipment losses exceeded the gains, Tidewater did not investigate in a timely manner to determine the cause of the losses. Tidewater did not have procedures in place that instructed its employees on the loss/gain acceptability limits and when the losses were abnormal enough to indicate a leak on the system.

On the day of discovery, Tidewater crews evaluated the product shipments and found a general loss trend in inventory amounts. A series of standup test were performed on the suspected pipeline to determine the root cause of the shortages. At each test, the pipeline failed to maintain the pressure that was applied. On all but the last, the tests were invalidated for reasons such as valve malfunction, unusual sounds, and confirmation by other crewmembers. At each test Tidewater crews looked for reasons to invalidate their observations. Their observations indicated a leak may have existed yet, the crews failed to recognize the indications of a leak and react accordingly. It was later after the fifth test when the physical signs of the gasoline migrating to the surface that Tidewater crews reacted to the abnormal condition. Tidewater did not have procedures in place that instructed their employees when to apply a standup test and how to conduct the test.

Management failed to put emphasis on the corrosion control maintenance of the three pipelines and in particular identifying the need for cathodic protection or hot spot protection for the three pipelines. Since the initial installation, the pipeline did not have a cathodic protection system applied to it. In the case of a bare pipeline a coating and current requirement study should have been done on the pipeline and where areas of active corrosion were found to mitigate it. Critical to the maintenance of the pipeline system was cathodic protection and stray current mitigation. Tidewater did not provide cathodic protection on the pipeline nor did Tidewater provide a means to evaluate and reduced the stray current that eventually led to the failure of the pipeline.

TIDEWATER VIOLATIONS

1. **Cathodic Protection**
   CFR Title 49 Part 195.414

   This regulation requires an operator of a hazardous liquid pipeline to have cathodic protection. Each operator must electrically inspect each bare low-stress pipeline hazardous liquid intrastate pipeline that was installed before July 12, 1996 to determine any areas in which active corrosion is taking place. The operator may not increase its established operating pressure on a section of bare pipeline until the section has been so electrically inspected. In any areas where active corrosion is found, the operator must provide cathodic protection.

   Findings:
   At the time of the leak, Tidewater had approximately 1,500 feet of bare non-cathodically protected pipe on the inbound pipeline. The pipeline that transports unleaded gasoline to the Chevron terminal facilities. Tidewater's lack of action to determine and mitigate active corrosion on its pipeline caused an approximately ¼ by ⅜ inch hole near the 1:00 position on the pipeline. The hole was discovered on the Inbound Gasoline pipeline in the vicinity where the Chevron's perimeter fence crossed perpendicularly with the pipeline.

2. **External Corrosion Control**
   CFR Title 49 Part 195.416

   Each operator must, electrically inspect the bare pipe in its pipeline that is not cathodically protected and must study leak records for that pipe to determine if additional protection is needed. at intervals not exceeding 5 years

   Any pipe that is found to be generally corroded so that the remaining wall thickness is less than the minimum thickness required by the pipe specification tolerances must be replaced with coated pipe that meets the requirements of this part. However, generally corroded pipe need not be replaced if localized corrosion pitting is found to exist to a degree where leakage might result, the pipe must be replaced or repaired, or the operating pressure must be reduced commensurate with the strength of the pipe based on the actual remaining wall thickness in the pits.

   Findings:
   Tidewater did not electrically inspect each bare section of its low-stress pipeline system to determine if there were areas of active corrosion taking place. PSI material analysis report of July 28, 2000 indicated the cause of the failure was external corrosion due to interference or stray current.

Remediation Actions by Tidewater

Hydrotested all three pipelines
Shut down
Replaced the bare thin walled sections
Ran internal inspections tool
Evaluated anomalies
Close interval survey
Installed cathodic protection system
Modified welding procedures
Surge analysis
Agreed to internal inspection in 5 years
Additional testing
Geometric pig
Pipeline coating integrity inspection

Recommendations

- Tidewater pipeline personnel should be trained on the procedures that an employee would need to recognize and react to an abnormal condition such as pipeline leak. Operators that transport hazardous liquids must have standard operation procedures in place that operators are trained and qualified on to recognize and react to an abnormal transfer operation. A qualified employee must be able to recognize when the product transfer is outside of the normal acceptability range. The procedures should be specific enough to address the possible scenarios for a leak and follow-up action when a leak is suspected.
- Tidewater should replace the existing bare sections of pipeline with coated steel pipe that has been electrically inspected for manufactured defects such as lamination and mill defects prior to installation into the ground.
- Tidewater should conduct internal inspections on the pipeline immediately after installation in the ground to obtain a baseline for analysis and conduct internal inspections on a periodic basis to determine detrimental corrosion anomalies on the pipeline.
- Tidewater should provide cathodic protection on all three pipelines that provides protection from the development and growth of corrosion cells. This may be accomplished using either an impressed current supply or galvanic anode installation. Bare sections of the pipeline that are not under cathodic protection should be hot spot protected. A schedule of maintenance must be setup to determine the status of the cathodic system and ensure the system is operated and maintained.
- Tidewater should maintain equipment to validate the cathodic protection system is operating by performing pipe-to-soil potentials, testing wire leads; determine when galvanic anodes have reached their useful life, if galvanic anodes are used.
- Tidewater should work with operators who have pipelines in the affective area to investigate stray current surrounding the pipelines and mitigate any effects of stray current from foreign sources.
- Tidewater should have procedures in place that instructed their employees when to apply a standup test and know the bounds of an abnormal condition.
- Tidewater should periodically conduct an integrity assessment of the pipeline using tools such as inline inspection (smart pig) for determining corrosion or deformation of the pipeline that would effect the integrity of the pipeline.

Appendix A

Area Map

Plan View Drawing (671SW13.DWG)

Accident Report – Hazardous Liquid Pipeline (DOT No. 7000-1)

National Response Center Incident Report #536183

Washington State Military Department Emergency Management Division incident report #00-1799

Material Analysis report 689-06 by Professional Service Industries (PSI)

Appendix B Photograph log

Figure 1: Incident Site Overview

Figure 2: Failure Site With Tidewater Crewmen Exposing the Pipelines

Figure 3: Chevron Fence Post Over the Pipeline

Figure 4: Fence Post Showing the End Protrusion

Figure 5: Tidewater Crewman Exposing the Three Pipelines

Figure 6: Inbound Gasoline Pipeline Close-up Showing ¼ by ⅜ inch hole