Alaska Dept of Labor & Workforce Development

Office of Pipeline Safety
Research & Special Programs Administration

JOINT AFTER-ACTION REPORT FOR THE TAPS BULLET HOLE RESPONSE

(October 2001)

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FOREWORD

Following any significant response to an oil or hazardous substance release incident, the key response agencies normally prepare an after-action report to document the significant lessons learned in order to improve future responses of this nature. Staff from Alyeska Pipeline Service Company (APSC), the State of Alaska Departments of Environmental Conservation (ADEC), Fish and Game (ADF&G), Labor and Workforce Development (ADOL), Natural Resources (ADNR), and Public Safety (ADPS), the U.S. Environmental Protection Agency (EPA), the Joint Pipeline Office (JPO), U.S. Department of Transportation-Office of Pipeline Safety (DOT-OPS), U.S. Department of the Interior-Bureau of Land Management (DOI-BLM), and other entities have collaborated in producing this joint after-action report.

While this report highlights areas requiring improvement, there were many positive aspects of the response as well. These include the rapid and coordinated response by APSC, State, and Federal response teams, the effective containment and control of the spilled product using established as well as innovative tactics, and the recovery of a large amount of the crude oil. Details of the significant, positive lessons learned are included within each section.

APSC as well as the Federal and State agencies are committed to improve their collective spill response capabilities through applying the lessons learned contained in this report. These lessons learned may also be periodically reviewed during future drills and spill incidents to ensure similar problems do not occur, and to further refine and improve the spill response process. Corrective actions may be immediate in some cases, while long term for other, more complex issues.

This report identifies only those issues directly related to the TAPS Milepost 400 event, and provides consensus-based observations and recommendations developed by the work group. Individual agencies may also have developed internal lessons-learned reports, specific to improving the agency's ability to respond to an oil or hazardous substance release.

An electronic file of this report is available at: http://www.state.ak.us/dec/dspar/perp/home.htm

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INTRODUCTION

During the afternoon of October 4, 2001, an oil spill occurred when the Trans-Alaska Pipeline System (TAPS) was shot with a high power rifle. The incident occurred approximately 80 miles north of Fairbanks near the community of Livengood. Alyeska Pipeline Service Co. (APSC) discovered the leak by aerial security surveillance, and also spotted the alleged shooter. Alaska State Troopers and pipeline security staff apprehended the alleged shooter within hours. State and federal agencies along with APSC and its contractors quickly responded to the release. The APSC Fairbanks Emergency Operations Center (FEOC) was activated, and the Unified Command was formed to direct incident management operations.

The impacted section of the pipeline was quickly isolated by control valves; however, the residual oil in the pipeline was still under pressure, and crude oil sprayed from the bullet hole for an extended period of time. Steps were immediately taken to reduce the pressure within the section of the line. Oil remaining in the section of pipeline was pumped around Remote Gate Valve 65 into the segment north of the isolation valve as a method to reduce segment pressure.

The high pressure also created a serious hazard for responders: a fine mist of oil created a potentially explosive atmosphere. Fire crews were staged near the spill with foam suppressants as heavy equipment was brought in to stop the leak.

A hydraulic clamp, designed, built and tested for such a leak, was lifted by crane into place within 36 hours after the release. By the next morning, the bullet hole had been permanently plugged, North Slope oil production resumed at the normal pace, and the flow through the pipeline was restored.

Trenches, berms and containment pits were dug and proved effective in containing the oil to within a quarter of a mile of the leak. In fact, even before the bullet hole was plugged, crews were recovering more oil than the actual release rate. Recovered oil was re-injected into the line at Pump Station 7. To date, approximately 175,793 gallons (of the estimated 285,600 gallons of spilled product) has been recovered, and removal of the contaminated soils and vegetation is presently underway.

Detailed information regarding this incident (i.e., Situation Reports, photos, other documents) may be obtained by visiting the Unified Command website at:

http://www.state.ak.us/dec/dspar/perp/011004301/index.htm

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EXECUTIVE SUMMARY

In the course of discussing and developing the lessons learned from this event, the after-action report work group members expressed a common concern; the need to stress the hazards associated with this response in order to view the overall operation in the proper perspective. Too often, an oil spill is viewed as a puddle of product on land, or a viscous layer or sheen on water. In this event, the release of crude oil from the bullet hole initially began as an aerosol spray, which created explosive vapor levels much higher than a flowing release of product.

Another public concern that needs to be addressed is the length of time taken from the initial bullet hole release to the installation of the clamp and the subsequent permanent repair. The issues discussed below (and in the subsequent sections of this report) will hopefully provide a general overview of the problems faced by the response crews. The overall driving factor was the need to have everything in place and all of the safety issues addressed prior to installing the hydraulic clamp.

While the purpose of this report is to identify elements of the response that may be subject to improvement, it must be remembered that the overall response is considered to have gone well. Due to the efforts of the responders, spilled oil was contained in a limited area, thus limiting environmental damage. Pipeline throughput, important to the economy of the State and the nation, was restored with minimal disruption to the public. Despite the hazardous nature of the event, no one was injured, and TAPS, an asset to National Security, was restored to service promptly.

Source Control: Source control for a leaking barrel may be to simply drive in a wooden peg. It is not so simple for a large diameter oil pipeline. After the area has been characterized for hazards to response personnel and the appropriate safety plan has been established, the leak source must be, at least cursorily, examined. The insulation remaining around the pipeline must be removed. The nature of the damage must be generally known to determine what methods can be used to stop the leak, and what may be needed for the permanent repair.

Concerns for working near a high-pressure leak (See also the section on Safety): High-pressure spray atomizes volatile elements very quickly, potentially producing significantly higher vapor concentrations, an explosive atmosphere, and an extreme fire hazard, without large amounts of liquid oil pooled nearby. The high-pressure jet also spreads the oil over a larger area, with the wind having a greater affect on the spread of the oil aerially.

Health and safety: There are significant health and safety threats while working around an oil spill. There are exposures to air contaminated from benzene, dermatitis from skin contact with crude oil, reduced visibility, and slips, trips and falls from walking in oiled surfaces. Workers were protected from these hazards by wearing respirators, gloves, boots, hardhats, safety glasses, and fire resistant clothing, as appropriate. Decontamination stations were set up for workers leaving the hot zone. Because of the fire hazard during the repair, emergency crews were suited up in bunker gear to rescue oil spill workers if needed.

Fire/explosion: With the presence of flammable vapors, any ignition source, including a spark of static electricity, could have started a fire. If the vapor concentrations were high enough, an explosion could occur. The mechanized construction equipment needed to lift or apply heavy clamps against the pipeline's internal pressure is almost always a potential source of ignition. The general public may view crude oil as less of an explosive hazard than gasoline. This is not the case as vapors from a crude oil spill can ignite in much the same manner as vapors from a gasoline release.

Significant Lessons Learned

- **Incident Command System:** While there was excellent sharing of information and duties within the staff assigned to the spill, communications between the Unified Command and the Joint Pipeline Office senior management could be enhanced by exploring new methods for direct meetings and information flow.

- **Unified Command Website:** The Joint Information Center (JIC) and associated web site provided an excellent source of public information.

- **Communications:** Communications between the field and the Incident Management Team (IMT) at the Emergency Operations Center (EOC) could be improved, especially early on during the response when developing and disseminating Incident Action Plans (IAPs).

- **Firefighting Support:** Mutual aid received from the Steese Volunteer Fire Department together with the expertise brought in from Williams Fire and Hazard Control provided a critical element of the overall site safety.

- **Leak Detection:** The spill was visually detected shortly after the pipeline was shot, and before any leak detection systems alarmed. Although the on line leak detection systems were functioning as designed, there are limitations to these systems. There is ongoing work to improve the capabilities of existing leak detection systems, which are believed to be best available technology (BAT). The current leak detection sensitivities are well within the sensitivity requirements of 1% of throughput and are consistent with BAT, per State regulatory requirements. Nevertheless, APSC is targeting improvements to its overall leak detection abilities to compensate for changing pipeline operations and routine operational activities.

- **Source Control:** The Plidco Smith+ Clamp, despite its common name of "bullet clamp," was deemed inappropriate to seal this bullet hole because installation against the jet stream pressure and the hazardous environment was considered unsafe for the workers who would have to manually install the clamp. The Pipeline Hydraulic Clamp was chosen because it could be applied remotely under the site line pressure and jet stream force. There were no issues related to that decision that require immediate actions. However, several ideas to increase the ability to reduce pressure and/or stop the leak at a site merit investigation for effectiveness and practicality. (See details in Section IV, Source Control). While making preparations to reduce the pressure of the oil at the spill site, there was pipe movement at Check Valve 50 that resulted in tripped anchors. Changes to procedures are suggested for maintenance of the relief valves and for operations while check valves are locked open.

- **Safety:** The safety controls implemented to reduce exposures to hazards prevented a serious injury, fire, or similar disaster from occurring. However, there are areas that could be improved.

  Future exercises and preparedness training should include appropriate participation by community fire departments together with APSC fire and safety personnel in order to establish or enhance mutual aid and working relationships. There should be an effort to identify in-state and out-of-state resources that could enhance fire prevention and fire suppression capabilities.

- **Containment and Cleanup:** In the initial stages, the decision to concentrate available resources on containment rather than source control was made in the field. Because of the complexity of the source control issue, it was best managed by technical staff at the EOC. This decision was strategic in limiting the area of contamination and allowed time to safely address source control.

- **Return to Service:** Prior to the decision to install a Threaded O-Ring (TOR), there were discussions of different options for repair. There are additional agencies involved with TAPS repair and startup that are not closely involved with the oil spill response. Close coordination with Joint Pipeline Office agency personnel not at the Fairbanks Emergency Operations Center was required to ensure that pipeline restart and future operational issues were adequately addressed.

- **Contingency Plan Implementation:** In general, the provisions of the Cplan were implemented during this response. However, certain sections of the plan will require revision to more completely describe the existing systems such as leak detection and source control, while other portions of the plan should be revised to include the effects of hazardous conditions on response actions. The Cplan could be enhanced to include the containment tactics used in this response as well as more information on permits needed for portions of the response.

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Appendices

SECTION I: The Incident Command System

1. Agency Jurisdiction:

The U.S. Environmental Protection Agency (EPA) and the Alaska Department of Environmental Conservation (ADEC) are the lead Federal and State oil spill response agencies per the National Contingency Plan and Alaska State statutes/ regulations. Both the Bureau of Land Management (BLM) and the Alaska Department of Natural Resources (ADNR) have clean-up oversight authorities arising from the stipulations of the State and Federal Right of Way Leases, but work with EPA /ADEC to coordinate these authorities. Other agencies involved in this incident with significant support roles include U.S. Department of the Interior (DOI), U.S. Department of Transportation Office of Pipeline Safety (DOT-OPS), and the Alaska Department of Fish & Game (ADF&G). All of these agencies are represented in the Joint Pipeline Office (JPO).

2. Background:

After the Exxon Valdez Oil Spill in 1989, the Incident Command System (ICS) (which grew out of wildland firefighting) has been applied to oil and hazardous substance spill response as an incident management system of national and state choice. Alaska state regulations require oil industry response plans from companies such as Alyeska Pipeline Service Company (APSC) and also specify the use of ICS to manage a response effort. The Alaska Federal / State Preparedness Plan for Response to Oil and Hazardous Substance Discharges / Releases (the Federal and State government's response plan) utilizes the ICS / Unified Command (UC) as the Federal / State unified response organization for use in Alaska.

Upon discovery of the oil discharge, APSC immediately activated their Fairbanks Business Unit Incident Management Team (IMT) and opened an Emergency Operations Center (EOC) at the Fairbanks Doyon Industrial Facility. APSC's IMT utilizes the ICS to organize and manage spill response. Upon notification of the Federal On-Scene Coordinator (EPA) and the State On-Scene Coordinator (ADEC) by APSC, both organizations sent representatives to APSC's EOC and the spill site. A Unified Command consisting of APSC, Federal and State government employees was established within the first several hours of the response.

3. Observations and Recommendations:

A. Command and Control:

(1) Unified Command:

a. **Observation:** While the UC (composed of APSC's Incident Commander, Federal and State OSC's) provided joint command and control over oil spill response actions (including source control), further work needs to be done to ensure that the concerns and focus of the BLM Authorized Officer (AO) and ADNR's State Pipeline Coordinator (SPC) are reflected throughout the incident management. The roles of Federal and State OSC's are to ensure an effective response to oil and hazardous substance spills, while the AO/SPC's roles are focused on asset protection issues such as pipeline repair and return to service. While there is commonality between these roles, there are also separate and discreet functions. This incident worked well with a BLM representative from the JPO functioning as a BLM/ADNR Liaison / alternate FOSC in the Unified Command, and a representative from DOT-OPS working with APSC's pipeline repair unit. While there was excellent sharing of information and duties within the staff assigned to the spill, communications between the UC and JPO senior management could be enhanced by exploring new methods for direct meetings and information flow.

Recommendation: Methods for using the ICS's planning cycle, existing Incident Management Teams, and Crisis Management Teams need to be further explored and detailed in a written plan. Checklists for activating technical specialists available from JPO to mobilize and integrate into an IMT as well as procedures for establishing routine communications between the UC and the AO/SPC should be included. Additional preparedness exercises (as held in the past) need to be continued involving not only spill responders but also the AO/SPC or their representatives along with members of JPO with technical expertise in pipeline operations and repair. The JPO should maintain a contact phone staffed 24 hours a day during significant events.

b. Observation: Both the Federal and State agencies and APSC need to expand on integration of their response staff. Technical specialists from government agencies were generally based at their office and they worked the spill remotely. Due to the relative short duration of the emergency phase of this event and the limited size of the spill impact area, this arrangement worked fine but the information flow and understanding of needs can be improved if the specialists were co-located with the IMT. The agencies and APSC need to share tables in the various ICS sections and workgroups and address critical issues as soon as possible.

Recommendation: Further training and participation during joint exercises will foster and further develop working relationships and information flow.

(2) Command Staff:

a. Observation: A Joint Information Center (JIC) was established early on and consisted of APSC's Corporate Communications personnel and media specialists from the JPO and ADEC. ADEC assisted this effort with the establishment of a world wide web site for the Unified Command. Press releases/ updates, digital photos, as well as agency situation and pollution reports were routinely and frequently posted. The JIC and associated web site provided an excellent source of public information.

Recommendation: Continue practice as a routine.

b. Observation: Two weeks after the incident, four additional bullet strikes were discovered on the backside of the pipe near MP 400 (approximately one mile north of the spill site). Although APSC conducted a wide area check for additional bullet strikes within the first 12 hours of the response, these strikes were missed.

Recommendation: Personnel conducting reconnaissance in response to potential future shooting incidents should consider this event and recall that bullet strikes may be extremely small and difficult to detect.

Figure I-1: The Incident Management Team at the Fairbanks EOC.

B. Operations Section: (Also see section on Containment and Cleanup Actions)

(1) Observation: Unlike wildland firefighting activities, use of the ICS to manage oil spill response often involves an IMT located in an EOC remotely located from on-site field activities. APSC places its Operations Section Chief in the field and establishes an Operations Liaison position located in the EOC with the rest of the IMT. This situation requires clear and constant communications between the two positions to ensure there is no disconnect between field operations and the IMT. Communications between the field and the IMT early on during the response could be improved, especially when developing and disseminating Incident Action Plans (IAPs). As the incident progressed and an on-site field command center with enhanced communications was established, information flow between the two levels of the response organization improved.

Recommendation: Establish an on-scene command post / center early on in the response and post IAPs conspicuously, ensuring task force leaders are briefed at shift changes. Also see Planning Section observations and recommendations below.

(2) Observation: During the first hours, the Unified Command decided to consider this as a worst case spill and boom the Tolovana River (because of the situation and the time of day). This was not properly communicated to the Operations Section.

Recommendation: It is critical to maintain communication between sections of the ICS during the initial "Ops driven" phase of the response to track UC decisions which pertain to that phase, prior to production of the first IAP.

C. Planning Section:

Observation: The Situation Unit experienced difficulty early on in getting detailed information from the site. On-scene personnel were completely occupied and reacting to the immediate needs of the response. By the end of the second day, IMT personnel from the Resource Unit and the Situation Status Unit were dispatched to the field to gather information directly.

Recommendation: Consider establishing and deploying a support structure "go team" earlier in the incident to scope out the site, review and assess problems and issues, make judgment calls for logistics and support, then either return to the EOC to directly report status and information gained, or report information over available communications systems.

D. Logistics Section: No Observations/Recommendations identified.

E. Finance/Administration Section: No Observations/Recommendations identified.

F. Other Related Issues

Observation: Having pre-established relationships with other response community members such as Alaska Clean Seas, SERVS, FBI and the Alaska State Troopers contributed to the overall success of the response. Alaska Clean Seas brought in North Slope clean-up expertise and improved establishment of site work zones and decontamination stations. SERVS equipment such as shore vacuum systems and Desmi hydraulic viscous oil pumps augmented pipeline response equipment and improved oil recovery operations. The presence of the FBI and Alaska State Troopers at APSC's EOC as well as on site provided coordinated law enforcement and security with APSC resources.

Recommendation: Continued training and participation during exercises with each of these entities will foster and further develop working relationships.

SECTION II: Trans-Alaska Pipeline System (TAPS) Security

Items pertaining to overall security of the Trans-Alaska Pipeline System are not included in this report. TAPS security is addressed as part of a separate report entitled ***State of Alaska Terrorism Disaster Policy Cabinet*** (November 12, 2001). The report is available on the following State of Alaska website:

http://www.gov.state.ak.us/omb/Homeland1.pdf

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SECTION III: TAPS Leak Detection

1. Agency Jurisdiction:

Alaska Administrative Code, Title 18, Chapter 75, as administered by ADEC states: "(a) A crude oil transmission pipeline must be equipped with a leak detection system capable of promptly detecting a leak, including (1) if technically feasible, the continuous capability to detect a daily discharge equal to not more than one percent of daily throughput; (2) flow verification through an accounting method, at least once every 24 hours; and …." [18 AAC 75.055(a)]

BLM administers the Federal Agreement and Grant of Right of Way for TAPS, which requires APSC to annually submit a Cplan for review and approval. As used in Stipulation (2.14.2), Oil Spill control includes the detection of a spill and thus leak detection.

2. Background:

APSC has three different leak detection systems in place: 1) Deviation Alarms, 2) Line Volume Balance (LVB) and 3) Transient Volume Balance (TVB). The size of the leak on October 4, 2001 was too small to trigger the Deviation Alarms. The time interval between visual detection and pipeline shutdown was less than the time interval required for LVB to detect and trigger an alarm. The pipeline shutdown was begun within 30 minutes of the onset of the leak. Only the TVB had a theoretical chance of detecting and alarming for a leak of this magnitude in the 30-minute time window between the onset of the leak and pipeline shutdown.

In order to deal with instrument noise, data degradation, and other dynamic operating activities that generate hydraulic transients, the TVB reduces its effective alarm sensitivity for a period of time following such disruptions. This process is called data validation (note: this process is actually a form of statistical analysis to determine the effective alarm sensitivity). Post event analyses shows that the leak was sensed by TVB at 2:44 PM, approximately 13 minutes after the onset of the leak; however, the data validation requirements rejected the event. Figure III-1 clearly shows the initiation of the leak at 2:31 PM. However, it also shows even larger excursions associated with the passage of the cleaning pig through Pump Station 6. The leak would have had to be approximately 350 barrels per hour (BPH) leak rate, to meet the validation conditions existing at 2:44 PM. If the leak had occurred just prior to the pig passage an alarm would have sounded at the pipeline console. Without the leak validation process, the TVB segment between Pump Stations 6 and 7 would have been in an alarm state for much of the time period between October 2, 2001 and October 4, 2001. This time period is associated with the pig passage through this segment and would have been attributed to the flow measurement shift generated by the pigging operation.

Although the TVB did not alarm, it is estimated that LVB would have alarmed within 4 to 10 hours after the start of the leak. The LVB leak detection sensitivity had been reduced earlier in the day by the idling of the North end of the pipeline at 9:58 AM. Prior to this event, the LVB sensitivities were well below the initial 5500 barrels per day (BPD) leak rate caused by the bullet hole.

Continuous and accurate flow measurements are essential for the operation of flow-based leak detection systems such as LVB and TVB. Non-quantifiable flow measurement shifts as observed prior to the October 4, 2001 event temporarily reduce the sensitivity of leak detection systems until steady-state conditions are reestablished. Specific operations such as pipeline shutdowns, restarts, pump switch overs, and pigging operations can create these temporary flow measurement shifts. As an example, lower oil temperatures and resultant increased waxing has necessitated more frequent cleaning pig runs on TAPS. The increase in the number of these operations in turn, increases the likelihood for a temporary reduction in leak detection sensitivity as the pig passes through the station facilities. APSC has recognized these detection sensitivity impacts and the need to continue with improvements to its Leak Detection capability. Prior to the October 4, 2001 event, APSC began a two-year $2.5M Pipeline Leak Detection Improvement Project to further enhance the leak detection capabilities on TAPS.

Definitions:

Deviation Alarms: The deviation alarm system detects large leaks, greater than 1% of pipeline oil flow. There are three types of deviation alarms: 1) Pressure alarms are activated when the oil pressure changes by more than 15 psi; 2) flow alarms are activated if the amount of oil entering or leaving a station varies too much between check times; and 3) flow deviation alarms are activated when the difference in the amount of oil flow between the upstream and downstream pump stations changes greater than 700 BPH.

Line Volume Balance (LVB): LVB is a line-wide leak detection system that depends on the statistical analysis of pipeline flow measurements. This system requires a minimum of two hours to determine a leak. It does not model physical pipeline oil flow. It does not have good leak location ability and does not handle unsteady flow conditions. The system statistically determines imbalances for the analysis for 48 hours of data with measurements taken every 30 minutes.

Transient Volume Balance (TVB): TVB is APSC's most rapid method of detecting small leaks. It analyzes pipeline segments between pump stations every 60 seconds. It models unsteady flow conditions and calculates for imbalances for five time periods ranging from four minutes to the recent eight hours.

Leading Edge Flow Meters (LEFMs): The LEFMs are located at the discharge of Pump Station 1 and the suction and discharge for all other Pump Stations. The LEFM estimates oil flow volume from the time it takes sound to travel in the direction of oil flow versus against the direction of flow. The result of these measurements is a velocity profile for the oil. Given the pipe cross sectional area and oil properties, the oil flow rate is determined.

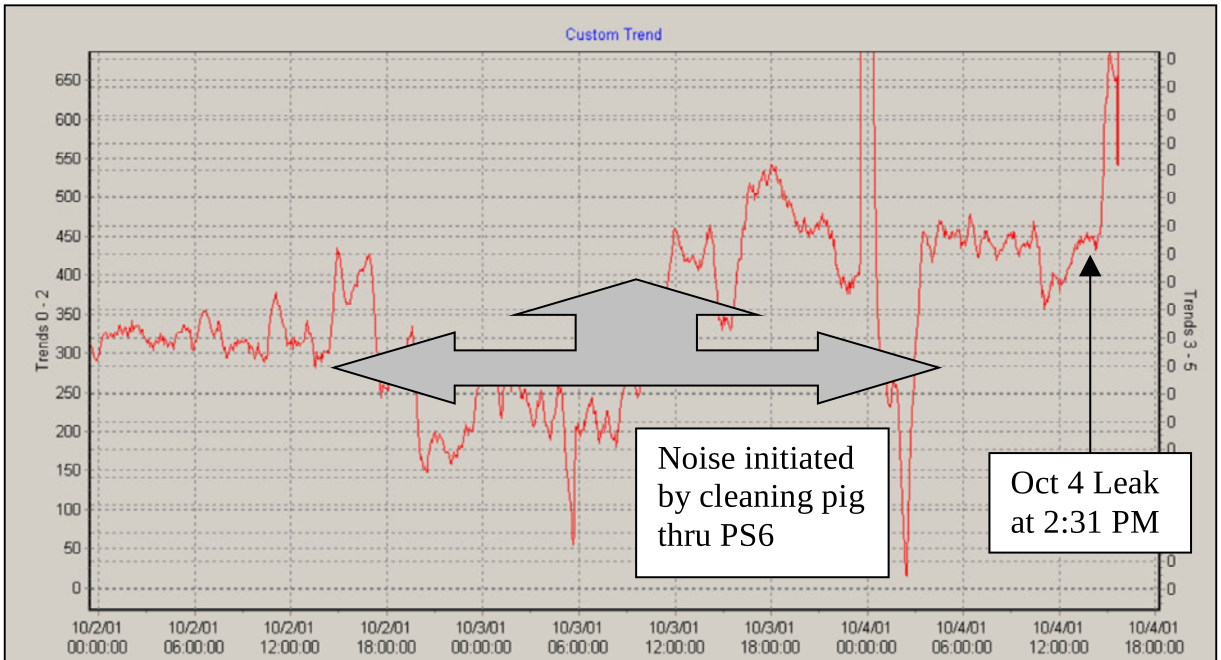

Figure III-1: Volume Balance between PS6 and PS7 uncorrected for long-term average.

3. Observations and Recommendations:

- The spill was visually detected shortly after the pipeline was shot, and before any leak detection systems alarmed.
- Although the on line leak detection systems were functioning as designed, there are limitations to these systems.
- There is ongoing work to improve the capabilities of existing leak detection systems.

A. Performance Summary:

(1) None of the APSC Leak Detection Systems alarmed, before the leak was discovered visually, as a result of the bullet hole leak of October 4, 2001. The current leak detection sensitivities are well within the 1% of throughput and is known BAT, per State regulatory requirements.

(2) The TVB Leak Detection System did detect a volume imbalance between Pump Station 6 and Pump Station 7; however, the imbalance did not meet other necessary validation conditions for an audible leak alarm to be sounded to the pipeline controllers at the Valdez Terminal. The TVB was operating normally, however flow measurement shifts after the passage of a cleaning pig through Pump Station 6 reduced the TVB's effective sensitivity.

(3) It is estimated the LVB Leak Detection System would have detected the leak within 4 to 10 hours after the onset of the leak.

B. Improving Leak Detection:

APSC has a Pipeline Leak Detection Improvement Project underway. The current leak detection sensitivities are well within the 1% of throughput and is known BAT, per State regulatory requirements. However, APSC is targeting improvements to its overall leak detection abilities to compensate for changing pipeline operations and routine operational activities. Steps are being taken to improve the current flow measurements and to improve the ability of the leak detection software to identify and to compensate for measurement shifts. Addressing these flow measurement shifts is one of the highest priorities of this effort. Improvements to the leak detection logic will allow for better processing of flow measurement shifts and slack line flow conditions. Flow measurement technology alternatives will also be evaluated and appropriate recommendations prepared for continual improvement in pipeline leak detection capabilities. Additionally, and as part of this project, the screen displays available to the Operations Control Center (OCC) Controllers will also be enhanced to provide more effective pipeline leak detection monitoring. Overall, the ability of the leak detection system to compensate for changing pipeline operations will be improved.

Recommendation: Continue on-going efforts to improve current systems.

SECTION IV: Source Control

1. Agency Jurisdiction:

The FOSC and the SOSC exercise the respective authorities of the U.S. Environmental Protection Agency and the Alaska Department of Environmental Conservation (ADEC) and provide immediate direction to the oil spill response, including source control.

ADEC regulations at 18 AAC 75.055(b) require that the operator be able to stop the incoming flow of oil (shut down the pipeline) within one hour of detecting a discharge. ADEC also requires source control be addressed in the contingency plan [18 AAC 75.425(e)(1)(F)(i)]. These source control procedures, "to stop the discharge at its source and prevent further spread," must also meet ADEC's best available technology review requirements [18 AAC 75.425(e)(4)(A)(i)].

BLM administers the Federal Agreement and Grant of Right of Way for TAPS. Stipulation 2.14 requires an oil spill contingency plan that includes "immediate corrective action including Oil Spill Control . . .." Source control is therefore a requisite to provide immediate corrective action.

DOT-OPS approves the oil spill contingency plan under its authority in 40 CFR Part 195, including source control strategies.

2. Background:

Scope of action: Source control for a leaking barrel may be to simply drive in a wooden peg. It is not so simple for a large diameter oil pipeline. After the area has been characterized for hazards and the appropriate safety plan has been established, the leak source must be, at least cursorily, examined. The insulation remaining around the pipeline must be removed. The nature of the damage must be generally known to determine both what sort of methods can be used to stop the leak, and what may be needed for the permanent repair.

TAPS has over 177 pipeline valves that can stop the flow of oil. Each pair of valves can enclose a segment of pipeline. The Oil Spill Contingency Plan (Cplan) accepts that shutting down the pipeline and stopping the flow of oil to the segment with the leak is initial source control. The ultimate size of the spill is, at that point, limited to the TAPS design volume in the segment. The spill volume will be less if the leak is not at the lowest point in the segment. Because of the hydraulic profile of the pipeline, rising over high points and dropping through valleys, it may be possible to completely empty a segment of oil by closing the valve on one end of a segment only and allowing the oil to drain to an adjacent lower segment. It is completely dependent on where and what type of leak occurs.

Concerns for working near a high-pressure leak (See also the section on Safety): A high-pressure crude oil spray atomizes volatile elements very quickly, potentially producing significantly higher vapor concentrations without large amounts of liquid oil pooled nearby. The high-pressure jet also spreads the oil over a larger area, with the wind having a greater affect on the spread of oil aerially.

Health and safety: There are significant health and safety threats while working around an oil spill. Personal Protective Equipment (PPE), including air filters, self-contained breathing apparatus, and protective clothing, can protect workers from respiratory exposure or skin contact, but other dangers exist including slips, trips and falls and reduced visibility and sight lines. A decontamination station needs to be set up, especially in case any worker needs to be evacuated from the area.

Fire/explosion: With the presence of flammable vapors in the outdoors, any ignition source, including a spark of static electricity, could start a fire. If the vapor concentrations were high enough, an explosion could occur. The mechanized construction equipment needed to lift or apply heavy clamps against pressure is almost always a potential source of ignition.

Limit further spread of spilled oil by responders : Prior to entering the site, appropriate site control must be established to restrict access and limit the spread of contamination.

3. Observations and Recommendations:

A. Pipeline Shutdown

Observations: On October 4, 2001, the Operations Control Center (OCC) received notification of a leak on the pipeline between Pump Station 6 and Pump Station 7 near Milepost 400. The leak was detected at approximately 2:53 PM during a fly over by an APSC Security surveillance helicopter. On receipt of this report at 2:54 PM, OCC controllers initiated a pipeline shutdown. The shutdown sequence was designed to minimize oil pressure at the leak location.

Based on the leak location, the OCC initiated an orderly shutdown of Pump Stations 1, 3 and 4 (Pump Station 2 is ramped down). This series of actions was taken to stop the injection of any additional volume of oil into the pipeline system. The final Pump Station in the series, Pump Station 4, was idled at 2:58 PM. The mainline pumping units at Pump Station 7 and Pump Station 9 (south of the leak site) were left on line in an effort to continue to reduce the pressure in the segment where the leak was located.

At approximately 3:00 PM, the OCC contacted APSC System Engineering to verify the exact leak location and to jointly determine the most effective plan to reduce pipeline volume and pressure in the segment containing the leak at Milepost 400.975, approximately 14 miles upstream of Pump Station 7. To further isolate the leak segment from the upstream segment, the closure of the Remote Gate Valves (RGVs) in the segment between Pump Station 4 and Pump Station 5 was initiated at 3:23 PM. To provide maximum evacuation of pressure and volume from the leak area it was determined necessary to drain down the volume and pressures from the local high points at Milepost 394 and Milepost 403. To achieve this goal, Pump Station 7 was left on line until its suction pressure was below 200 psi. As the pressure and volume decreased in the segment, one of the two pumps at Pump Station 9 was idled at 3:49 PM. The suction pressure at Pump Station 7 was 180 psi at 4:02 PM and was idled. Additional oil was pulled through the segment by continuing the pumping operation at Pump Station 9 until 4:21 PM when it was idled. At this point the RGVs between Pump Stations 6 and 7 were commanded closed. At shutdown, the calculated leak site pressure was 415 psi.

Recommendations: The pipeline controller appears to have taken the appropriate actions for the information provided. The operating requirement at 18 AAC 75.055(b), which addresses stopping the incoming flow of oil, was met. There is no indication that changes are called for in training or procedure.

B. Pressure Reduction

Background:
Once a segment of pipeline is isolated, pressure will be reduced as oil drains down. Depending on the hydraulic profile of the segment, pressure may be further reduced by using external pumps at one of the pipeline valves bordering the segment to pump oil into the adjacent segment. Special fittings are required to attach the pumps to the valves.

Observations: The pressure was too high for the safe application of the Plidco Smith+ Clamp (also known as the Bullet Clamp). While this clamp could, once installed, withstand the pressure of the oil, it requires that workers physically manipulate it into position over the jet stream of oil. The larger the jet stream is, the more difficult it is to install. In addition to the physical dangers involved, the placement of workers in the area of the oil spray was deemed unacceptable. The Team Clamp (also known as the Hydraulic Clamp) could be applied without placing workers in the immediate area of the spray. The clamp is designed for installation for TAPS operating pressures and potential leak jet streams. However, the pressure at the leak was higher than the pressure that had been used during testing and training for the application of the clamp.

The oil level at Check Valve (CKV) 66 was below that of the valve, so pumping downstream was not feasible. To pump upstream of RGV65 required overcoming the pressure of the oil at the valve. An APSC Pump Around Skid (formerly known as the Gel Block Skid) had been developed and assembled to do just that. This skid was already being mobilized and was capable of pumping approximately 200 gpm against the pressure at the valve. The pump operation would push the oil back toward Pump Station 5. The pump was set by 6:00 AM on October 5, 2001. However, pumping did not begin until approximately 7:45 AM because of work that had to be completed to allow oil to be pumped back into tankage at Pump Station 5. It required approximately 29 hours to reduce the pressure at the site of the leak for the planned permanent repairs.

A second pump was later brought to the site as a backup should the first pump fail. The second pump was not used.

Recommendations: There were no issues identified that require immediate actions. However, several ideas to increase the ability to reduce pressure and/or stop the leak at a site merit investigation for effectiveness and practicality. They include:

- Modifications to the pump skid or the valves to allow faster connection of pumps,
- Having more pump capacity available, both in terms of number of skids distributed along TAPS and the capacity of each pump,
- Develop a decision tree or other planning tool to determine allowable pump around parameters for locations along the pipeline.

Other more speculative actions may include:

- Investigating tools to tap into the pipeline and withdraw oil directly.

Caveat
At any given site, pressure reduction via pump around may or may not be effective. In limited circumstances, pressure may only be reduced through drain-down at, or in the vicinity of, the leak.

Check Valve 50 Incident

Background:
During routine ground surveillance on January 4, 2002, APSC discovered that CKV 50 had moved 13 inches upstream (northerly) and that nine pipeline anchors had tripped. Further investigation revealed that the Ledeen actuator shear key, which attaches the check valve clapper to the actuator, had failed. This evidence clearly pointed to a significant backflow of oil at CKV 50 causing the valve to slam shut.

It should be noted that check valves under normal operating conditions are designed to prevent the backflow of oil. A review of pressure and flow data for Pump Station 5 and Pump Station 6 from October 1, 2001 to January 4, 2002 by APSC hydraulic engineers found that there was one significant backflow event which occurred on Oct 5, 2002. Three other potential relief events were examined but none of these events caused reverse flow into Pump Station 5. The significant reverse flow event occurred on October 5, 2001 at 7:24 AM during shutdown procedures implemented as part of the Milepost 400 Bullet Hole response.

The broader issue of pipeline movement and tripped anchors is being addressed in an ongoing analysis of the aboveground pipeline using Reliability Centered Maintenance (RCM) methodology. This analysis will produce recommendations for maintenance and monitoring procedures to ensure pipeline integrity.

Observations:
During the Milepost 400 incident, the check valve clappers from Pump Station 5 to Gobblers Knob (4.8 miles of pipeline) were opened in anticipation of flowing oil backward to reduce the pressure at MP 400. At this time the Pump Station 5 relief valves were out of service. To provide a flow path to the tanks at Pump Station 5, the relief valves needed to be brought into service. It was anticipated that the relief set points would be set slightly higher than the static head pressure from Gobblers Knob to allow a slow flow of oil through the relief valves into the tanks. In the process of bringing the relief valves back into service, all four relief valves were opened fully. This led to a reverse flow of greater than 1.3 million barrels/day through the four relief valves into Pump Station 5. The high backflow rate through the check valve probably caused the shear key connecting the Ledeen actuator to the valve clapper shaft to shear, allowing the clapper to drop suddenly and stop the flow of oil. The force of the moving oil against the closed clapper caused the valve and pipe movement.

Recommendations:
The recommendations from the ongoing RCM analysis of the aboveground pipe are not yet available. The following are preliminary recommendations, which should be reviewed when the RCM recommendations become available.

(1) Consider modifying the mainline relief valve maintenance procedures to include closing the inlet or outlet block valve prior to stroking the valve to eliminate the possibility of the reverse pipeline flow condition.

(2) Consider modifying existing OCC procedures to reduce the likelihood of crude oil backflow when the check valve clappers are locked up for smart pig passage or other special situations.

C. Stopping the Leak (Temporary Patch or Plug)

Background:
The purpose of the temporary patch or plug is only to stop the flow of oil from the leak. If, for any reason, it is necessary to continue pipeline operations before a final, permanent repair can be completed, the considerations included in the section "return to operations" must be considered.

Many of the complications of working near or at high-pressure flammable liquids are covered above and in the section on safety.

Before the leak can be stopped, it must be exposed, that is, the pipe insulation must be removed. The insulation will be saturated with oil and difficult to handle. The jet stream of oil and flammable vapors may also interfere with the safe removal of the insulation.

Selection of Patch:
There are two fundamental limits on use of any patch. First, the patch must be engineered to hold onto the pipe and seal against the leak. Second, it must be designed so that workers are able to install the patch safely while the leak is ongoing. One of the most secure types of patch for a small hole in a pipe is a clamp that bands the circumference of the pipe and connects to itself. More extensive damage may require a sleeve, which encloses a greater length of pipe.

Engineering limits on clamps:
There are three criteria that relate to a clamp's ability to patch a leak. The quality of being able to seal and contain a fluid under pressure is known as pressure boundary containment. The clamp must also meet temperature rating requirements as stresses and forces can vary significantly with changes in temperatures. Third, if remotely actuated, the clamp must be able to close against the jet stream force of the leaking oil.

Installation limits on clamps:
If a clamp is not remotely activated, it must be manually closed against the jet stream force of the leaking oil. For the pipeline Hydraulic Clamp, installation issues related to the lifting device to place the clamp and the operations of the clamping mechanism need to be addressed.

Observations: The Plidco Smith+ Clamp, despite it's common name of "bullet hole clamp," was deemed inappropriate to seal this bullet hole because installation against the jet stream pressure in the hazardous vapor environment was considered unsafe for the workers who would have to manually install the clamp. The pipeline Hydraulic Clamp was chosen because it could be applied remotely under the site line pressure and jet stream force.

Additional fire and safety expertise was called on by contracting with Williams Fire and Hazard Control (Williams) and bringing them on site. During this time (October 5), crews started removing insulation from near the leak and oil recovery rates from several containment ponds (installed that day and the night before) were matching the leak rate. Before the evening of October 5, all of the additional requested tools and equipment were on site. Application of the clamp, however, was deferred until the Williams crew was on site and had fully reviewed the situation and procedures. The clamp was applied by 3:00 AM on October 6.

Additional considerations:
See page VII-1 in the "Return to Service" section for a discussion of the criteria for pipeline repair prior to restart.

Recommendations: Review of decision processes and the sequence of events reveals that worker safety was the highest priority during decision-making. Those decisions are unassailable. Nevertheless, there are a number of actions that can save time in a response to a similar event in the future.

- Further develop scenarios, procedures and training to use the Pipeline Hydraulic Clamp, Smith+ Clamp and other existing tools and methodology under appropriately extreme conditions. Define those conditions and the limits to the tools and methodology. Ensure the integration of safety concerns and issues during scenario and procedure development and training.

- Investigate development of additional methods, tools, and safety plans that may be used to stop or mitigate the leakage of oil.

- Review existing procedures and processes related to source control (e.g., Pump Around Skid use and insulation removal) for potential modification and safety concerns.

In general, ensure an integration between source control methodologies and safety concerns described in Section V.

Figure IV-1: Response crew installing the hydraulic clamp

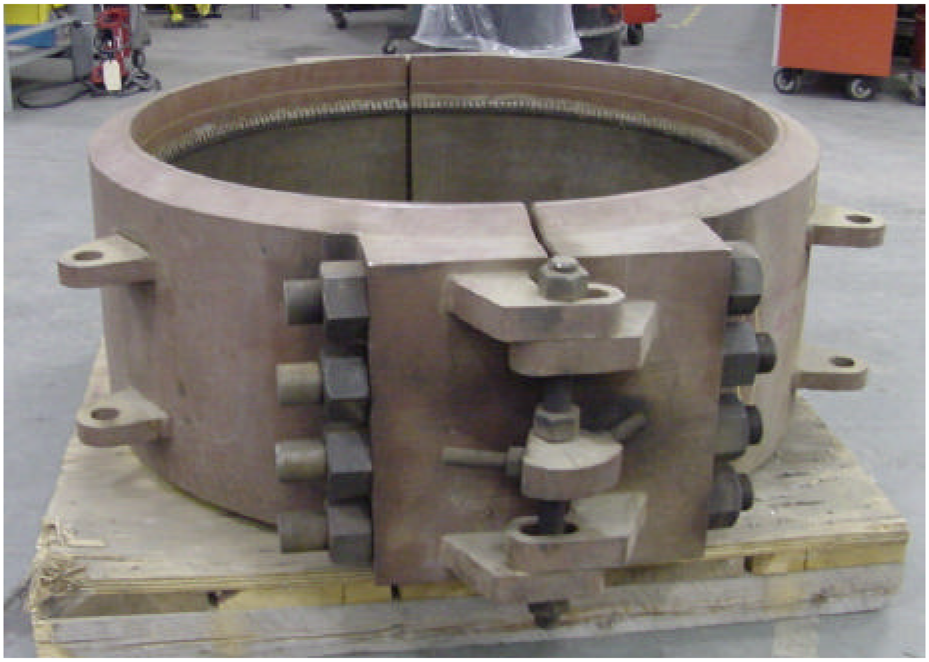
Figure IV-2: Plidco Pipeline Sleeve Clamp

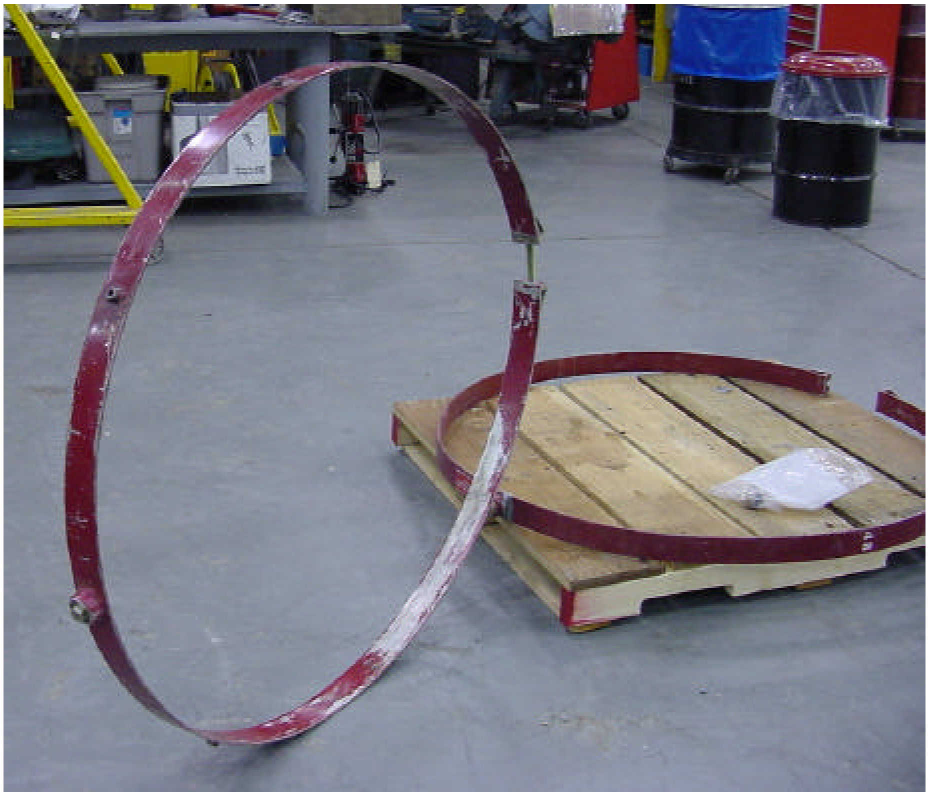

Figure IV-3: Plidco Bullet Hole Clamp

SECTION V: Safety

1. Agency Jurisdiction:

The Alaska Department of Labor and Workforce Development, Occupational Safety and Health (AKOSH) has jurisdiction for worker safety. AKOSH conducted an on site inspection. The officer with AKOSH and JPO Department of Labor Safety Liaison, conducted an inspection of the oil spill at Milepost 400 of the Trans-Alaska Pipeline on October 8 and 10 for compliance with 29 CFR 1910.120(q), Emergency Response.

The Alaska Department of Public Safety State Fire Marshal's Office (SFM) has jurisdiction for fire prevention and suppression. The SFM did not conduct an on site inspection.

BLM and ADNR have safety authorities arising from the Stipulation 1.20, *Health and Safety* of the Federal Agreement and Grant of Right of Way and the State Right of Way Lease.

EPA and ADEC are the lead Federal and State oil spill response agencies per the National Contingency Plan and Alaska State statutes/ regulations.

2. Background:

Alyeska Pipeline Service Company (APSC) managed the cleanup with the assistance of approximately fifteen contractors. There was an average of 150 workers on site at any given time. Alyeska was the first responder to control the site. Once the incident command structure was up and running, the work was organized into task forces supervised by APSC employees.

Task Force One consisted of personnel (outfitted in Level C PPE) working to contain and recover oil. These workers used absorbent pads, pumps, skimmers, vacuum units, shovels, and other hand tools. Contractors included Alaska Clean Seas Cooperative, CCI, and village response teams from Minto (Tolovana Construction), Stevens Village (River Village Inc.), and Rampart.

Task Force Two operated the earth-moving equipment that loaded dump trucks with contaminated soil for transport to the spoiled material staging area at the Alaska Department of Transportation and Public Facilities (DOTPF) materials pit north of the Elliot Highway. Houston NANA was the primary contractor for this task force with support from the village response teams.

Task Force Three was the Environmental Unit, which was made up of APSC employees supported by SLR, an environmental contractor. This task force collected soil, water, and vegetation samples for testing and provided overall environmental monitoring of the cleanup site and contaminated materials staging area.

Task Force Four was the crew located at the contaminated material staging area in the DOTPF materials pit north of the Elliot Highway. This crew received and stored the contaminated soil for future treatment, prepared the used absorbent pads for disposal, and operated the separator that removed debris from the recovered oil. Phillips Environmental and MI Corporation operated the unit with support from Houston NANA.

The Repair Task Force, made up of Houston NANA employees, was disbanded after the leak was repaired.

On October 9, Task Forces One and Two were reorganized into Task Force One, and Task Force Four became Task Force Two. The remaining task forces and others on site were referred to as the Support Group.

There are significant health and safety threats while working around an oil spill. Personal Protective Equipment (PPE), including air filters, self-contained breathing apparatus, and protective clothing, can protect workers from respiratory exposure or skin contact, but other dangers include slips, trips and falls and reduced visibility and sight lines.

With the presence of flammable vapors in the outdoors, any ignition source, including a spark of static electricity, could start a fire. If the vapor concentrations are high enough, an explosion could occur. The mechanized construction equipment needed to lift or apply heavy clamps against pressure is almost always a potential source of ignition.

3. Observations and Recommendations:

A. Emergency Response Plan

Observation: OSHA 1910.120(q)(1) requires an Emergency Response Plan. A plan by that title does not exist; however, the requirements can be found in the following APSC documents: CP35-1 *Oil Spill Contingency Plan*, EC 71-7 *Emergency Contingency Action Plan*, and the *Site-Specific Hazardous Waste Operations Health & Safety Plan*.

Recommendation: Future Site-Specific Health & Safety Plans should be called *Emergency Response Plan* or *Site Specific Emergency Response Plan* and address each of the items required by 29 CFR 1910.120(q)(2).

B. Personal Protective Equipment (PPE)

Observation: Workers in the hot zone were wearing Level C PPE, which included chemical resistant clothing, gloves, boots, safety glasses, hardhat, and respirators.

Respirators are not required when monitoring results indicate vapors are less than the Permissible Exposure Limit (PEL). In such cases, workers were observed in Level C PPE without a respirator creating the image that workers were not properly protected. They are required to be trained and fit-tested for respirators and must use the respirator when the hazardous atmosphere exceeds the permissible limits.

All other workers were wearing gloves, boots, hardhat, and safety glasses.

Recommendation: None.

Figure V-1: Workers in protective clothing installing the clamp.

C. Air Monitoring

Observation: Various contractors took air samples for Lower Explosive Limits (LEL), hydrocarbons, and benzene. The results were posted in the decontamination area and updated, as changes occurred. Some workers used respirators; however, they were not required to because the hazardous atmosphere was below the exposure limits.

Recommendation: None.

D. Respirator Fit Test

Observation: Records of APSC employees and its contractors' employees who responded to the spill were evaluated for respirator fit testing as required by 29 CFR 1910.134(f). No evidence was provided that one of the Houston NANA Baseline Crew employees was fit tested.

Recommendation: The fit testing records of employees who have spill response responsibilities should be reviewed annually for currency.

E. Controlled Entry

Observation: A security guard was posted at the intersection of the Elliot Highway and the pipeline right-of-way and the entry to the DOTPF materials pit main staging area. Additional entry points were controlled at the support staging area and the warm/hot zone. There were no problems with entry to the staging areas and spill site.

Recommendations: None.

F. Decontamination

Observation: The decontamination area setup was progressive and fully operational within 48 hours.

Recommendations: None.

G. On Site Safety Briefing and Training

Observation: Everyone entering the support staging area received a site-specific orientation. The degree of training depended on the work the individual was tasked to perform. For example, visitors received a brief orientation explaining traffic patterns, smoking areas, and what to do in the event of an emergency. Visitors were required to be with an escort at all times. Workers in the warm zone, hot zone, or spoiled material staging area received a detailed orientation.

Recommendations: None.

H. Hazardous Waste Operations and Emergency Response (HAZWOPER) Training

(1) Observation: The training records of APSC and Houston NANA's first responders to the oil spill were evaluated for initial and annual refresher HAZWOPER, *First Responder Operations Level* (8 hour) training required by 29 CFR 1910.120(q)(6)(ii). No deficiencies were noted.

Recommendation: None.

(2) Observation: The training records of Houston NANA's repair crew were evaluated for initial and annual refresher HAZWOPER *Hazardous Materials Technician* (24 hour) required by 1910.120(q)(6)(iii). No evidence was provided that two Houston NANA Repair Crew employees received this training or annual refresher training prior to working on the spill.

Recommendation: Training records of employees who have spill response responsibilities should be reviewed annually for currency.

(3) Observation: The training records of APSC and its contractors' support staff who entered the warm and hot zones were reviewed for initial and annual refresher HAZWOPER *Hazardous Materials Specialists* (24 hour) training required by 1910.120(q)(6)(iv). No deficiencies were noted.

Recommendation: None.

(4) Observation: The training records of APSC's Operations Section Chiefs were evaluated for HAZWOPER *Hazardous Materials Specialists* training required by 1910.120(q)(6)(iv) and *On Scene Incident Commander* training required by 1910.120(q)(6)(v). No deficiencies were noted.

Recommendation: None.

I. Fire Prevention

Observation: APSC made every effort possible to prevent a fire. The atmosphere was monitored for Lower Explosive Limits. Staging areas, a warm zone, and a hot zone were established. Access was restricted in the warm and hot zone. Vehicles were kept in the staging areas and non-sparking tools were used in the warm and hot zones to minimize sources of ignition.

Recommendation: None.

J. Fire Suppression

(1) Observation: Repair crews who removed the insulation wore Silver Fire Resistant Proximity Suits. Repair crews who installed the clamp wore Blue Fire Resistant Clothing. Firefighters on standby for rescue or fire fighting wore bunker gear. Foam was available as an extinguishing agent in the event of fire. The Steese Volunteer Fire Department dispatched a fire engine and crew to assist with any fire fighting. Williams Fire and Hazard Control was dispatched from Texas for onsite fire fighting expertise.

Recommendation: APSC should continue to seek the assistance of the Fairbanks North Star Borough Emergency Operations Department and the Municipality of Anchorage Emergency Services staff for the coordination of local fire suppression resources and support.

(2) Observation: Mutual aid received from the Steese Volunteer Fire Department together with the expertise brought in from Williams Fire and Hazard Control provided a critical element of the overall site safety.

Recommendation: Future exercises and preparedness training should include participation by community fire departments together with APSC fire and safety personnel in order to establish or enhance mutual aid and working relationships. There should also be an effort to identify in-state and out-of-state resources that could enhance fire prevention and fire suppression capabilities.

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SECTION VI: Containment and Cleanup Actions

1. Agency Jurisdiction:

EPA and ADEC have overall Responsible Party (RP) oversight responsibilities for all aspects of the response. However, agency jurisdictions overlap in the areas of containment, cleanup actions and restoration.

- ADNR manages the land on which the damaged pipeline is located and the area contaminated by the oil spill. The contaminated area lies within the Tanana Valley State Forest.
- ADNR Division of Forestry has been, and continues to be, actively involved in the land use permitting process as well as the review of APSC's rehabilitation plan.
- ADF&G monitors the potential impact to fish and wildlife.
- ADEC maintains jurisdiction and oversight of containment and cleanup operations.
- The State Pipeline Coordinator's Office within ADNR administers the State Right of Way Lease for TAPS.
- BLM, Office of Pipeline Monitoring has jurisdiction through the Federal Agreement and Grant of Right of Way for TAPS.

Grant / Lease Requirements - Stipulation 2.12.1 Restoration **--** "Areas disturbed by Permittees/Lessees shall be restored by Permittees/Lessees to the satisfaction of the Authorized Officer/Pipeline Coordinator as stated in writing" for the Right of Way.

For purposes of Stipulation 2.12, "disturbance" is a deviation from the natural and normal condition of the land. "Restore" means returning a disturbed site to its original or normal physical condition and natural biological productivity and diversity by means of the best available protection, stabilization, erosion control and habitat reconstruction and revegetation techniques, with the intent of reestablishing native plant species. Restoration is completed as soon as possible, as required by Stipulation 2.4.4.1.

The Authorized Officer and State Pipeline Coordinator interpret restoration success on a site-specific basis and consider whether the restoration measures taken: (1) remove all contaminated material; (2) to the extent possible, return a disturbed site to its original or normal physical condition and natural biological productivity and diversity with reestablishment of native plant and animal species; (3) prevent erosion; (4) conform to the adjoining land forms and approximate the original land contours; (5) maintain pipeline system integrity; (6) remove improvements as required by the appropriate authority; and (7) provide for public safety.

These jurisdictional authorities are applied through the SOSC to ensure a single, coordinated approach.

2. Background:

It is essential to understand that there are several components to a spill response, primarily source mitigation, containment, cleanup, and restoration. Only containment and cleanup are discussed in this section. Containment may be defined as those actions which prevent the spill from spreading or migrating at an avoidable rate, thereby minimizing the area affected.

There are eight criteria listed in 18AAC 75.320 which must be applied to determine the adequacy of containment and cleanup. These criteria address the availability and proper utilization of appropriate spill response resources. For the containment portion of this spill response, all eight criteria were met. For the cleanup portion, which is still in progress, all eight criteria are also being met.

In addition, it is important to understand that this cleanup presents some rather unique challenges which require time for review and appraisal of the various options. It also involved a pilot test of various techniques to aid in the decision making. The range of options has been systematically refined and the final decisions are imminent. However, since the final decisions have not been made, only lessons learned from actions taken to this point will be included.

3. Observations and Recommendations:

A. Observation: It is of paramount importance to keep a spill to land confined to land. To accomplish this objective the proper resources are earth-moving equipment, pumps, hoses, rolling and stationary tankage. Contingencies must be put in place to sling blocking materials and boom to remote locations using helicopters should primary containment prove insufficient. Since major areas of TAPS are inaccessible except by the service road and air, the planning process should identify helicopter assets capable of transporting equipment such as boom, tankage, pumps and skimmers to remote containment areas.

Recommendation: None. Both of these actions were taken on this spill.

B. Observation: Source control and containment actions should occur concurrently. When it is determined that the time to achieve source control will exceed the time to achieve containment, increased emphasis must be placed on achieving and maintaining the containment. This approach proved successful as the footprint of this spill did not significantly increase after about 7-1/2 hours.

Recommendation: None.

C. Observation: Pre-approved and pre-identified containment sites should be activated as quickly as possible (using a checklist) in spill events where even a remote chance exists that oil will reach water.

Recommendation: Develop a checklist to focus on critical response information such as determining the location of pre-determined containment sites, determining the rate of advance of the oil spill and containment actions.

D. Observation: Attention to the life safety of responders and the public must be rigorously applied to all phases of an oil spill response. This response presented unique challenges that were addressed with good site control measures and innovation. Examples are a) the close coordination of response mobilization directors with the Alaska State Troopers and APSC Security from the time of spill discovery (2:55 PM) to the apprehension of the alleged perpetrator (6:40 PM) which allowed response personnel to safely enter the spill scene, and b) the use of the Pump Around Skid to reduce the volume of oil in the pipeline segment. The use of the Pump Around Skid, as an alternative source control measure, reduced the amount of oil spilled to ground when it was determined that the atmospheric conditions at the leak point were too hazardous for personnel to enter.

Recommendation: None.

E. **Observation:** Adequate personnel and supporting resources were applied in a timely manner to allow pre-planning for subsequent phases of the response. The environmental unit took proactive steps to develop and implement plans, in concert with agency personnel, to gather site contamination information related to the extent of surface oil contamination, depth of soil penetration, and develop predictions of the free oil direction and rate of advance. These timely efforts provided the Unified Command and the rest of the response organization with solid data to use in selecting the best tactics.

   Recommendation: None.

F. **Observation:** Innovation and use of different tactics to fit the spill should be a part of every response. An innovative tactic was developed to accelerate the drainage of free oil from the forest mat. The tactic used was to create a number of shallow trenches in a linked chevron pattern that followed the natural slope of the site and drained into existing collection pits. Chainsaws were used to cut approximately 4 – 6 inches through the vegetative mat, and lift the mat out to make a shallow trench. This tactic is familiar to forest fire fighters for building fire breaks.

   Recommendation: This tactic should be memorialized in response tactic manuals, such as the Alaska Clean Seas Tactics Manual.

G. **Observation:** The sudden release of crude oil at Milepost 400 posed a low risk to fish and wildlife in the immediate area, since the spill impacted area was limited. Shorty Creek and the Tolovana River are located approximately ½- and 1-mile from the spill site, respectively. Land between these fish-bearing waters and the spill site is relatively level terrain and covered by dense natural vegetation. Although a variety of wildlife transits through this area, there is no information suggesting that wildlife habitually use this area for nesting, breeding, calving, staging or feeding. The wildlife exclusionary fencing installed during the clean-up phase will minimize accidental contact with contaminants by animals traveling through or foraging in the area. The fence will also deter recreational snow machine users from unknowingly entering the site.

   Recommendation: APSC schedule periodic site visits to ensure that the fence is functioning as intended and to perform fence maintenance as needed.

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Figure VI-1: Lined containment cell

SECTION VII: Return to Service

1. Agency Jurisdiction:

DOT-OPS administers the regulations at 40 CFR Part 194 for the response plans for onshore oil pipelines. BLM administers the Federal Agreement and Grant of Right of Way for TAPS and ADNR administers the State Right of Way Lease for TAPS, both of which address pipeline integrity and the safe operations of TAPS.

2. Overall Background:

This section deals less with the response to spilled oil, but more with the safe return to service of the pipeline. TAPS is a national asset. Loss of service for extended periods may cause disruptions in fuel supplies for Alaska and the West Coast. The degree of disruption is related to the length of time the pipeline is shut down. This must be balanced against assuring safe operation of the pipeline. All of the requirements to ensure safe operation and pipeline integrity must be in place prior to restart. Those requirements include a suitable repair and resolution of any integrity issues that may have arisen during the event.

For this event, the selection of the repair method, the repair itself, the restart and the agency coordination all proceeded in a timely and acceptable manner. There were no other integrity issues. This section is included due to issues that never occurred, but in the future, might.

3. Observations and Recommendations:

A. Permanent Repairs

Background:
There are many criteria that apply to selecting an acceptable repair of the pipeline prior to restart. First and most immediate are APSC's own manuals, which describe design and operating requirements for the pipeline and its systems. These manuals include procedures for inspection of the damaged area of the pipe, procedures and approvals for pipe repair methods and materials, and post repair inspection procedures and documentation. The APSC manuals are written to ensure conformance with applicable industry standards (e.g., American Petroleum Institute and National Association of Corrosion Engineers) and applicable regulations. Regulations include those administered by DOT-OPS (40 CFR Part 195) and the terms of the Federal Agreement and Grant of Right of Way, and the State Right of Way Lease.

Observations: Because of the degree of pressure reduction and the nature of the damage, APSC was able to install a standard pipeline fitting (known as a Threaded O-Ring (TOR)) using previously approved welding procedures. The fitting and its installation met all of APSC's operating requirements and satisfied all regulatory requirements.

Because of the nature of the leak, there were no other integrity issues that would have affected the decision to restart the line.

Prior to the decision to install a TOR, there were discussions of different options for repair. Since there are additional agencies involved with TAPS repair and startup that are not closely involved with the oil spill response, a significant amount of time was spent coordinating with agency personnel not at the EOC.

Recommendations: See observations and recommendations under the Incident Command System (ICS) Section, Unified Command, page I-2.

Figure VII-1: Permanent repair (Threaded O-Ring)

B. TAPS Restart Process

Background:
After completion of the repairs and satisfactory resolution of all integrity issues, operations were resumed. There have been occasional problems associated with pipeline restart including recent oil spills. Generally, those problems have been associated with work done while the pipeline was shutdown as opposed to related to the actions taken to restart the line. Nevertheless, the pipeline operator must adapt the startup sequence to the condition of the line when it was shutdown.

Observations: The restart of the pipeline was conducted using established procedures and approval protocols. The startup sequence took into account the actions taken during the initial shutdown and the subsequent draindown activities required for the repair of the pipe. Prior to the startup, all mainline valves were returned to the respective normal positions for pipeline operation and slack segments of the pipeline were refilled under controlled conditions.

After establishing an open flow path from Pump Station1 to the Valdez Marine Terminal, the pipeline startup was initiated at 3:24 AM on October 7, 2001. The startup sequence began with the start of a mainline pump at Pump Station 1. As pressure and flow began to be restored in the pipeline system, the pumps at the downstream pumping stations, beginning with Pump Station 3, were sequentially brought on line. The mainline startup culminated at 7:35 AM with the start up of a mainline pump at Pump Station 12. The pipeline startup was without incident and was witnessed by an Agency observer at the OCC in Valdez.

Recommendation: Continue current practices.

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SECTION VIII: Contingency Plan Implementation

1. Agency Jurisdiction:

Oil spill contingency plans (Cplans) are required by Federal regulations and State statutes as well as the Grant and Lease of Right of Way for TAPS. ADEC has the authority to approve Oil Discharge Prevention and Contingency Plans under State statutes pertaining to oil and hazardous substances pollution control, AS 46.04.030, Oil Discharge Prevention and Contingency Plans. State regulations requiring and governing the contents of Cplans are addressed under 18 AAC 75.400 through 18 AAC 75.495.

BLM administers the Federal Agreement and Grant of Right of Way for TAPS, which requires that APSC annually submit the Cplan for review and approval. DOT-OPS has facility response plan requirements found in 49 CFR Part 194 for on shore oil pipelines. By agreement between DOT-OPS and EPA, EPA jurisdiction associated with a facility response plan is limited to non-transportation related bulk oil storage (i.e., turbine fuel tanks).

2. Background:

Under Alaska law, a contingency plan is called an Oil Discharge Prevention and Contingency Plan because it includes actions to prevent an oil spill and, in the event of a spill, provides for a level of pre-planning and preparedness to be able to effectively respond. The oil spill plan is a legally binding contract between the state and the plan holder wherein certain resources, personnel and commensurate levels of training are committed. All Cplans approved by the State of Alaska must contain four sections. The Response Action Plan section is intended to be the operational document used during a response. It contains an emergency action plan to guide first responders as well as descriptions of response strategies for the plan holder's resources. The Prevention Plan section describes the measures in place to prevent or reduce the risk of spills from the operation. The Supplemental Information section contains supporting information and detail necessary to determine the plan's compliance with state requirements. The Best Available Technology (BAT) section requires that the plan demonstrate the use of best available technology using specific criteria listed in the regulations.

The TAPS Cplan contains cross-references meeting the approval criteria for the response plans for DOT-OPS and EPA. BLM's review of the plan is based on the criteria presented in Stipulation 2.14 of the Federal Agreement and Grant of Right of Way for TAPS. These criteria are relatively broad, and therefore, the plan format as described in State regulations is used for the basis of the review.

To compile this chapter of the Joint After-Action Report, documentation from the response was compared to the Cplan. Two questions were asked: 1) was the Cplan satisfactorily implemented as currently written; and 2) can portions of the plan be amended to more accurately reflect the response or to incorporate lessons learned to improve any of the four sections of the plan? The issues discussed in this section address the topics of the other sections of this report. A brief review of the specific contingency plan requirements for each topic is provided as well as a general description of the current Cplan contents. Only the most significant portions of the plan having to do with this response are addressed in this report. In addition, recommendations are included in this report that identify portions of the plan that may be amended to more accurately reflect the response or to incorporate lessons learned to improve any of the four sections of the plan.

The review of Cplan implementation is in accordance with the Trans-Alaska Pipeline System, Pipeline Oil Discharge Prevention and Contingency Plan Ed 3, Rev 4, November 2000. Effective November 30, 2001, a new revision of the plan was approved with some text changes. This approval acknowledged that this after-action report may identify recommended plan improvements.

3. Observations and Recommendations:

A. Incident Command System

Cplan Requirements: The regulations under 18 AAC 75.425(e)(3)(C) require that the plan contain a description of the command system to be used in response to a discharge and that the command system be compatible with the state's response structure outlined in the state master plan (i.e., the Federal/State Unified Plan) prepared under AS 46.04.200.

Under 49 CFR Part 194, the response plan must demonstrate consistency with the National Contingency Plan and Area Contingency Plans.

APSC's ICS organization is described in Section 2.3 of the Cplan. The structure, duties and commitment for adequate numbers of personnel to sustain an adequate response is given in this section.

Observation: Overall, the requirements of the Cplan regarding ICS were implemented during this response. Although some recommendations are provided in the ICS section of this report such as to structure a "go team" early in the response, these are incident-specific and do not warrant amendments to the Cplan.

Recommendation: None related to Cplan implementation.

B. TAPS Leak Detection

Cplan Requirements: In accordance with the requirements of the Best Available Technology section of the plan, a case-by-case analysis and review is required under 18 AAC 75.425(e)(4)(A)(iv). This portion of the regulation states that "for a crude oil transmission pipeline contingency plan: leak detection, monitoring, and operating requirements for crude oil pipelines that include prompt leak detection as required by 18 AAC 75.055(a)."

18 AAC 75.055(a) states: "A crude oil transmission pipeline must be equipped with a leak detection system capable of promptly detecting a leak, including (1) if technically feasible, the continuous capability to detect a daily discharge equal to not more than one percent of daily throughput; (2) flow verification through an accounting method, at least once every 24 hours; …."

Under 49 CFR Part 194, the response plan must list spill detection procedures. Additionally, Stipulation 2.14.2 of the Federal Agreement and Grant of Right of Way for TAPS requires that the Cplan include provisions for spill detection.

The Cplan describes the leak detection systems in place on TAPS under Section 3.1.8.3. A description is given of both means of leak detection: visual observations and three on-line leak detection methods. Section 4.2.13 of the plan gives a BAT analysis of the leak detection system and states that the transient volume balance (TVB) system for TAPS is BAT with detection thresholds of 115 bph in tight-line and 163 bph in slack-line conditions.

(1) Visual Leak Detection

Observation: A security surveillance flight detected the leak. Security surveillance flights are additional to the regular aerial surveillance schedule.

Recommendation: Alaska law and hence the Cplan only requires weekly aerial surveillance. State regulations are the most stringent regarding the frequency of aerial surveillance. No actions are required regarding Cplan implementation.

(2) On Line Leak Detection

Observations: Analysis made after the incident regarding the on-line leak detection systems did not correspond to the Cplan text because the limitations of the system are not thoroughly described. The system met the regulatory required sensitivity based on the average behavior of the system. The passage of a cleaning pig through the Pump Station 6 to Pump Station 7 pipeline segment reduced the TVB's effective sensitivity to below that as indicated in the Cplan. The BAT analysis in the plan indicates that TVB is BAT. However, under the circumstances of October 4, 2001, only the LVB system would have detected the leak within 4 to 10 hours.

Recommendations: Portions of Section 3.1.8.3 of the Cplan having to do with describing leak detection will require revision to more thoroughly describe the TAPS leak detection system. The text changes should delineate specifications and limitations of the systems more completely. Information such as when and for what percentage of time alarms are suppressed should be added. Also, more specific information about leak detection thresholds and the time required to detect a leak should be included.

The BAT section of the plan regarding leak detection, Section 4.2.13, will need to be re-written to more accurately show that leak detection for TAPS relies on the concurrent use of the LVB and TVB systems, and the deviation alarms. This is not a change in the systems, but rather a better description of the current capabilities.

APSC has a Pipeline Leak Detection Improvement Project underway to improve leak detection capabilities. (See Section III for further details). It is anticipated that this project will reduce the limitations of the systems. As changes in TAPS leak detection are made, corresponding updates to the Cplan text will be necessary.

C. Source Control

Cplan Requirements: ADEC regulations at 18 AAC 75.055(b) require that the operator be able to stop the incoming flow of oil (shut down the pipeline) within one hour of detecting a discharge. ADEC interprets this to mean oil entering TAPS at Pump Station 1. ADEC also requires source control be addressed in the contingency plan [18 AAC 75.425(e)(1)(F)(i)]. These source control procedures "to stop the discharge at its source and prevent further spread," must also meet ADEC's best available technology review requirements [18 AAC 75.425(e)(4)(A)(i)].

DOT-OPS regulates source control strategies under 40 CFR Part 195. BLM administers Stipulation 2.14 of the Federal Agreement and Grant of Right of Way which includes "immediate corrective action including Oil Spill Control."

The Cplan under Section 1.7.2, Procedures to Stop the Discharge, discusses pipeline shutdown and temporary patching/repair/isolation. Under shutdown, a summary of flow stoppage and valve closure on the pipeline system is given. A short description is also included that may be used under some conditions to reduce the amount of oil spilled by keeping certain valves open or shut or by continuing to operate downstream pump stations. Under temporary patching/repair/isolation is a list of clamps and sleeves for emergency patching or repair that can be used to stop a leak.

The BAT Section of the plan states that isolation valves and temporary patching/repair are considered BAT. Current methods using the mainline valves are given in the BAT analysis table. Under Temporary Patching/Repair, a description of the method includes "Repair leaking pipe with a temporary sleeve or clamp. This includes mechanical flange leak clamps, buckle sleeves, and bullet hole clamps." Also included is a short discussion of the 48" hydraulically operated pipeline clamp, considered an alternative method. A properly installed sleeve is given as the preferred method to repair damaged pipe.

(1) Pipeline Shutdown

Observation: Pipeline shutdown was implemented as described in the Cplan.

Recommendation: None related to Cplan implementation.

(2) Pressure Reduction

Observations: Procedures described in the plan such as holding certain valves open to attempt to back flow oil to an upstream pump station were implemented during this response. The back flow of oil at Check Valve 50 resulted in the movement of the pipeline at the check valve and tripped anchors (See Section IV of this report).

Because of the location of the bullet hole, other techniques were necessary to reduce pressure at the valve. There is currently no mention of the Pump Around Skid that was mobilized at the site and used to reduce the pressure to allow for the application of the clamps.

Recommendations: Section 1.7.2 of the Cplan should be amended to describe in more detail the considerations and possible consequences should the option to backflow oil to an upstream pump station be taken. The Cplan under this same section should also be amended to include information about the Pump Around Skid as a method of pressure reduction related to source control. Other parts of the plan should identify the personnel required to implement the skid and the appropriate training required.

Figure VIII-1: Alyeska's Pump Around Skid in Operation

(3) Stopping the Leak (Temporary Patch or Plug)

Observations: Certain clamps as listed in the Cplan under Section 1.7.2.2 were not used in the response due to worker safety considerations regarding manual installation of the clamp in a hazardous environment. The description given for the clamps in the Cplan text does not include the safety limitations of applying the devices in an uncontrolled vapor environment. The pipeline Hydraulic Clamp that was used to seal the leak is described in the Cplan as a new, prototype clamp, and its use is considered an alternative method. A number of repair clamps described in the plan were mobilized to the site and prepared for installation. The Team Hydraulic clamp, several Plidco sleeve clamps, and several bullet clamps were on site and available for use once the personnel hazard was reduced. Any of these clamps could have effectively sealed the hole in the pipe to stop the flow of oil. Subsequently, a simple device to plug and repair the hole was used – a TOR plug. This was selected for its simplicity, ease of installation, and reduction of potential long-term pipeline integrity and maintenance issues.

Although the BAT Section of the plan gives "properly installed sleeve" as the preferred method to repair damaged pipe, this is regarded generally as a permanent repair practice, rather than a source control device.

Recommendations: The Cplan should be modified to more accurately reflect the limitations of applying the clamps in a vapor environment. Information on the pipeline Hydraulic Clamp needs to be updated to reflect the testing which has occurred and its capabilities. The training section should be reviewed and corresponding changes should be made to include training having to do with clamp application and the mitigation of hazards imposed by a crude oil spill. Portions of the Cplan must be reviewed to assure that mobilization and response times take into account appropriate source control methods. The BAT Section for temporary patching and repair should be reviewed in light of the lessons learned from this incident. Plan text that now addresses permanent repairs should be reviewed to address methods that specifically relate to source control.

D. Safety

Cplan Requirements: The response action plan must include information on safety. The requirements under 18 AAC 75.425(e)(1)(C) call for a description of the steps necessary to develop an incident-specific safety plan for conducting a response, based on applicable safety standards. The required plan contents under 18 AAC 75.425(e)(3)(D) call for a description of the realistic maximum response operating limitations that might be encountered at the facility or operation and, based on environmental and safety considerations, an analysis of the frequency and duration, expressed as a percentage of time, of limitations that would render mechanical and other response methods ineffective.

AKOSH uses the requirements under 29 CFR 1910.120(q) to evaluate the emergency response.

Section 1.4 of the Cplan describes initial actions to ensure the safety of responders, the duties of the safety officer, an example of the Site Safety and Control Analysis form, ICS response actions, hydrocarbon vapor testing, and fire prevention and control.

Section 2.4 of the Cplan describes Realistic Maximum Response Operating Limitations (RMROL) which include environmental factors that affect response and prevention activities. The section also lists RMROL compensating measures.

Section 2.8 of the Cplan describes APSC's oil spill training and exercise programs. Required training for various employees is given in this section.

Observations: In general, safety requirements of the Cplan were met.

One exception had to do with respirator fit testing, whereby the fit test records of one Baseline crew employee could not be provided. Fit tests are given to employees through APSC course OSCP/04, Personnel Safety at Oil Spill Site. According to the OSCP training matrix, this course is scheduled to be taught yearly to many employees including Baseline crews.

Another exception was that no evidence could be provided to indicate that two repair crew employees received 24-hour HAZWOPER Hazardous Materials Technician training or annual refresher training prior to working on the spill.

Because of the hazardous conditions at this spill, most notably an explosive atmosphere and extreme fire hazard, a multitude of precautions were exercised in order to prevent an explosion or a fire. This resulted in source control efforts taking longer than expected. Although the Cplan lists environmental factors that may preclude response activities, such as daylight hours, temperature or wind, no discussion is given regarding factors which may contribute to a high risk of explosion or fire that may in turn preclude a response for safety reasons.

Recommendations: Section 1.4 of the plan, which discusses site safety, the role of the Unified Command, and fire prevention and control may require updating to reflect the recommendation in this report that APSC and the agencies examine fire suppression capabilities of APSC for future events.

Section 2.4 of the Cplan should be reviewed and revised to address Realistic Maximum Response Operating Limits and compensating measures having to do with explosive atmospheres, extreme fire hazards, and response personnel safety. Information should be included in the plan to more realistically describe how portions of a response may be delayed by responder safety issues. Other portions of the plan should be reviewed to ensure that threats to responder safety are realistically described, such as in the plan scenarios.

The training matrix in the plan under Section 2.8 was not completely enforced for two individuals. Training must be kept up to date and records of employees should be reviewed annually for currency.

E. Containment and Cleanup

Cplan Requirements: The regulation under 18 AAC 75.425(e)(1)(F) requires the Cplan to provide a description of the discharge containment, control, and cleanup actions to be taken to conduct and maintain an effective response. The plan should include a description of the actions to be taken to contain and control the spilled oil and to recover the contained or controlled oil. Procedures and methods to exclude oil from environmentally sensitive areas and areas of public concern are also included. Department approval criteria under 18 AAC 75.445(d) contain requirements for response strategies including adequate personnel, equipment and strategies to meet the response planning standard.

Under 49 CFR Part 194, the response plan must list response activities and response resources, personnel and equipment.

Multiple sections of the Cplan contain information related to containment and cleanup actions. The Response Action Plan (Section 1) contains information on response strategies such as communications, protection of environmentally sensitive areas, containment and control strategies and recovery strategies.

Observations: Overall, the Cplan was implemented for containment and control actions as part of the MP 400 response. Resources and personnel were mobilized in a timely fashion. Oil containment and control strategies were successful and oil was kept from reaching nearby river drainages, thereby protecting environmentally sensitive areas. Oil recovery strategies were also satisfactorily implemented.

The Cplan identifies containment site, CS 6-31A, located at the Unnamed Creek confluence with the Tolovana River, two and a half miles southwest of the pipeline. This containment site was not immediately activated as control actions were thought to be occurring successfully closer to the pipeline. However, if oil had escaped on land containment and entered Shorty Creek, it could have reached the Tolovana River**.** (See ICS Section, B. Operations Section, page I –3.)

Recommendations: The Cplan does not address the system that was ultimately used to track the volume of oil recovered i.e., use of a recovered oil-filtering skid with a metering system. Amending the plan to include the various techniques that may be useful to estimate oil recovery could prove useful for quantifying important aspects of the response such as temporary storage and ultimate disposition of recovered oil. The regulations under 18 AAC 75.425(e)(1)(F)(ix) require procedures and plans for estimating the amount of oil recovered.

The tactic used during the MP 400 spill to pool and collect oil by use of trenches is broadly referred to in Section 1.7.6.6.1 of the plan, Containment and Exclusion Techniques, where trenches for containing the flow of oil through a subsurface layer is discussed. However the specific technique used during this response is not discussed or illustrated. Considering the success of this technique and the number of areas crossed by TAPS where this on-land technique may be applied, this would be a useful addition to tactics manuals.

Some personnel have suggested that the Cplan should more specifically identify/list required permits. In addition, it is possible that pre-identifying certain permits during the planning process would speed up actions taken during the response. Section 1.7.9 of the Cplan discusses recovered oil transfer, storage and disposal. This section refers to APSC's EN–43-2, waste management manual for handling requirements for wastes generated from a spill. Specific permits required during a response are discussed in the scenarios, and identifying specialized permits is listed as one of the Planning Section Chief's duties in the current version of the Cplan. Although regulations require that permits be pre-identified in the plan for only non-mechanical response information, it may be useful to list the many permits that are already in place. In addition, identifying and investigating the pre-authorization for certain key permits may be a worthwhile plan improvement.

F. Return to Service

Cplan Requirements: The Cplan requires pipeline system repairs to be completed in accordance with regulatory requirements and approved methods. The pipeline restart must be conducted in accordance with methods and practices that prevent system damage and oil spills.

Observations: The repair plan was developed and implemented in accordance with regulatory requirements. JPO staff personnel had an opportunity to review the repair plan prior to execution.

The pipeline restart was conducted in accordance with system operating procedures and witnessed by a JPO representative.

Recommendation: Continue current practices.

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Appendix A: Response Timeline

The following sequence of events is compiled from notes provided by APSC, ADEC, EPA, and JPO.

Date	Time	Description of Actions
Jun-Aug 2001		Annual Security Linewalk performed to examine both sides of the pipeline. Crews worked from MP 395 south to PS12, then from PS1 to MP 395.
Oct 4	1431	TAPS struck by bullet, pipeline begins to release oil from bullet hole.
	1442	APSC security helicopter observes two individuals riding ATVs on Right of Way south of RGV 65.
	1444	Security helicopter lands and questions one individual, second individual departs area at high rate of speed. Security Officer questions individual. Individual states that his brother has just shot the pipeline and it was leaking oil. Security Officer obtains additional information and returns to the helicopter to find the spill location.
	1453	Spill discovered by APSC Security personnel during helicopter overflight.
	1455	Security Helicopter Observer reports oil spill just South of CKV 66 to Security at PS7 via APSC radio system.
	1455	Security Helicopter Observer reports oil spill to APSC Fairbanks Business Unit Security Lead via APSC radio system. Also reports that oil leak could be the result of a gunshot.
	1455	TAPS OCC controllers initiate pipeline shutdown. PS1, PS3, and PS4 were shutdown in sequence, with PS4 idled at 2:58 pm.
	1455	Fairbanks EOC at APSC Fairbanks Business Unit opened for crisis management. Federal and state on-scene coordinators identified.
	1500	OCC contacted APSC System Engineering to verify exact leak location.
	1520	Fairbanks DEC staff notified of the release.
	1520	Security patrols dispatched from Fairbanks and PS6 to set up check-points South and North of the spill site to keep personnel (APSC and third party out of harm's way) until the suspect is apprehended and the area cleared.

	1523	Closure of RGVs between PS4 and PS5 initiated.
	1630	Unified Command established.
	1700	Two APSC technicians arrive at RGV 65, but are held there until area can be cleared by APSC Security and Alaska State Troopers. Vacuum truck and fire truck at Livengood. On hold due to security concerns.
	1840	Suspect taken into custody by Alaska State Troopers.
	1848	DEC responders on scene.
	1900	Response crews released from checkpoints to respond to oil spill. Response crews and equipment gain access to site. Establish Site Safety Plan for highly hazardous environment – fire, personnel. Staging area set up; response tactics include building containment pits.
	1910	60-ton crane on way from Fairbanks.
	2120	Hydraulic repair clamp on site.
	2200-2300	60-ton crane on site.
	2245	FBI debriefs APSC Corporate Security at APSC's Fairbanks office.
Oct 5	0045	First containment cell completed (leading edge of the oil established).
	0056	Four vacuum trucks on scene.
	0001-0130	Response/recovery crews identified leading edge of oil spill, established collection basins and contained the leading edge of the spill. The oil did not advance beyond this point.
	0300	Steese Volunteer Fire Department on site at CKV 66 – adjacent to leak site. PS7 fire truck and ambulance at RGV 65 staging area.
	0335	Oil recovery begins (initiated pumping of oil to vacuum truck).
	0500	Fire trucks and ambulance on site.
	0745	Pump around is up and running at RGV 65. This was set up to help relieve oil flow and pressure from the bullet puncture.
	0845	Additional response crews and equipment continue to arrive. 8,400 gallons of recovered oil delivered to PS7.
	1145	DEC informs Governor's Office that spill is contained.
	1400	Response crews are recovering spilled oil at a rate equal to or greater than the continuing discharge rate from the pipeline. This stabilizes the environmental threat.

	1445	Williams fire crew on site. This was a critical element in the overall safety approach to the spill response. Focus is on the people preparing to conduct the repair of the pipeline. The Williams crew is highly experienced in high-pressure oil fires. The fire crew assessed the repair and fire safety plan, proceeded with pipe insulation removal, then rested for the clamp procedure.
	2130	Crane positioned to install hydraulic clamp.
Oct 6	0040	Determination that crane needs to be repositioned (not enough reach on the crane to install the clamp.)
	0235	Pipeline Hydraulic Clamp successfully put in place. Leak rate from 160 gallons/hour to less than .5 gallon/hour. 43,975 gallons of oil recovered.
		During the day, the eastside of the pipeline (away from the spill area) was walked and examined from Manley Hot Springs Road Crossing PLMP 395 to PLMP 405.5.
	1700	Drilling started for permanent repair process.
	1740	Permanent repair begins with the removal of the hydraulic clamp.
	1835	Hole in pipeline is plugged with threaded O-ring pipe plug (TOR).
	2300	Seal welding of TOR and inspection complete. This completed permanent repair of the pipeline.
Oct 7	0324	TAPS restart initiated with start of mainline pump at PS1.
	0630	88,541 gallons of oil recovered.
	0700	North Slope operations resumed full production.
	0735	Pipeline fully operational. TAPS mainline startup completed with start up of mainline pump at PS12.
	0900	Williams and PetroStar refineries in North Pole returned to normal supply of crude oil.
	End of Day	Pipeline reaches approximately 800,000 barrels per day (bpd) (pre-spill average was 927,000 bpd)
Oct 8		Pipeline throughput exceeds 1,000,000 bpd. Spill estimate 6,800 barrels (285,600 gallons); 2,108 barrels (88,541 gallons) of oil recovered.

Oct 10		The UC declared spill response activities to date satisfactory, approved scope and details of on-going clean up plan and approved draft environmental remediation plan. Determined special processes of UC no longer required. ICS discontinued at 1800 and transitioned to project management. 3,095 barrels (130,000 gallons) of oil recovered.
Oct 18	1830	Four additional bullet strikes discovered near MP 400, approximately one mile north of the incident. Bullet strikes penetrated the outer insulation jacket and caused sufficient damage to the pipe wall to require repair.
Oct 19		Both sides of the pipeline walked and re-examined from MP 395 to PS7 MP 414. Two sleeves were applied to repair the damage from the additional four bullet strikes discovered on October 18. The pipeline was not shut down.
Oct 20		Both sides of pipeline walked and re-examined from CKV 63 (MP 432) to Livengood (MP 397).
Oct 21		APSC crews have recovered and re-injected a total of 171,234 gallons of crude oil into the pipeline at PS7. The recovered fluids are primarily crude oil but may include water from the permafrost melt and snowmelt.
Oct 28		APSC crews have recovered and re-injected a total of 174,452 gallons of crude oil into the pipeline at PS7. Crude oil recovery rates have decreased significantly due to diminishing amounts of free oil and decreasing ambient temperatures with the onset of winter in Interior Alaska.
Jan 4		A total of 175,749 gallons of liquids (primarily crude oil) has been recovered from the spill site. All trees that were heavily oiled and those trees whose roots were affected by subsurface oiling have been removed and stacked on site.
Jan 9		APSC remobilized for the cleanup phase beginning this date.

For additional information on the status of the cleanup operation, visit the ADEC website at:

http://www.state.ak.us/dec/dspar/perp/011004301/index.htm

Appendix B: List of Acronyms

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
ADPS	Alaska Department of Public Safety
ADOL	Alaska Department of Labor and Workforce Development
AKOSH	Alaska Department of Labor and Workforce Development Occupational Safety and Health
ADOTPF	Alaska Department of Transportation and Public Facilities, also DOTPF
AO	Authorized Officer (BLM)
APSC	Alyeska Pipeline Service Company
AS	Alaska Statute
ATV	All Terrain Vehicle
BAT	Best Available Technology
BBL	Barrels
BPD	Barrels per day
BPH	Barrels per hour
CFR	Code of Federal Regulations
Cplan	Contingency Plan, also CP
CS	Containment Site
CV	Check Valve (TAPS), also CKV
DOI-BLM	U.S. Department of the Interior, Bureau of Land Management
DOT-OPS	U.S. Department of Transportation, Office of Pipeline Safety
EC	Emergency Controls
EOC	Emergency Operations Center
EPA	U.S. Environmental Protection Agency
FBI	Federal Bureau of Investigation
FEOC	Fairbanks Emergency Operations Center (APSC)
FOSC	Federal On-Scene Coordinator (EPA)
GPM	Gallons Per Minute
HAZWOPER	Hazardous Waste Operations and Emergency Response
IAP	Incident Action Plan

ICS	Incident Command System
IMT	Incident Management Team
JIC	Joint Information Center
JPO	Joint Pipeline Office
LEFM	Leading Edge Flow Meter
LEL	Lower Explosive Limits
LVB	Line Volume Balance
MP	Milepost (TAPS)
OCC	Operations Control Center
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
PLMP	Pipeline Milepost
PPE	Personal Protective Equipment
PS	Pump Station (TAPS)
PSI	Pounds per Square Inch
RCM	Reliability Centered Maintenance
RGV	Remote Gate Valve
RMROL	Realistic Maximum Response Operating Limitations
RP	Responsible Party
SERVS	Ship Escort Response Vessel System (APSC)
SFM	State Fire Marshal's Office (ADPS)
SOSC	State On-Scene Coordinator (ADEC)
SPC	State Pipeline Coordinator (ADNR)
TAPS	Trans-Alaska Pipeline System
TLV	Threshold Limit Value
TOR	Threaded O-Ring plug
TVB	Transient Volume Balance
UC	Unified Command