Bureau of Land Management

Comprehensive Monitoring Program Report
Selected Portions of TAPS Maintenance Program

June 2007

Bureau of Land Management
411 West 4th Avenue
Anchorage, Alaska 99501
(907) 257-1300

20070612-5

Our Message to Stakeholders

TAPS and BLM

The Trans-Alaska Pipeline System (TAPS) transports nearly 19 percent of the nation's domestically produced crude oil through the unique and fragile environment of Alaska. TAPS is critical to the nation's economy and security. Revenues and investment income from crude oil transported by TAPS account for 80 percent of the State of Alaska's general fund. Since start up in 1977, TAPS has safely transported more than 13 billion barrels of crude oil from Prudhoe Bay to Valdez.

BLM's Comprehensive Monitoring Program

BLM's vision is: ***To work proactively with the oil and gas industry in Alaska to achieve safe operation, environmental protection, and continued transportation of oil and gas in compliance with legal requirements.*** The BLM Comprehensive Monitoring Program (CMP) is intended to influence continuous improvement in Alyeska Pipeline Service Company's management of TAPS construction, operations and maintenance activities. The BLM CMP process is focused on problem prevention rather than reaction, emergency response, and damage control.

CMP reports periodically communicate to BLM stakeholders summaries of past monitoring efforts. The reports revisit critical TAPS audit deficiencies; incorporate concerns raised by TAPS employees and outside interest groups; address high risk activities; verify compliance with laws, regulations, permit conditions, and Grant/Lease stipulations; verify compliance with important internal Alyeska controls such as the quality, safety and environmental programs; and evaluate causal factors and trends related to recent TAPS incidents. Reports have previously covered one of twelve CMP functional topics:

- Alaska Native Employment & Training
- Configuration Management
- Employee Concerns Program
- Equal Employment Opportunity
- Quality
- ***Maintenance***
- Safety
- Project Design
- Project Performance
- Environmental Protection
- Risk Management
- Operations

About This Report

The BLM is pleased to present selected portions of *TAPS Maintenance Program for 2007* to our stakeholders. While the operation of TAPS will never be risk-free, BLM oversight helps minimize environmental risks, maximize compliance with worker safety and pipeline integrity standards, and improve maintenance performance.

Nolan Heath

for **Jerry Brossia**
Authorized Officer

Table of Contents

Our Message to Stakeholders

Executive Summary 4

Chapter 1 **Introduction and Purpose** 6

Chapter 2 **Federal Grant of Right-of-Way Compliance** 6
1.18 Surveillance and Maintenance 6
1.21 Conduct of Operations 7
2.4 Erosion Control 7

Technical Stipulations 7
3.5 Slope Stability 7
3.9 Construction and Operation .....

Chapter 3 **Background and History** 7
Monitoring Maintenance Compliance 7
History of Valve Maintenance and Testing Programs 8

Chapter 4 **Methodology and Scope** 8

Chapter 5 **Results and Discussion** 9

Chapter 6 **Conclusion** 25

Chapter 7 **Future Work** 26

Executive Summary

The Comprehensive Monitoring Program (CMP) report, *TAPS Maintenance Program 2007* is the 4th cycle at CMP reporting, and the fourth to evaluate maintenance performance of the Trans-Alaska Pipeline System (TAPS). The status of five maintenance topics is addressed:

1) preventive and workpad maintenance,
2) electrical systems,
3) Reliability Centered Maintenance (RCM),
4) deferred maintenance, and
5) mainline valves.

The performance of most TAPS maintenance areas BLM evaluated has either improved or remained the same since 2000. Planning, preparation, and execution of mainline valve repair projects achieved a high standard of performance.

BLM's study of the five maintenance areas included six stipulations of the Grant. The aspects of noncompliance contained in this report vary in significance and should be put in perspective. Some aspects of noncompliance have previously existed on TAPS and have been corrected by Alyeska.

Principal Observations and Conclusions about TAPS Maintenance

- **All stipulations monitored and analyzed by BLM were found in compliance. However BLM identified areas of concern in slope stability, and Reliability Centered Maintenance. Alyeska has efforts underway to address each issue. BLM will verify completed corrections.**

- **During a pipeline startup on July 8, 2005 Alyeska discovered the Remote Gate Valve (RGV) 32 achieved a closed position ahead of RGV-33 which left a pressure of 443 psi behind RGV-32 with a slack line condition downstream of RGV-32. Opening of RGV-32 at the startup caused an inrush of upstream oil flowing into the downstream slack line causing the pipeline to move several inches. Alyeska adapted a temporary operating procedure to reduce the risk of future pipe movement in this segment. Strategic Reconfiguration Automation and Control Systems have mitigated this condition.**

- **Alyeska has met their commitments for the mainline valve testing and repair program. Planning, preparation and execution of mainline valve repair projects achieved a high standard of performance. Maintenance goals include:**

  1) Retesting of the mainline valves with known internal leak-through during the first seven year and fifteen year re-test cycles.

  2) Several RCM analyses are planned for 2007 including mainline backpressure control valves conducted by VMT and an evaluation of the pigging process and

valve sequencing used during Pump Station pig passage.

3) An evaluation of the design of check valve bonnet tape wrap for epoxy injection installed at CKV-68A to determine feasibility of applying this at other bonnet weep locations.

4) Retest of RGV's 37, 73, 95B, 98A, 103, 107, 108 and CKV's 64, 75, 78, 79, 84A and initiate quantitative leak through testing of associated 6" by-pass valves.

5) Accomplish a 36 hour maintenance shutdown currently scheduled for July 28 – 29, 2007. The work scope for this shutdown will be finalized in May.

- Review of Alyeska's annual slope stability monitoring report and a field oversight trip, identified several slope locations needing additional studies and are considered a priority. Consequently, it is concluded, that in order to be assured that these new slopes with high study priority by Alyeska are in compliance with Grant and Lease standards for Stipulation 3.5, Slope Stability, that Alyeska needs to finalize their liquefaction studies and report their final results and conclusions regarding any outstanding slopes subject to a high potential for liquefaction and a dynamic factor of safety less than 1.0 as the Grant and Lease Stipulation 3.5 requires.

- Alyeska met scheduled goals for the mainline valve program, including below ground valve investigations and the mainline valve maintenance review.

- Preventive maintenance work required by regulation was completed within required time frames, which was an improvement over previous reporting year's performance. However, BLM did discovered however there is a small back log of non-regulated preventive maintenance work orders most requiring a shutdown to perform.

- BLM incorporated issues from concerned TAPS workers into its monitoring. Two of the TAPS workers valve concerns were not validated after BLM's investigation. One concern involved mainline remote operated and check valves, another was the load testing and split ring adjustments of the above ground pipe. Theses concerns were not validated during the investigation by the BLM.

1.0 Introduction and Purpose

All CMP reports evaluate compliance with relevant regulations and the *Federal Agreement and Grant of Right-of-Way.* BLM's past CMP reports have covered pipeline system operations, environmental protection, worker safety, employee concerns, pipeline system projects, and Alaska Native employment and training. Renewal of the 30-year Federal Grant and State Lease for TAPS was renewed in January of 2004. Therefore, systematic monitoring of compliance is a central purpose of the CMP. The purpose of this report is to:

1) explain BLM's systematic monitoring approach to the oversight of pipeline system maintenance.

2) describe BLM's approach to monitoring pipeline system integrity concerns, and present the status of slope stability for areas of concern the pipeline traverses, such as the Squirrel Creek, Treasure Creek, Pump Station 11, and Klutina slopes.

3) communicate to the public and higher authorities about Alyeska's performance of maintaining the pipeline system, including preventative maintenance and valve systems; and performance maintaining the work pad, material sites, and slopes the pipeline traverses.

4) discuss Grant and Lease compliance issues identified through BLM monitoring of TAPS maintenance.

5) evaluate significant issues raised by TAPS workers.

2.0 Federal Grant and State Lease Compliance

1.18 *Surveillance and Maintenance*

Stipulation 1.18.1. This first stipulation requires the permittee to conduct a surveillance and maintenance program applicable to the sub arctic and arctic environment. It should be designed to (1) provide for public health and safety, (2) prevent damage to natural resources, (3) prevent erosion, and (4) maintain pipeline integrity.

Stipulation 1.18.3. This stipulation requires maintenance of complete and up-to-date records on pipeline system maintenance activities and specifically references modification of records. (Stipulation 1.18.3 was also noted in the previously released *CMP Operations* report as an area of noncompliance). BLM surveillances and Alyeska's quality assurance activities showed that modification records, including as-built drawings, were updated within required time frames. In addition, the work packages BLM reviewed were complete. BLM determined that the record keeping of civil maintenance tasks in Alyeska's system was adequate.

Stipulations 1.18.2 and 1.18.4. BLM plans to evaluate the second and fourth aspects, Stipulations 1.18.2 and 1.18.4, in future reports. Stipulation 1.18.2 requires a communication system that ensures the transmission of information necessary for the safe operation of the pipeline.

1.21 *Conduct of Operations*

Stipulation 1.21.1 requires the permittee to perform all TAPS operations in a safe and workmanlike manner to ensure the safety and integrity of TAPS, and always employ and maintain personnel and equipment sufficient for that purpose

2.4 Erosion Control

This stipulation has several elements that address the avoidance and minimization of erosion in and around the pipeline system and related facilities. In 2003 - 2006, BLM conducted surveillance and reviews of erosion and its resulting effects and documented those results in an Environmental CMP report.

Technical Stipulations

3.5 *Slope Stability*

This stipulation specifies that areas subject to mudflows, landslides, avalanches, rock falls, and other types of mass movements shall be avoided where practicable in locating the pipeline. Where it is not practicable, measures shall be taken to prevent the occurrence of or protect the pipeline against the effects of mass movements.

3.9 *Construction and Operation*

Stipulation 3.9.1. Compliance with Stipulation 3.9.1 requires that all construction, operation, maintenance, and termination activities in connection with TAPS shall be conducted so as to avoid or minimize thermal and other environmental changes; and to provide maximum protection for the public, fish and wildlife habitat. All working platforms, pads, fills and other surface modifications shall be planned and executed in such a way that any resulting degradation of permafrost will not jeopardize the pipeline foundations.

3.0 Background/History

Monitoring Maintenance Performance

This is BLM's fourth CMP report regarding TAPS maintenance. Before 1994, State and Federal oversight of TAPS focused on surface and subsurface protection, environmental issues, corrosion, oil spill contingency and land use permitting. BLM has significantly increased monitoring of the maintenance of the pipeline system. In response to identified deficiencies in the earlier CMP reports on TAPS, BLM expanded oversight to include maintenance of pipeline system hardware. BLM planned the first evaluation of TAPS maintenance in late 1996, began initial field work in 1997, and has continued monitoring pipeline system maintenance throughout the period from 2003 - 2006.

History of the TAPS Valve Maintenance and Testing Programs. Until 1996, the key objective of Alyeska's maintenance for remote gate valves was to keep the valves operating and functional. This means mainline valves would open and close on command when controlled either manually or from the Operations Control Center at the Valdez Marine Terminal. In 1996, Alyeska conducted a review of their mainline valve maintenance program. The review determined

improvement was needed in valve preventive maintenance, inspection, operational testing, and personnel training. Several things needed to be done, including 1) a risk assessment, 2) integrity testing of the valves, and 3) development of an aggressive valve sealing plan. After the review, Alyeska modified their valve maintenance program to evaluate the condition of TAPS mainline valves. In 1998, Alyeska developed an overall TAPS valve maintenance management plan. The intent of this maintenance program was to inspect and test valve operation, including sealing capabilities and operation of valve actuators, with the goal of ensuring reliable operation of valves.

Alyeska began testing the performance of mainline valves in 1996. They confirmed Remote Gate Valve 60 would not seal completely when it closed. Information from performing winterization maintenance suggested the problem might not be limited to Remote Gate Valve 60. Corrective maintenance procedures were attempted, including sealants to the seat surface through internal passages designed for this purpose. This failed to mitigate the sealing problems. Four agencies entered into a memorandum of agreement with Alyeska, referred to as the *Valve MOA,* which established a valve testing program to determine the sealing performance of mainline valves and require as necessary interim oil spill contingency plans. Valve testing identified two valves, Remote Gate Valve 80, and Check Valve 122 that had a greater leak-through rate and lower performance than Remote Gate Valve 60. In 1998, Remote Gate Valve 80 was replaced and Check Valve 122 was repaired in place. Since then RGV's 39 and 60 and Check Valve 109 have been replaced. Additional testing did identify valves with some leak through, but the performance degradation was so slight they are not candidates for repair and replacement at this time.

4.0 Methodology and Scope

The scope of this report includes BLM oversight of TAPS maintenance from October 2003 through October 2006. BLM conducted surveillances and assessments to evaluate selected portions of Alyeska Pipeline Service Company's maintenance program and formed conclusions based on the assessments. This report focuses on activities integral to the maintenance of TAPS: preventive, mainline valve, work pad civil maintenance and surveillance, slope stability, and Reliability Centered Maintenance. This report explains the issues, describes their status, and discusses compliance with the *Federal Agreement and Grant of Right-of-Way.* BLM evaluated these elements to determine whether Alyeska's maintenance activities were conducted with:

- minimum environmental impact;
- conformance to employee safety standards;
- protection of pipeline system integrity;
- compliance with the *Federal Agreement and Grant of Right-of-Way;*
- conformance with all the approved maintenance plans and the required documentation of maintenance.

The scope for the portions of the TAPS maintenance program BLM evaluated are laid out in more detail below.

Preventive Maintenance. In 1997, BLM completed surveillances of selected preventive maintenance areas and identified areas of concern. BLM examined the areas of concern again between 2003 and 2006, which included required regulatory and mandatory preventive maintenance tasks. BLM reviewed samples of 2006 records to verify whether required preventive maintenance was completed in a timely manner.

Mainline Valve Maintenance. During the time frame covered by this report, BLM reviewed mainline valve maintenance along TAPS including the TAPS Valve Management Maintenance Plan Annual Reports.

Workpad Maintenance. Between 2003 and 2006 BLM conducted surveillances of Alyeska's surveillance, monitoring and maintenance of the workpad and identified areas of concern that involved the workpad and above ground mainline conditions. BLM has developed an Aerial Surveillance program that identifies possible areas of concern which are then verified by ground surveillance. BLM will look at these areas of concern again in 2007.

Reliability Centered Maintenance. The Joint Pipeline Office, conducted surveillances to verify 176 Reliability Centered Maintenance2 (RCM2) failure mode recommended tasks on the Trans Alaska Pipeline System (TAPS) in 2003/2004 per a Memorandum of Agreement dated June 27, 2002. After evaluating the results of the surveillances, the BLM was unable to independently substantiate that Alyeska is completing the RCM2 program failure mode recommended tasks on TAPS.

Slope Maintenance. The Joint Pipeline Office, conducted surveillances to verify 176 Reliability Centered Maintenance2 (RCM2) failure mode recommended tasks on the Trans Alaska Pipeline System (TAPS) in 2003/2004 per a Memorandum of Agreement dated June 27, 2002. After evaluating the results of the surveillances, the BLM was unable to independently substantiate that Alyeska is completing the RCM2 program failure mode recommended tasks on TAPS.

5.0 Results and Discussion

TAPS Preventive Maintenance

- BLM's review of the implementation of the Reliability Centered Maintenance involved the Fairbanks Field Station conducting surveillances to verify 123 Reliability Centered Maintenance2 (RCM2) failure mode recommended tasks on the Trans Alaska Pipeline System (TAPS) in 2003/2004 per a Memorandum of Agreement dated June 27, 2002. After evaluating the results of the surveillances, the BLM was unable to independently substantiate that Alyeska is completing the RCM2 program failure mode recommended tasks on TAPS. The Valdez Field Station also accomplished verifications of 53 RCM2 failure mode recommended tasks on TAPS in 2003/2004. After evaluation of the representative sample of failure modes verified for this assessment, the BLM was unable to independently substantiate that Alyeska was completing RCM recommended Failure Mode Tasks on the Valdez Marine Terminal (VMT).

- Preventive maintenance work required by regulation was completed within required time frames which was an improvement over 2000-2003 performance.

- Preventive maintenance tasks which are not regulatory or mandatory, but are important in protecting pipeline safety and integrity were found to be seldom overdue and backlogged. Alyeska reported that 98% of these preventive maintenance tasks were completed within 60 days of the original due date, eliminating the concern they weren't being performed.

Reliability Centered Maintenance.
Reliability Centered Maintenance was discussed in the BLM CMP reports "TAPS Maintenance Report 1999/2000 and TAPS Maintenance and Sustained Useful Life January 2001 – May 2002". Alyeska determined maintenance activities for newly installed or existing systems and equipment on TAPS in accordance with a structured, comprehensive and industry recognized methodology, and on an ongoing basis the subjects for such determinations were identified and prioritized by Alyeska staff consistent with the intent and terms of the ROW Grant and ROW Lease

BLM interfaced with Alyeska Reliability Engineers to determine if the RCM2 Failure Modes were in the Alyeska Action Tracking System to monitor current status. The Alyeska Engineer provided the BLM with information from the Alyeska Action Tracking System about whether failure mode recommended tasks assignments were in progress or incorporated into a work order or procedure. All of the failure mode recommended tasks for this assessment were in the Alyeska Action Tracking System.

The Alyeska Passport work management system provides information for maintenance activities in the work order process. The model work orders contain specific maintenance procedures or reference specific Alyeska procedures (i.e., Safe Maintenance Procedures).

The model work orders generate preventative maintenance work orders that assign maintenance tasks to be completed by Alyeska on a regular frequency. The BLM used the work order numbers provided by the Action Tracking System and tracked the work orders to the Alyeska Passport System where the procedure numbers are referenced. The work orders, referenced procedures and field visits were used to accomplish the RCM2 failure mode recommended task verifications.

Alyeska has committed to implementing an Equipment Maintenance Strategy applicable to all equipment or operating systems. Reliability centered maintenance determines what maintenance is necessary by applying the following seven questions:

1. What are the functions and associated performance standards of the asset in its present operating context (function)?
2. In what ways does it fail to fulfill its function (functional failures)?
3. What causes each functional failure (failure mode)?
4. What happens when each failure occurs (failure effects)?
5. In what ways does each failure matter (failure consequences)?
6. What can be done to predict or prevent each failure (proactive tasks and task intervals)?
7. What should be done if suitable proactive task cannot be found (default actions)?

Alyeska maintenance system manual was updated to indicate how Alyeska would meet implementation of RCM stating in part that:

"Operations Engineers will review and approve preventative maintenance change requests and develop new PM's per the RCM study results".

ALYESKA Manual (Preventive Maintenance (PM) Change/New PM Process states the Operations and Maintenance Engineer will process related PM change input per Equipment Maintenance Strategy EMS and states in part that:

"A PM activity that is a result of an RCM Analysis shall be identified in the PM system".

As Alyeska proceeded with implementation of the RCM2 methodology the BLM conducted periodic checks to validate accomplishments of the tasks prescribed to address the failure modes identified as having hidden, safety or environmental consequences. These checks were documented by BLM on surveillance reports for tracking of the maintenance implementation in a quantifiable manner.

The RCM2 oversight strategy implemented by the BLM was to select a small sample of the total identified failure modes using a stratified random sample technique. The sampling process assured that the BLM was able to represent the overall population of the identified failure modes including failure modes within all systems analyzed through the RCM2 process.

Alyeska provided the BLM a monthly RCM2 failure mode analyses report related to all failure modes that had hidden, safety, or environmental consequences for all RCM2 analyses completed on TAPS to date. The BLM verified the completion of the RCM2 failure mode recommended tasks independent of the information provided by ALYESKA in the monthly RCM2 failure mode analyses report.

The BLM Fairbanks Field Station accomplished verifications of 123 RCM2 failure mode recommended tasks on TAPS.

Of the verifications accomplished 86 revealed one or more of the following:

- there was no direct link between the Alyeska procedures and work orders in that the recommended tasks for the failure modes were not listed as activities to be completed in the procedures or on work orders.

- the recommended tasks were in progress with need dates in the passport action tracking system after the dates the BLM verification was accomplished.

- in 11 cases the specific recommended task associated with an RCM2 failure mode was not cited in the procedure; however, the BLM verified that the procedure referenced all accessible components of the recommended task and noted on the surveillance report that the task was completed. There was still no direct connection between the RCM2 failure mode and the maintenance activity.

The disconnect found by BLM is that Alyeska procedures and/or model work orders for the RCM2 recommended tasks didn't list the failure mode or specific recommended task as an activity to complete.

Based on the results of the APSC audit of the RCM2 process and implementation on TAPS, the BLM determine to continue monitoring completion of the RCM2 failure mode recommended tasks through the oversight program.

Successful implementation of the RCM2 recommended tasks required careful attention that derived tasks are described in enough detail to ensure that the accomplishment of the task will be documented correctly. Updating of current and future maintenance activities to include the RCM2 failure mode code and recommended tasks in detail would provide a link between the recommended task and completion ensuring any work arising from the tasks is dealt with appropriately. A Preventative Maintenance activity that is a result of an RCM 2 Analysis shall be identified in the Preventative Maintenance system.

Alyeska conducted an assessment in 2004 to evaluate whether the company was resolving issues identified in the RCM studies that were conducted as part of the Right of Way renewal process. The assessment identified 422 hidden, safety, or environmental action items from the RCM studies. Alyeska has closed all 422 items and BLM will monitor to ensure satisfactory implementation.

In Valdez 5 action items of the 3951 action request identified by the assessment are left to complete scheduled to complete by the end of 2007.

The Pipeline has 24 open action items of the over 800 items identified in the assessment. Progress is steady and will complete by the end of 2007.

Alyeska has committed to report annually to the BLM on the status of all RCM studies by January 31st of each year.

TAPS Preventive and Deferred Maintenance. Preventive maintenance is the service, inspection, and performance of function checks of the pipeline system on a scheduled basis. It is intended to prolong equipment life and avoid in-service failure. Some areas of preventive maintenance are mandatory and are required to be performed on a specific schedule set by State or Federal regulatory agencies.

BLM began monitoring preventive maintenance in late 1996 after reviewing Alyeska trending reports which cited preventive maintenance backlogs. BLM's initial assessment focused on those TAPS preventive maintenance tasks required by regulation. Alyeska's preventive maintenance records reside in their electronic tracking system which generates work orders for preventive maintenance tasks. When work orders are generated, each has a required due date for completion of the preventive maintenance task.

Alyeska's Scheduling and Tracking of Preventive Maintenance Tasks

Alyeska categorizes maintenance tasks and assigns each category a level of importance, using codes in the electronic data base Alyeska currently uses to track TAPS maintenance work. Preventive maintenance tasks are grouped by priority codes:

Priority 01 - *Emergency work*...requires immediate action.
Priority 02 - *Reactive work*... not known, or not scheduled fourteen days in advance of implementation date.
Priority 03 - Non-*deferrable preventive maintenance tasks*... regulatory and mandatory preventive maintenance tasks that may not be deferred.
Priority 04 - *Routine preventive maintenance tasks*... routine tasks that are not regulatory driven, and may be deferred.
Priority 05 - *Lowest priority preventive maintenance tasks*... these may be deferred.

Priority 03 PM Tasks. Required preventive maintenance work orders are categorized as *Priority 03*. A review of *Priority 03* preventive maintenance items revealed they were completed within required time frames, except those that could not be completed without TAPS being shut down. This was in alignment with past performance for completion of *Priority 03* preventive maintenance tasks.

Priority 04 PM Tasks. BLM also reviewed *Priority 04* preventive maintenance tasks. These tasks are not regulatory or mandatory, but are important to safety and integrity of the pipeline. An Alyeska query to obtain information for BLM revealed 134 tasks were overdue for *Priority 04* preventive maintenance line-wide. 98% of *Priority 04* preventive maintenance tasks were being completed within 60 days of the original due date.

TAPS Mainline Valve Maintenance

- Alyeska has met their commitments for the mainline valve testing and repair program. Planning, preparation, and execution of mainline valve repair projects achieved a high standard of performance. Maintenance goals include

  - Mainline valve sealing performance for all critical valves is now known or determinate for the first time since construction. The performance of all mainline valves has been determined, retesting of the mainline valves with known internal leak-through has begun for the first seven year cycle and will continue with the fifteen year re-test cycles.

The TAPS Mainline Valve Maintenance Program

What's the Purpose and Function of the Valves Along TAPS?
The Trans-Alaska Pipeline System includes a number of valves that can isolate sections of pipeline in the event of a leak. Properly operating valves are important elements in pipeline oil spill prevention and response. Mainline Ablock valves are positioned at strategic locations along the main pipeline to block the flow of oil and isolate sections of the pipeline. A total of 179 mainline block valves are situated along TAPS to control and block the flow of oil when necessary. The mainline system includes 86 check valves and 96 gate valves, of which 86 are above ground and 91 are below ground. The remote gate valves require communication from the pipeline controllers in Valdez to close or open and can stop pipeline flow in both directions. Check valves operate one way and prevent the reverse flow of oil. They are designed to be held open, either mechanically or by flowing oil and to drop closed automatically when oil flow stops or is reversed.

The Importance of Valve Maintenance
Valves must be maintained to, minimize and limit potential spills, provide overpressure protection, and isolate sections of the pipeline. Alyeska developed a valve maintenance program consisting of testing and evaluating valves and making any necessary repairs or replacements. The primary objective of the mainline valve maintenance and testing programs is to assure the sealing capability of TAPS mainline valves, by testing and repairing all valves as necessary. Repair options consist of removing and replacing the entire valve, repairing or rebuilding the valve in place, or using sealing agents to re-establish the seal. Valve sealing standards are necessary because valves may lose their ability to seal over time. Minimum valve sealing performance standards are unique for each block valve depending on the valve's location along the pipeline.

Until 1996, the key objective of Alyeska's maintenance for remote gate valves was to keep the valves operating and functional. This means mainline valves would open and close on command when controlled either manually or from the Operations Control Center at the Valdez Marine Terminal. In 1996, Alyeska conducted a review of their mainline valve maintenance program. The review determined improvement was needed in valve preventive maintenance, inspection, operational testing, and personnel training. Several things needed to be done, including 1) a risk assessment, 2) integrity testing of the valves, and 3) development of an aggressive valve sealing plan. After the review, Alyeska modified their valve maintenance program to evaluate the condition of TAPS mainline valves. In 1998, Alyeska developed an overall TAPS valve maintenance management plan. The intent of this maintenance program was to inspect and test valve operation, including sealing capabilities and operation of valve actuators, with the goal of ensuring reliable operation of valves.

Alyeska began testing the performance of mainline valves in 1996. They confirmed Remote Gate Valve 60 would not seal completely when it closed. Information from performing winterization maintenance suggested the problem might not be limited to Remote Gate Valve 60. Corrective maintenance procedures were attempted, including sealants to the seat surface through internal passages designed for this purpose. This failed to mitigate the sealing problems. Four agencies entered into a memorandum of agreement with Alyeska, referred to as the *Valve MOA,* which established a valve testing program to determine the sealing performance of mainline valves and require as necessary interim oil spill contingency plans. Valve testing identified two valves, Remote Gate Valve 80, and Check Valve 122 that had a greater leak-through rate and lower performance than Remote Gate Valve 60. In 1998, Remote Gate Valve 80 was replaced and Check Valve 122 was repaired in place. Since then RGV's 39 and 60 and Check Valve 109 have been replaced. Additional testing did identify valves with some leak through, but the performance degradation was so slight they are not candidates for repair and replacement at this time.

Why Is It Important to Winterize Mainline Valves?
The purpose of winterization maintenance on remote gate valves is to inhibit internal corrosion. During this maintenance procedure, water is drained from the valve body and glycol, an antifreeze solution, is pumped in. When internal valve seals perform properly, the contents of the valve body can be drained without the loss of oil from the pipeline. If an internal seal does not perform properly, oil can flow directly into the valve body.

Annual Winterization Finds Valve Problems
During their annual winterization maintenance, Alyeska notes that many mainline gate valves have internal sealing problems. More than half of the remote gate valves showed pressure in the valve body during

winterization and testing, which suggested possible internal seal leakage. Alyeska has defined actual operating performance of all mainline valves which is annotated in the TAPS Valve Maintenance Management Plan annual reports.

The valve maintenance program and the mainline valve testing program are subsets of the overall TAPS valve program. The development of the TAPS valve program which integrated elements of the TAPS quality program, maintenance program, configuration management, operations and documentation was a landmark effort for Alyeska. Within Alyeska, different disciplines with different perspectives provide tools and linkages between programs and disciplines to address hardware issues or operations issues in a more comprehensive manner. Alyeska met their goals and commitments with the high priority, high visibility items related to valve maintenance, tests of mainline valve performance with respect to leak through, repairing Check Valve 122, replacing CKV 109 and replacing Remote Gate Valves 39, 60, and 80. The preparation and execution of the valve repairs achieved a very high standard.

Mainline Valve Maintenance and Repair Projects

Each summer TAPS is shut down for extensive valve maintenance projects. In the past one mainline valve was repaired and four others were replaced. Alyeska estimated a down time of 30 to36 hours for each valve repair or replacement and in most cases restarted the pipeline in less time after valve work was completed. The planning, preparation and execution of the valve repair and replacement projects achieved a high standard.

Remote Gate Valves 39, 60 and 80 were removed from the mainline and replaced with refurbished gate valves. After Alyeska removed the valves from the pipeline system, the internal parts of the valves were inspected and extensive seat and gate damage was observed. The damage was most severe on the downstream side of the gate and seat. All Remote Gate Valves were successfully replaced ahead of schedule.

Check Valves 109 and 122 had experienced internal leak through of oil. Damage to the valve parts was minimal, and it is believed that the debris and sludge found at the bottom of the check valves was the reason why they had not sealed properly. Check Valve 122 was repaired in place by replacing the seat ring and clapper assembly, Check Valve 109 was replace with a refurbished Check Valve.

The BLM received a Concern in regards to the Trans Alaska Pipeline System (TAPS) Mainline Remote Operated Gate Valves (RGV) and Check Valves (CKV). The Joint Pipeline Office (BLM) investigated the complaint which consisted of multiple concerns. The BLM conducted several interviews regarding maintenance, preventative maintenance and testing of the mainline valves, and researched the TAPS Valve Maintenance Management Plan (TVMMP) reports.

Based on the BLM investigation of the concerns, the existing conditions did not support all of the concerns or require emergency action by the Joint Pipeline Office. Several observations did support additional follow-up by the BLM to validate compliance with the BLM approved design basis and criteria and the Federal Grant and State Lease.

TAPS Workpad Surveillance, Monitoring, and Maintenance

- Alyeska's maintenance records documented the workpad and above ground maintenance repairs.

- BLM has developed and implemented an Aerial Surveillance Program for the TAPS Right-of-Way. The BLM has accomplished 200 aerial surveillances of the ROW between 2003 and 2006 with no unsatisfactory conditions noted.

What Is the Purpose of the Workpad?

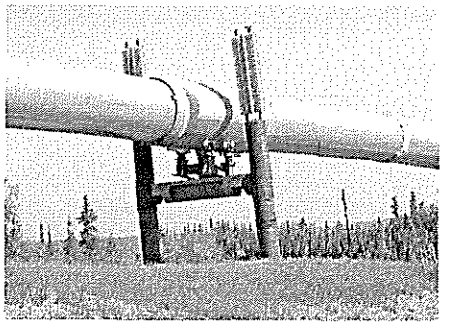
The workpad is the portion of the TAPS right-of-way which encompasses 1) the gravel fill on which the pipeline is located, 2) the travel lane adjacent to the pipeline, and 3) additional fill required for construction. The workpad was constructed to provide a traffic surface for access and work platforms for the heavy equipment required to install the pipe. It serves as the primary means of access for doing work and inspections to both prevent and respond to any oil or chemical spills on or near the workpad, pipeline, and supporting facilities. The workpad width varies, depending on the pipeline mode, terrain, and soil conditions. Maintaining the workpad is important to provide access to the pipeline system.

BLM conducted surveillances and assessments from 2003 - 2006 to determine whether Alyeska's work pad surveillance, monitoring and maintenance programs complied with the Grant and Lease. BLM conducted surveillances at the pump stations, reviewed the work pad and above ground mainline conditions, reviewed the annual line walk data from 2003 -2006, and reviewed right of way surveillance system records. The records BLM reviewed contained the necessary detail of workpad maintenance work Alyeska had completed. BLM found no problems with the record keeping of up-to-date workpad maintenance records and coordination of the project permitting process.

Up-To-Date Workpad Maintenance Records. Section 9 of the Grant and Lease requires Alyeska to maintain quality records of natural resource rehabilitation and tangible property repairs. Grant and Lease Stipulation 1.18 requires complete and up-to-date records on maintenance performed along the pipeline system. Some surveillances had documented actions taken but the results were inconsistent. Much of the work pad maintenance is done by Alyeska contractors using a blanket work order for each asset area. The maintenance coordinators provided descriptions of the task to be done under the blanket work order.

Project Permitting Process. Coordination of projects and permitting is an area where Alyeska has typically excelled. During the years of this CMP Alyeska did coordinate the permitting process with BLM and regulatory agencies during planning, scheduling and design of maintenance projects.

Good coordination and advance planning for the project permitting process is beneficial for Alyeska, BLM, and the regulatory agencies. Projects must be planned and scheduled with BLM and regulatory agencies to ensure both protection of pipeline integrity and the environment.



Slope Stability

Review of Alyeska's annual slope stability monitoring report and a field oversight trip, identified several slope locations requiring additional priority study on their part. Consequently, it is concluded, that in order to be assured that these new slopes with high study priority by Alyeska are in compliance with Grant and Lease standards for Stipulation 3.5, Slope Stability, that Alyeska needs to finalize their liquefaction studies and report their final results and conclusions regarding any outstanding slopes subject to a high potential for liquefaction and a dynamic factor of safety less than 1.0 as the Grant and Lease Stipulation 3.5 requires.

Alyeska's proactive geo-technical study program as part of their overall aboveground monitoring program addresses the intent of Stipulation 3.9 in terms of the prevention of degradation of permafrost due to the presence of the pipeline. Heat pipe operational research, monitoring and maintenance efforts have been instrumental in this regard. As a consequence these broad operational research, and geo-technical and aboveground monitoring efforts demonstrate compliance with Stipulation 1.18 concerning monitoring, surveillance and maintenance, Stipulation 3.5 on Slope Stability and Stipulation 3.9.1 regarding prevention of permafrost degradation.

BLM recommended that a letter be sent to Alyeska requesting updated slope stability evaluations and determinations of the static and dynamic factors of safety for the remaining high priority study slopes, B11, B13 and B14b by December 31, 2006. An updated BLM technical slope stability review will be conducted in 2007.

The Importance of Design Basis and Factors of Safety for Slope Stability

What is the Design Basis?
The design basis is a compilation of current engineering criteria for facilities within the Trans-Alaska Pipeline System (TAPS). These criteria determine the engineering standards for the facilities that comprise TAPS. Design basis standards represent quantitative and qualitative values for facilities and have been agreed upon by the TAPS owners, Alyeska Pipeline Service Company, and the Joint Pipeline Office. The design basis serves as a collection of technical standards and requirements for the purpose of construction, operation and maintenance of the pipeline system.

How is the Design Basis used for slope stability?
The pipeline traverses many slopes along its route. Some of these slopes are steep, and some have ice-rich soils or other soil conditions that make them susceptible to down slope movement. The TAPS design basis considers all slopes greater than 10% significant slopes. These slopes must be designed to withstand a Adesign contingency earthquake,≅ which is a rare earthquake of extreme magnitude which may occur at intervals of several hundred years. For *static* conditions, the calculated factor of safety for the slope must be at least 1.5. For *dynamic* conditions, the slope must be capable of resisting dynamic stresses with a factor of safety no less than 1.0, or total

slope movements no greater than 5 inches.

Is Alyeska working this issue aggressively?
The slope stability issues are being aggressively worked by both Alyeska and BLM. Nothing in this report should suggest lack of responsiveness by Alyeska. Rather, this report presents a Amid-course≅ status report of an actively, evolving technical evaluation.

2002 Results:

In May 2002, Alyeska responded to a BLM request for information identifying TAPS soils that might be thawing. Alyeska completed a comprehensive multi-year study identifying slopes with a high potential for liquefaction that might represent a hazard to TAPS. This led to substantial progress in Alyeska's geo-technical analysis and data gathering to identify new areas of concern based on improved understanding of areas with a potential for liquefaction, research on the role heat pipes have played and upgrading their maintenance, and a much improved aboveground geo-technical monitoring program.

The Phase I screening study was completed in 2002. This study identified slope areas requiring additional study and evaluation. It includes 21 slopes in the belowground pipeline and 129 slopes in the aboveground pipe support system. Final review of these locations resulted in 17 belowground and 82 aboveground areas where additional geo-technical information was necessary in order to further evaluate the slopes.

2003 Results:

Phase II in 2003 eliminated 67 % of the aboveground slopes of concern and 86 % of the belowground slopes of concern of the total of 150 slopes identified in 2002. The 2003 Phase II study concluded there were 41 slopes in the aboveground pipeline and 3 slopes in the belowground pipeline that required further analysis. Of these, 44 slopes remain a high potential for liquefaction, and 16 of these slopes are identified in the following table from the Alyeska 2003 report of Aboveground Monitoring Report as having a high potential as a liquefaction hazard to TAPS. Alyeska recommended follow-up study of the 44 slopes of interest.

High Priority Slopes *

Slope	Start MP	End MP	Priority
16	331.57	331.86	High
26	379.12	379.16	High
29	408.42	408.58	High
31a	411.39	411.58	High
31b	411.58	411.85	High
40	448.32	448.76	High
41a	450.19	450.67	High
41b	450.67	450.78	High
78	721.8	722.55	High
79	725.32	725.83	High
80	726.13	727.63	High

81	728.07	728.32	High
82	729.66	729.73	High
B11	752.45	752.47	High
B13	769.31	769.35	High
B14b	771.29	771.57	High

*Annual 2003 Aboveground Pipeline Monitoring Report

2004 Results:

Alyeska recommended for 2005 and 2006 a variety of civil monitoring and maintenance actions. Highlights of these recommendations include the following:

1. Fault Monitoring: (Denali Fault Crossing, GPS surveys of permanent benchmarks at major fault crossings, complete assessment of the Donnelly Dome Fault Crossing);
2. Slope Stability Monitoring: (MP-175,MP-241,MP-290,MP-392, and MP-696)
3. Inclinometer replacements in 2006 at five annual slope monitoring locations; thermistor strings, and instrumented heat pipe pressure transducers and instrumentation;
4. The 2002 results identified 1,192 slopes with liquefaction potential. Of these, only 11 remain with high liquefaction potential. Final assessment of these locations was completed in 2005 in the *Phase 2B Geohazard Report*; Target completion date is 3rd quarter of 2006;
5. Installation of XYZ survey monitoring points on the PS-11 Hill and Lost Creek Hill during 2005 and 2006;
6. Annual monitoring of Valdez Marine Terminal slope stability; and
7. Annual monitoring of facilities.

The extensive documentation compiled by the multi-year soils and liquefaction analysis studies will serve as a long-term baseline for future monitoring of potentially hazardous slopes and areas with high potential for soil liquefaction on TAPS. Upon completion of Alyeska's Soil Liquefaction study and in order to ensure the above high priority slopes and areas subject to high liquefaction potential are in compliance with the original design basis requirements and BLM interpretations of Stipulation 3.5, it would be advisable to determine the static and dynamic factors of safety for these slopes using Alyeska's new updated geo-technical information concerning these slopes.

Alyeska plans to complete the final study phase of the outstanding high priority slope locations with potential for liquefaction by the end of the 3rd quarter of 2006. Upon completion of the *Geohazard Study, Phase 2b,* it will be self evident which slopes of the final group of 11 may need to have additional study to determine their factors of safety for a determination of their compliance with the standards of the Slope Stability Stipulation 3.5.

2005 Slope Stability Field Oversight Results:

An oversight survey of select slope stability monitoring locations was made during June 20-23, 2005 by Alyeska. The field sites visited ranged from the Worthington Glacier at the southernmost end of the pipeline to just north of PS 5. Forest fires and smoke in the PS 5 area limited travel to areas south of PS 5. The purpose of this oversight trip was to ensure Alyeska is

conducting its annual slope stability monitoring surveys and to observe those locations exhibiting symptoms of geotechnical problems affecting the aboveground pipe. The aboveground pipe system of TAPS is located in thaw unstable soils in contrast with the belowground pipe system which is located in thaw stable soil. The following are summaries of brief observations made at the sites visited along with representative photos taken of various geotechnical and aboveground pipe conditions.

Denali Fault Crossing:

Figure 1 is a view looking south from the southern boundary of the Denali Fault Zone. The trees south of this boundary do not exhibit any of the cracks and splits common to the trees within the Fault Zone. Post earthquake repairs were made to the aboveground pipe in this area.

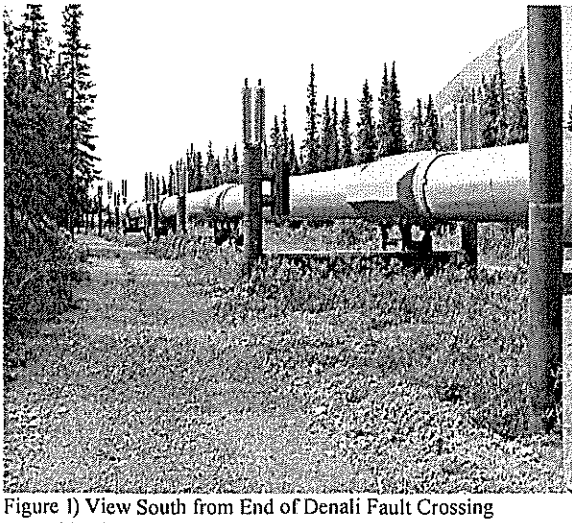


Figure 1) View South from End of Denali Fault Crossing

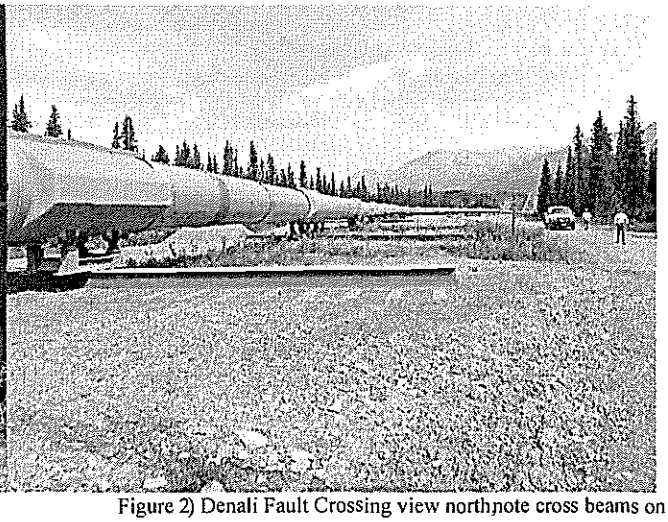


Figure 2) Denali Fault Crossing view northnote cross beams on ground level

Figure 2 shows the repaired pipe within the Fault Crossing area. The insulation package surrounding the aboveground pipe has been undergoing maintenance attention and repairs. Maintaining dry insulation around the pipe will help to ensure a maximum timeframe before any entrained water in the oil can freeze in various low point during potential lengthy winter shutdowns. Thus, insulation package maintenance is an important component of the aboveground pipe system and its integrity.

Review of Alyeska's annual slope stability monitoring report indicates they have identified several slope locations needing priority study on their part. Consequently, it is concluded in this report, that in order to be assured that these new slopes with high study priority by Alyeska are in compliance with Grant and Lease standards for Stipulation 3.5, Slope Stability, new static and dynamic factors of safety need to be determined based on Alyeska's latest geo-technical information concerning the high priority slopes and provided to BLM for our review.

With Alyeska's proactive geo-technical study program as part of their overall aboveground monitoring program address the intent of Stipulation 3.9 in terms of the prevention of degradation of permafrost due to the presence of the pipeline. Heat pipe operational research, monitoring and maintenance efforts have been instrumental in this regard. As a consequence

these broad operational research, and geo-technical and aboveground monitoring efforts demonstrate compliance with Stipulation 1.18 concerning monitoring, surveillance and maintenance, Stipulation 3.5 on Slope Stability and Stipulation 3.9.1 regarding prevention of permafrost degradation.

A letter was sent to Alyeska requesting updated slope stability evaluations and determinations of the static and dynamic factors of safety for the remaining high priority study slopes, B11, B13 and B14b by December 31, 2006. An updated BLM slope stability review will be conducted in 2007 to identify if any need to be analyzed for compliance with factors of safety according to the official interpretation of Stipulation 3.5.

The Importance of Slope Stability for TAPS

What Causes Slope Failure?
Slope failure is normally caused by a combination of factors, including slope angle, amount of soil moisture, and gravity. Although some slope failure is attributed to the amount of moisture the soil is able to hold before giving way, slope failures do occur with dry soil conditions on excessively steep slopes. In Alaska, an additional factor is permafrost which normally stabilizes frozen soils on steep slopes. When permafrost thaws on steep slopes, the soil becomes moisture-laden, less stable, and gravity moves it down slope. Another factor is seismic activity or a design contingency earthquake, which can induce slope failure in some areas under certain conditions.

Squirrel Creek and Pump Station 11 Slopes: Factors of Safety
Slope stability is an issue on the Squirrel Creek slopes because the calculated factors of safety are not in compliance with the design basis requirements of 1.5 for the static, and 1.0 for the dynamic factors of safety. The factor of safety is a measurement of the degree of safety on a slope. A safety factor of 1.0 means the natural forces pushing down slope equals the resisting forces. The Pump Station 11 slope *static* factor of safety is 1.3 and the *dynamic* factor of safety is less than 1.0, neither of which meets the design basis standard.

How Did BLM Approach the Slope Stability and Design Basis Issues?
The approach to evaluating the integrity of the Treasure Creek, Pump Station 11, Klutina, and the Squirrel Creek slopes was similar to how BLM studies other issues:

1) Determine whether the slopes and above ground pipe are safe.
2) Conduct detailed surveillance and assessment work to identify significant findings to be resolved.
3) Resolve findings using the risk assessment process.
4) Require the system to comply with the design basis or adjudicate engineering supported waivers or modifications.
5) Verify that corrective and preventive actions have been completed.

Aerial Surveillance Program

The BLM has developed and implemented an aerial surveillance program; the purpose of the program is to monitor the Permittees' common agent, Alyeska, to assure compliance with the *Agreement and Grant of Right-of-Way.* Aerial Surveillance is a method of obtaining Objective Evidence in support of the compliance monitoring effort. Areas determined by aerial surveillance to have probably concerns are followed-up by ground surveillance.

Employee Concerns Related to TAPS Maintenance

Valve Maintenance

This CMP documents the investigation results of an employee concern and the actions required to resolve any substantiated concerns.

Below is a listing of the concerns BLM received in regards to the TAPS Valve Maintenance Management Plan. The concern stated that the mainline valves on the pipeline are not in compliance with the Federal Grant and State Lease Stipulations and State or Federal Regulations in conjunction with the following:

► Over the years, the use of improper mainline valve seat seal lubricants has resulted in "Valve Sealer" being injected into the seats instead of "Valve Saver". This has left the seal galleys plugged with a sandstone-like substance and no way to rejuvenate the seals to stop or minimize the leak-by rate during a spill. During a prolonged shutdown situation this uncontrolled leak-by could also cause an over pressurization on the down stream section.

► Examples of pipeline check valves that do not function as designed are CKV 38, CKV 41, and CKV 109.

► The valve leak-by criteria and testing program developed by Alyeska and the BLM several years ago may be based on faulty assumptions. The entire program needs to be evaluated by an unbiased outside organization with appropriate credentials and expertise.

► Valves have not been re-tested to determine progressive and unacceptable leak-by rates/trends.

► 6" bypass valves have not been tested to determine if they have unacceptable leak by rates.

► Valve maintenance no adequate-PMs

► Valves removed from service have never been tested to determine the actual leak-by rate

as compared to the ASSUMED leak-by rate. This could have been done with a "prover" skid and varying pressures to check the removed valves leak rates. This would enable Alyeska to determine if their leak-by assumptions are true.

► Many of the 6" bypass valves on the 48" mainline valves leak and may prevent the use of a "pump around skid" to limit the amount of oil that could leak from the pipeline during an oil spill.

► This issue is directly related to oil spill volumes, over pressuring of the pipeline, techniques to pump oil around a valve, or mitigation methods. The issue is also directly related to ADEC regulations that require procedures to stop the discharge at its source.

► The majority of valves installed on the mainline pipe were installed to limit the amount of oil that could be spilled. A few valves were replaced as a result of testing that identified unacceptable leak-by because the valve could not seal. Baseline leak-by test data was collected on all valves, many as long as 6-7 years ago. An unknown number of mainline valves may need to be replaced now or in the future according to corrosion trending curve analysis.

► There is an <u>indeterminate</u> knowledge of the leak-by condition of the 48" mainline valves and also their 6" by-pass valves that would be used for source control and/or prevention of an oil spill.

► The present OSCP plan does not provide adequate source control tactics, equipment, procedures and trained personnel to limit the volume of oil that could leak from the pipeline.

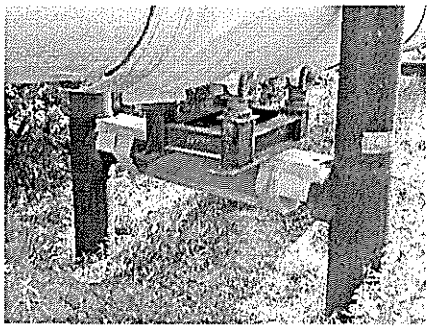
► In order to prevent or mitigate a spill, the OSCP relies upon the ability of the mainline valves to operate as intended. As a result of historical problems with the maintenance of the mainline and 6" bypass valves, along with continual corrosion, the actual condition of the valves is unknown. The majority of all mainline valves have been tested only once to determine the leak-by rate. This one test (data point) is not adequate to determine the current condition or degraded trends.

► Alyeska should reschedule re-testing of <u>all mainline valves and each 6" bypass valves</u> (on mainline valves) to ensure that they can be used with "Pump Around: skids during the critical periods of an oil spill. This will help to keep oil in the pipeline during a spill and/or limit the amount of oil that could leak out. The results should be compared to the baseline data to revise acceptable leak-by rates. Currently only one of the by-pass valves is kept open and both are changed and car sealed. If the closed by-pass valve has an unacceptable leak-rate this could contribute to an over pressurization of the downstream section.

1. Include pump around skids in the OSCP and identify them as spill source control equipment.
2. Test all 6" by-pass valves to determine the condition and leak-by rates.
3. Install hot tap fittings for pressure gages on all 6" bypass lines
4. Develop procedures for the pump around and/or storage for source control task at each valve.

5. Develop site specific safety plan for the pump around task
6. Determine site accessibility during all seasons for the pump around skid and all necessary support equipment
7. Ensure that all self contained and fully functional portable pump around skids are in place and strategically placed along the pipeline.
8. Train adequate numbers of response personnel in the pump around task

Based on the BLM investigation of the concerns, the existing conditions did not support all of the concerns or require emergency action by the Joint Pipeline Office. Several observations did support additional follow-up by the BLM to validate compliance with the BLM approved design basis and criteria and the Federal Grant and State Lease.



Load Cell/Split Ring Maintenance

The BLM received an Alyeska Employee Concern in regards to the TAPS Above Ground Pipe. The concern stated that; the annual monitoring and maintenance (Load cell/Split ring) work on the above ground (A/G) pipe does not meet the requirements of the RCM analysis developed by Alyeska and the BLM.

The BLM has investigated the by conducting several interviews regarding maintenance and testing of the Load Cells and Split Rings, researched the TAPS, MP 166 yearly reports and made field visits.

Based on the BLM investigation of the concerns, the existing conditions did not support all of the concerns or require emergency action by the BLM. The BLM is continuing to monitor the RCM process for TAPS above ground pipe maintenance and preventative maintenance using the established BLM surveillance procedures.

BLM will continue to monitor the TAPS Above Ground Pipeline RCM implementation of recommended actions, maintenance work and preventative maintenance work using the established BLM surveillance procedures to ensure the implementation of all RCM recommended Tasks per Government Letter #2335, dated December 8, 2004 (RCM Implementation Plan).

6.0 Conclusion

All stipulations monitored and analyzed by BLM were found in compliance. However BLM identified areas of concern in slope stability, and Reliability Centered Maintenance. Alyeska has

efforts underway to address each issue. BLM will verify completed corrections.

During a pipeline startup on July 8, 2005 Alyeska discovered the Remote Gate Valve (RGV) 32 achieved a closed position ahead of RGV-33 which left a pressure of 443 psi behind RGV-32 with a slack line condition downstream of RGV-32. Opening of RGV-32 at the startup caused an inrush of upstream oil flowing into the downstream slack line causing the pipeline to move several inches. Alyeska adapted a temporary operating procedure to reduce the risk of future pipe movement in this segment. Strategic Reconfiguration Automation and Control Systems have mitigated this condition.

Alyeska has met their commitments for the mainline valve testing and repair program. Planning, preparation and execution of mainline valve repair projects achieved a high standard of performance. Maintenance goals include:

1) Retesting of the mainline valves with known internal leak-through during the first seven year and fifteen year re-test cycles.

2) Several RCM analyses are planned for 2007 including mainline backpressure control valves conducted by VMT and an evaluation of the pigging process and valve sequencing used during Pump Station pig passage.

3) An evaluation of the design of check valve bonnet tape wrap for epoxy injection installed at CKV-68A to determine feasibility of applying this at other bonnet weep locations.

4) Retest of RGV's 37, 73, 95B, 98A, 103, 107, 108 and CKV's 64, 75, 78, 79, 84A and initiate quantitative leak through testing of associated 6" by-pass valves.

5) Accomplish a 36 hour maintenance shutdown currently scheduled for July 28 – 29, 2007. The work scope for this shutdown will be finalized in May.

Review of Alyeska's annual slope stability monitoring report and a field oversight trip, identified several slope locations needing additional studies and are considered a priority. Consequently, it is concluded, that in order to be assured that these new slopes with high study priority by Alyeska are in compliance with Grant and Lease standards for Stipulation 3.5, Slope Stability, that Alyeska needs to finalize their liquefaction studies and report their final results and conclusions regarding any outstanding slopes subject to a high potential for liquefaction and a dynamic factor of safety less than 1.0 as the Grant and Lease Stipulation 3.5 requires.

Alyeska met scheduled goals for the mainline valve program, including below ground valve investigations and the mainline valve maintenance review.

Preventive maintenance work required by regulation was completed within required time frames, which was an improvement over previous reporting year's performance. However, BLM did discovered however there is a small back log of non-regulated preventive maintenance work orders most requiring a shutdown to perform.

BLM incorporated issues from concerned TAPS workers into its monitoring. Two of the TAPS workers valve concerns were not validated after BLM's investigation. One concern involved mainline remote operated and check valves, another was the load testing and split ring adjustments of the above ground pipe. Theses concerns were not validated during the investigation by the BLM.

BLM review of Alyeska's annual slope stability monitoring report and a field oversight trip, identified several slope locations requiring additional priority study on their part. Consequently, it is concluded, that in order to be assured that these new slopes with high study priority by Alyeska are in compliance with Grant and Lease standards for Stipulation 3.5, Slope Stability, that Alyeska needs to finalize their liquefaction studies and report their final results and conclusions regarding any outstanding slopes subject to a high potential for liquefaction and a dynamic factor of safety less than 1.0 as the Grant and Lease Stipulation 3.5 requires.

7.0 Future Work

BLM Oversight for 2007/2008

BLM will continue to closely monitor Alyeska's compliance with the stipulations of the Grant and Lease for TAPS maintenance performance. Future work plans include follow-up surveillances for maintenance tasks completed in 1998 and tasks planned for completion in 1999.

Grant and Lease Compliance

BLM will follow Alyeska's progress with elements of the stipulations included in the *Federal Agreement and Grant of Right-of-Way.*

Employee Concerns Related to Maintenance

BLM will follow up with surveillances in 2007/2008 to validate Alyeska's completion plan for the Reliability Centered Maintenance, TAPS valve program and the above ground split ring and load cell program.

Preventive Maintenance

BLM will continue to monitor the backlog of overdue preventive maintenance tasks and Priority 03 work orders. BLM will also continue to monitor the RCM process to ensure complete implementation within the committed time frames

Slope Stability

BLM will complete surveillances for other slopes along the TAPS corridor. Resulting conclusions will be based on Alyeska's 2003-2006 slope stability work plans for the problem areas evaluated.

BLM recognizes that Alyeska is currently working to stabilize slopes in problem areas. For example, Alyeska has filled depressions in the ground containing vertical support members on many of the slopes. In addition, they completed projects on the Pump Station 11, Squirrel Creek, and Tazlina slopes that centered and leveled the support shoes on the vertical support members. BLM will continue to monitor Alyeska's progress on these

sites and others that have required slope stability maintenance, such as Wilber Creek and Coldfoot slopes.

Erosion Control

BLM plans to conduct an assessment of erosion in different locations along the pipeline, and will continue to monitor areas already identified as having erosion problems. The work pad that has been threatened by the erosive forces of flooding rivers and run off will be one area BLM will closely monitor.

Valve Maintenance

Alyeska has begun to address a wide spectrum of valve issues and is meeting high priority goals with acceptable performance. BLM will continue to monitor valve maintenance and re-testing of valves with known leak through at each testing cycle. Valves schedule for retest in 2007 are Remote Gate Valves (RGV) -37, 73, 95B, 98A, 103, 107 and 108. Also to be leak checked in 2007 are Check Valves 64, 75, 78, 79 and 84A.

Work Pad Maintenance

BLM will continue to monitor the TAPS workpad and above ground pipe to ensure continued compliance with the *Federal Agreement and Grant of Right-of-Way.*

Electrical Maintenance

BLM will make a concentrated effort to monitor TAPS electrical systems with the Alaska Department of Labor Electrical Inspector.