

October 19, 2011

VIA COURIER

Energy Resources Conservation Board
Field Surveillance and Operations Branch
Emergency Management Group
Suite 1000, 250 – 5 Street SW
Calgary, AB T2P 0R4

Attention: Mr. Brian Temple

**Re: Follow-up on Incident Investigation: Pipeline Failure
Pembina Pipeline Corporation (BA Code 0205)
Incident Location: 11-07-067-09-W5M
License No. 2349, Line 10, Segment ID 6072
FIS Incident No.: 20111497**

Pembina Pipeline Corporation ("Pembina") hereby submits the following report in response to the Energy Resource Conservation Board (the "ERCB") request for information related to the above-referenced pipeline failure, as outlined in the ERCB's letter dated August 18, 2011.

Executive Summary

On July 19, 2011, Pembina confirmed that it experienced a pipeline failure and subsequent sweet crude oil product release in the Swan Hills area of Alberta (the "Release"). The failure occurred on a 219.1 mm (8 inch) diameter crude oil gathering line known as the Moosehorn 8 inch pipeline, located at 11-07-67-09-W5M (the "Pipeline"). Sweet crude oil migrated down the slope off of the Pipeline right-of-way, down a swale with an 8-10% slope and continued for approximately 120 metres through mixed forest and ultimately into an un-named creek. Approximately 3.6 km of the un-named creek was impacted by the Release. A map showing the incident location and the area impacted by the Release is included as Attachment 1.

The affected Pipeline segment was shut in by Pembina's Edmonton Control Centre (the "ECC") at 07:42 on July 19, 2011. Oil was discovered on the surface at 11-07-67-09-W5M at approximately 18:30 that day. Pembina immediately activated its Emergency Response Plan ("ERP") and the response operations centre was established in the Pembina Swan Hills office at 19:00. Emergency response equipment was dispatched to the Release site and by 20:00 a containment weir was installed at Control Point 5, and earthen berms were built on the right-of-way to minimize any further effects from the Release on the un-named creek. At 10:30 on July 20, 2011, Pembina began operations to evacuate the column of oil from 10-18-67-09 W5M, which was up-slope of the break site. Seepage of oil from the Pipeline at the break site stopped at 11:00 on July 20, 2011 since the column of oil was brought to an elevation lower than the break site.

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Comprehensive containment and recovery operations were established and executed at the other control points within forty-eight hours of the discovery of the Release. As of the date of this letter, clean up efforts are still underway and the impacted land and unnamed creek have been significantly cleaned up.

Pembina worked closely and continuously with the ERCB, Alberta Environment ("AENV"), Alberta Sustainable Resource Development ("ASRD") and other regulatory agencies to ensure our containment and cleanup strategies were communicated and agreed upon.

The initial Release volume was estimated to be approximately 200 m³ of sweet crude oil. After further investigation, on August 3, 2011 the Release volume was revised to a range of 127 m³ to 159 m³ (800 to 1000 barrels). Lab analysis of flow through the pipe failure is anticipated to further refine this estimate. The current volume calculation can be found in Attachment 2.

The initial response to this incident was executed by Pembina staff. As the scope of the containment and recovery increased, contractors and staff were employed to assist in the containment and recovery effort. During the peak clean-up efforts in July, 2011 Pembina employed on average 150 persons per day on site. From July 19 to October 10, 2011, 45,581 man hours were worked by Pembina and contract staff on the Release. A detailed list of contractors and service providers is set forth in Section 3.6.

(1) Recommendations

1.1 Actions to improve existing operations:

Pembina has reviewed its operating procedures related to this Pipeline and the learnings and items Pembina is currently considering are as follows:

- Review Pembina's segment imbalance protocol and consider enhancements for more extensive review and approval on re-start procedures.
- Consider incorporating geotechnical baseline data into regular duties for Pembina field staff to ensure periodic physical checks are conducted.
- Develop a method to use geotechnical baseline data in future ECC Console Operator SCADA displays or reference notes for specific higher geotechnical risk pipeline segments.

1.2 Actions to prevent future occurrences:

For the purpose of the technical review enclosed in this report, the Pipeline has been divided into the following three (3) segments:

Segment	To (coordinates)	From (coordinates)	Note
1	Moosehorn Junction (31-202)	2-23 Crossover (42+487.6)	To be reactivated
2	2-23 Crossover (42+487.6)	3-32 Tie-In (50+648.4)	To be abandoned
3	3-32 Tie-In (50+648.4)	Swan Hills Terminal	Reactivated on August 19, 2011 with ERCB approval.

The segments are illustrated in the Alignment Drawings which can be found in Attachment 7.

The following is an explanation of the actions that will be taken on each segment to prevent future occurrences:

Segment 1

An ultrasonic crack detection tool configured to detect and quantify circumferentially orientated crack features is scheduled to be run in the Pipeline the week of November 7, 2011 on Segment #1. In addition and in parallel, Direct Assessment ("DA") excavations will be completed in Q4 2011. The locations of these excavations will be selected based on a geotechnical slope soil model recently completed. The excavation sites will target known areas of slope movement.

Pembina's geotechnical program is being evaluated and new monitoring techniques and frequencies are being assessed. A slope survey was completed on the entire Pipeline right-of-way in September 2011, and recommendations are being formulated for inspection, monitoring and mitigation for any geotechnically hazardous areas.

A Back-to-Service plan for Segment #1 will be created and presented to the ERCB following assessment of the information collected from technical actions outlined in this report.

Segment 2

The segment of Pipeline from the 2-23 Crossover point to 300 metres upstream of the Swan Hills Terminal will be abandoned. This section of Pipeline experienced all previous failures (detailed further below in Section 2.2), including the recent failure associated with the Release. All failures were associated with high axial stresses from slope movement which caused the Pipeline to crack. Pembina has concluded that, due to the manufacturing process and particular coating of this Pipeline, continued use of Segment #2 is not compatible with Pembina's safe operating practices.

Pembina will take all steps necessary to abandon Segment #2 in accordance with all regulatory requirements and procedures.

Segment 3

This last segment of Pipeline was reactivated on August 29, 2011. Pembina remains confident in the integrity of this section of the Pipeline, however Pembina has initiated a project to replace this last 300 metres of the Pipeline prior to the end of 2011. This section of the Pipeline will be replaced with a 4 inch pipe.

1.3 Actions to inform affected public of outcomes and findings:

Upon discovering the Release and failure of the Pipeline, Pembina's Communications and Public Affairs as well as its Land, Regulatory and Aboriginal Relations departments immediately began internal and external communications and notifications to potentially affected stakeholders. Pembina employed a process of transparent, open, honest and fact-based communication using a variety of communications tools during the early stages of the Release including:

- One-on-one conversations with internal company representatives, regulators, the Town of Swan Hills and elected government officials;
- An initial press release;
- Frequent website updates;
- Establishing a single company spokesperson and granting media interviews; and
- Employee bulletins (through the Pembina employee portal and employee newsletter).

Additional information and a detailed chronology of the communications employed by Pembina can be found in Attachment 4 to this report.

(2) Background to Incident

2.1 Operator history in the area:

Pembina, through its subsidiaries, has been operating crude and natural gas pipelines and related infrastructure in the Swan Hills area since 2000, when Pembina purchased the assets from Federated Pipe Lines Ltd.

The Swan Hills Gathering Laterals consist of 21 laterals located in the Swan Hills area. These laterals can be further divided by area into the following segments: the Mainline, the House Mountain Laterals, the Deer Mountain Laterals, the Swan Hills Area Laterals, the Virginia Hills Laterals, and the Carson Creek Laterals. The Swan Hills Laterals currently transport sweet crude oil from various field batteries and field gates to the Whitecourt Junction. From the Whitecourt Junction the sweet crude oil enters the Swan Hills Gathering Mainline, which transports the product to its eventual destination of Pipeline Alley in Edmonton, Alberta.

2.2 Details of any previous incidents or pipeline repair/replacement within the last five years including any system shutdowns:

There have not been any Pipeline incidents within the last five (5) years.

In 2007, 129 metres of the Pipeline was replaced on the north slope of the Moosehorn River. This slope was identified as a high geotechnical hazardous area which experiences continuous ground movement.

In 2006, 3 excavations were completed to address external corrosion. The repair method included steel compression reinforcement sleeves as per the requirements of CSA Z662-07, Section 10.9.2.7.

In 2011, 44 excavations were completed, to address all reported top-side and bottom-side dents with metal loss on the Pipeline. The repair methods included grinding and recoating, and 4 features were repaired using steel compression reinforcement sleeves.

2.3 Detailed description of pipeline design and construction including dates of construction if different projects:

Year of Construction:	1961/62
Material:	API 5L X42, 4.78 mm wall thickness
External Coating:	Polyethylene Tape and Fibreglass Outer Wrap
MOP:	8275 kPa
Operating Pressure:	~5000kPa

2.4 Summary and assessment of conditions and events immediately preceding the incident:

Pembina first noticed line imbalance issues on July 11, 2011. The following is a summary of events, observations and activities that Pembina noted and undertook in the days leading up to the Release on July 19, 2011.

On July 11, 2011, at 13:40, metering and density issues were noticed at the Swan Hills Terminal and were identified by the ECC. This was a result of a nitrogen purge conducted on an upstream gathering line connecting into Moosehorn Junction.

On July 15, 2011 at 06:29 the Pipeline was shut in due to measured segment volume imbalance levels. Pembina field staff were dispatched to investigate and conducted an operational pressure test within the licensed operating limits, and helicopter patrol of the associated laterals. At 22:42 the Pipeline was restarted since the pressure test was deemed to be satisfactory, the helicopter patrol did not see any areas of concern, and the line imbalances were thought to be a metering inaccuracy induced by the rapid density swing resulting from the nitrogen purge noted above.

On July 16, 2011 and July 17, 2011 backpressure adjustments on the backpressure control valve at the Swan Hills Terminal (at Terminus of this lateral) and equipment inspections were conducted at the Swan Hills Terminal, and the delivery meter was proven on July 18, 2011.

At 07:42 on July 19, 2011 the Pipeline was shut in due to continuing segment volume imbalance excursions and the Release was discovered at 18:30 at 11-07-67-09-W5M.

2.5 One copy only of the site specific emergency response plan(s) if in effect of the corporate emergency response plan, with comment on how well the plan(s) worked or where improvements could be made.

The Pembina corporate ERP was implemented and a site specific plan was created. The corporate ERP and site specific plan are attached to this report as Attachment 3.

The corporate ERP and site specific plans worked effectively and as intended. Both the Corporate Emergency Operations Center ("EOC") in Pembina's Calgary Head Office and Regional Emergency Operations Center ("REOC") in Pembina's Swan Hills Office were activated on July 19, 2011 and the Incident Command System was utilized consistently

throughout the duration of the response. Pembina provided complete and open access to the REOC for representatives from AENV and the Alberta Emergency Response Team ("ASERT"). Pembina acknowledges their critical support in the early stages of the Release response.

At this time, Pembina does not believe there are any significant improvements required to the way it executed the ERP and the site specific plan.

(3) Description of Incident

3.1 Summary of the event:

On July 19, 2011, Pembina confirmed that it had experienced a failure on the Pipeline and subsequent Release in the Swan Hills area of Alberta. Sweet crude oil migrated down slope off of the Pipeline right-of-way, down a swale with an 8-10% slope and continued for approximately 120 metres through mixed forest and ultimately into an un-named creek. Approximately 3.6 km of the un-named creek was impacted by the Release. A map showing the incident location and the impacted Release area is included as Attachment 1.

The affected Pipeline segment was shut in by Pembina's ECC at 07:42 on July 19, 2011. Oil was discovered on the surface at 10-07-67-09-W5M at approximately 18:30. Pembina immediately activated its ERP and the response operations centre was established in the Pembina Swan Hills office at 19:00. Emergency response equipment was dispatched to the Release site and by 20:00 a containment weir was installed at Control Point 5, and earthen berms were built on the right-of-way to minimize any further effects from the Release on the un-named creek. At 10:30 on July 20, 2011, Pembina began operations to evacuate the column of oil from 10-18-67-09 W5M, which is upslope of the break site. Seepage of oil from the Pipeline at the break site stopped at 11:00 on July 20, 2011 since the column of oil was brought to an elevation lower than the break site.

Comprehensive containment and recovery operations were established and executed at the other control points within forty eight hours of the release discovery.

As of the date of this report, clean-up efforts are still underway and the impacted land and creek have been significantly cleaned up.

Pembina worked closely and continuously with the ERCB, AENV, ASRD and other regulatory agencies to ensure our containment and clean-up strategies were communicated and agreed upon.

The initial Release volume was estimated to be approximately 200 m³ of sweet crude oil. After further investigation, on August 3, 2011 the Release volume was revised to a range of 127 m³ to 159 m³ (800 to 1000 barrels). Lab analysis of flow through the actual Pipeline failure is anticipated to further refine this estimate. The volume calculation can be found in Attachment 2.

Following Pembina's request, and in partnership with SWAT Consulting Inc., Eco-Web prepared a Wildlife Management Plan ("WMP") to address wildlife management on site and outline wildlife response measures. As containment and clean-up of the Release

continued and additional information was gathered from the field sections, the WMP was amended to the changing conditions of the site.

3.2 Details of external and internal notification:

Upon discovering the Release, Pembina activated its corporate ERP which includes notifications both internally to various departments within the company, members of Pembina's executive team and externally to regulatory bodies.

In addition, Pembina's Communications and Public Affairs as well as its Land, Regulatory and Aboriginal Relations departments immediately began internal and external communications and notifications to potentially affected stakeholders. Pembina employed a process of transparent, open, honest and fact-based communication using a variety of communications tools during the early stages of the Release including:

- One-on-one conversations with internal company representatives, regulators, the Town of Swan Hills and elected government officials;
- An initial press release;
- Frequent website updates;
- Establishing a single company spokesperson and granting media interviews; and
- Employee bulletins (through the Pembina employee portal and employee newsletter).

The regulatory agencies with oversight of the Release were informed of the Release on July 20, 2011. AENV's Swan Hills office was notified at 04:00, the ERCB St. Albert Field Centre was notified at 06:50, ASRD's High Prairie Office was notified during the morning of July 20, 2011, and Environment Canada was notified at 12:00.

Additional information and a detailed chronology of the communications employed can be found in Attachment 4 to this report.

3.3 Response and control measures:

Containment of the Release with respect to the impacted land and un-named creek was the initial response strategy. The un-named creek was immediately contained through installation of the weir at Control Point 5 and, as soon as equipment could be procured, the impacted land was bermed on the right-of-way to minimize any further effects from the Release on the un-named creek. Further containment and recovery was established and executed at the other control points in the next 48 hours. Several plans were developed and approved by the appropriate regulatory bodies to minimize impact to the environment (i.e. Wildlife Management Plan, Waste Management Plan).

3.4 Details of any monitoring programs (air, water, soils) including their results:

During the containment operations, there were 7 control points installed at pre-selected locations along approximately 4 kilometres of the un-named creek system: Control Point 1 ("CP1"), Control Point 2 ("CP2"), Control Point 3 ("CP3"), Control Point 4 ("CP4"), Control Point 5 ("CP5"), Control Point 5b ("CP5b"), and Control Point 6 ("CP6"). A map showing the control points is in Attachment 1. When site access was gained, the point of entry ("POE") was stripped of timber and salvaged for later use, and the impacted organics were stockpiled and sampled. Due to a small spring feeding the swale of the POE, a trench and weir system were installed at the visible POE into the un-named creek. Additional trenches were installed down gradient of the trench system to ensure full containment had been achieved.

To date, the free product has been removed from the un-named creek system using skimmers, hand recovery techniques, flushing techniques, and excavation; however, the water quality continues to be regularly monitored for trace hydrocarbon constituent concentration. Routine visual creek and shoreline assessment monitoring has determined that no apparent free product passed downstream of the final control point. Multiple surface water samples obtained on a routine basis have identified trace concentrations of hydrocarbon constituents in the un-named creek with declines evident as distance from the POE increased. The water quality sampling events were conducted three times daily in the initial stage of the Release recovery and, with AENV's permission, were reduced to daily sampling. At the date of this report, water sampling continues to be monitored daily.

A fish population assessment was conducted to determine if the known product in the soils and sediment and/or water column could be impacting fish. The evaluation indicated that no fish are likely to be present within the un-named creek system up gradient of CP5.

As part of Pembina's environmental assessment efforts, Pembina conducted localized air quality testing for Health Canada based criteria. It was determined that no adverse air quality conditions were present outside of the Release area.

A sediment quality monitoring program is being conducted at this time. The results of all soil, groundwater, sediment and air sample analyses are currently being reviewed by Pembina representatives, Pembina-retained consultants and AENV.

Remediation of the hydrocarbon impacted soils on the right-of-way and in the down gradient swale areas continue to be removed through excavation. This soil is being transported by off-road equipment to a temporary storage area consisting of an ERCB-approved lined, bermed cell. From this point, the soil is loaded onto highway trucks for transportation to the CCS Judy Creek facility. Soil remediation and assessment activities are ongoing at this time.

Currently, final reports detailing these programs are in progress. These reports will be readily available to the ERCB and AENV once they are prepared and finalized. The following attachments have been included for interim review:

Attachment 5, Deer Mountain 11-06-67-09W5M Remedial Action Plan
Attachment 12, AENV 7 Day Release Report

Attachment 13, Remediation and Reclamation Proposal

3.5 Security and safety measures for the site and potentially affected area:

Site security was staffed and maintained 24 hours a day, 7 days a week at the entrance and exit to the access road to the Release site. Third party safety consultants were assigned to each control point to assist in ensuring worker safety. All field activities (including ground disturbance) were completed as per the guidance of Pembina's health and safety policies and procedures. Given the number of activities completed in and around the un-named creek, there was an emphasis placed on safety for working around water. Pre-task hazard analyses were conducted for tasks not identified in Pembina's policies to ensure worker safety. Additional information on security and safety measures can be found in Attachment 3 to this report.

3.6 Use of contractors including specific areas of responsibilities:

Pembina has utilized the resources of several dozen contractors to provide many of the goods and services (equipment, consumables, and labour) required to appropriately respond to this Release. The major suppliers of critical goods and services are listed in the table below:

Consulting Company	Responsibility
SWAT Consulting Inc.	Spill response, remediation execution
Eco-Web Ecological Consulting Ltd.	Wildlife protection and management
Seasonal Impact Environmental Group Ltd.	Contaminated soil excavation & transportation
CCS Corporation (Judy Creek)	Contaminated material disposal
Worley Parsons	Water, soil sampling
Maxxam Analytics Inc.	Laboratory analysis
TERA Environmental Consultants	Environmental, TFA, Wildlife plans/applications
Lesser Slave Management Services	Slashing

3.7 Details of spill remediation and clean up. Include volume of contaminated soil removed, time and location of disposal and/or treatment details.

The disposal of the contaminated materials commenced on September 15, 2011 at the CCS Judy Creek facility. As of October 13, 2011 6503.29 tonnes of material (soil, organic and absorbent materials) have been disposed of. The material breakdown, as of the date of this report, is as follows:

Site	Location	Material (tonnes)
Site #1	11-07-67-9 W5M	6439.72
Absorbents booms and pads		63.57

Clean-up work continues and these volumes are expected to increase.

All soils, liquids, and other oilfield waste are being handled in accordance with Pembina's Waste Management Plan and ERCB Waste Management Approval Application No. 1696052 with amendments 1696435 and 1698075.

For details related to the Release remediation plan and clean-up, please see Attachment 5 and Attachment 10 for the Waste Management Plan.

3.8 Communications program and media involvement, including an assessment of their effectiveness, what worked well, and where improvements can be made.

Upon confirming the Release, the Pembina Communications and Public Affairs department immediately developed a communications plan. An early draft of a press release was prepared in anticipation of ERCB and AENV approval of our communications approach. Once approved, these materials were also provided to other departments within Pembina to ensure consistent messages with all stakeholders, such as customers, the investment community, and Aboriginal Communities. Despite these early activities, the news media (specifically 630 CHED radio in Edmonton) learned of the Release and began its reports before Pembina had published its press release. Pembina reacted quickly, by releasing its own press release in order to contain and control the messages being received by our stakeholders. A complete chronology of media involvement can be found in Attachment 4 to this report.

Pembina believes the media relations approach worked well. Pembina established, early on, a strong working relationship related to the Release with our ERCB and AENV counterparts and was able to communicate quickly and efficiently with all media once we had distributed our press release. Pembina found the media stories were consistent in their portrayal of the incident, and received very few requests for additional information from stakeholders. For the most part, the stories included factual information about the Release with little speculation about the event or clean-up activities.

Improvements on the media relations efforts that Pembina will take forward from the Release are in the future, we will:

- Move quickly to distribute the initial press release and eliminate the possibility of a third party distributing an inaccurate story;
- Determine earlier whether there is a need for on-site communications representation and a process for handling unexpected media visits to the spill site;
- Identify the visual needs of various media outlets and make images available earlier; and
- Update the communications plan throughout the activities to ensure it contains not only the early messages and approach, but reflects new developments as they occur.

3.9 *Actual (root cause) or suspected cause, the rationale used to determine cause*

Det Norske Veritas (“DNV”) conducted a Metallurgical Analysis of the failure section of the Pipeline to determine the root cause of failure. The findings of the analysis determined that the Release occurred at a colony of circumferentially oriented, OD surface breaking, interlinked near-neutral-pH stress corrosion cracks (“SCC”). Supporting evidence for the conclusion that the cause of the rupture was near-neutral-pH SCC includes:

- (1) The presence of a colony of circumferentially oriented cracks on the external surface of the pipe in the vicinity of the failure origin;
- (2) The interlinking of individual thumbnail shaped cracks within the colony to form the initiating flaw;
- (3) The transgranular path of the cracks within the colony;
- (4) The presence of other crack colonies in the vicinity of the failure origin; and
- (5) Evidence of the corrosion of the crack faces.

Details of the root cause investigation and photos of the circumferential cracking can be found in the DNV Final Report in Attachment 8.

3.10 *How repair/reconstruction activities were/are planned and performed.*

Segment 1

Pembina hopes to re-activate this segment of the Pipeline. The following activities will be performed to assess the integrity of this section of the Pipeline:

- A circumferential ultrasonic in-line inspection tool run is planned in early November 2011. The tool is designed to detect circumferential cracks.
- Based on the results of the inspection, integrity excavations will be selected at cracking indication sites.
- Direct assessment integrity digs will be completed. The location of the excavation sites will be based on the geotechnical slope soil model recently completed. Sites will target known areas of slope movement.
- A pig receiver has been installed at the 2-23 crossover point to ensure Segment #1 remains capable of accepting passage of in-line inspection tools
- Based on the results of the above activities, a formal Back-to-Service Plan will be submitted to the ERCB for its review and approval.

Section 2

Pembina intends to abandon this section of the Pipeline in place. The production from Section #1 will be re-routed into an existing 10 inch pipeline which parallels the Pipeline. A formal plan and application for the abandonment of this section will be submitted to the ERCB in due course.

Section 3

A 300 metre section of the Pipeline was reactivated, with approval from the ERCB, on August 19, 2011. Pembina remains confident that C-SCC will not be present in this segment. For C-SCC to occur three factors must be present:

- (1) Susceptible Material (steel pipeline);
- (2) Environment for corrosion (i.e. poor coating); and
- (3) Residual Axial Stress (geotechnical movement).

In this section of the Pipeline there is no evidence of geotechnical movement; thus, there should be no axial stresses present within the Pipeline. This segment will continue to transport product from the Celtic 3-32 site to Swan Hills Terminal. Pembina has initiated a project to replace the last 300 metres of the Pipeline before the end of 2011, and the 300 metres of existing Pipeline will be abandoned in place. This section of Pipeline will be replaced with a 4 inch pipe. A formal plan and application for the abandonment of this section will be submitted to the ERCB.

(4) Description of all impacts and steps taken to monitor and minimize the effects on:

- Public
- Workers
- Environment
- Animals, domestic and wildlife

Information related to impacts and steps taken to monitor and minimize the effects on public and workers can be found in Attachment 3, the Corporate ERP and site specific plan.

Information related to the environment can be located in the Remediation Action Plan in Attachment 5 and information related to monitoring and minimizing effects on animals and wildlife can be found in the Wildlife Management Plan in Attachment 10.

(5) A copy of or sufficient detail respecting appropriate maintenance and operating programs related to the pipeline

As part of routine maintenance on this Pipeline, Pembina has programs for in-line inspection, regular mechanical cleaning, and cathodic protection. The following is a summary of these programs.

In Line Inspection

High-Resolution ("Hi-Res") magnetic flux leakage ("MFL") in-line inspections ("ILI") continue to be the principle means by which Pembina characterizes external and internal corrosion. Historically, MFL have been completed specific to this Pipeline, on a 5-year frequency, with the last ILI inspection completed in 2010.

Pigging (Cleaning)

Mechanical cleaning using internal line scrapers to remove stagnant water, bacterial sludge, solids and other debris is currently performed weekly on the Pipeline.

Cathodic Protection Programs

The Pipeline is protected by three impressed current cathodic protection (“CP”) systems, located at the following locations:

1. Swan Hills Pump Station #1 (12-19-066-09 W5M)
2. Swan Hills Pump Station #2 (12-19-066-09 W5M)
3. Deer Mountain (04-07-069-08 W5M)

Measurements of the rectifier voltages, current and indicating metre potentials are recorded and reviewed monthly to ensure adequate levels of cathodic protection in accordance with CSA Z662. An annual compliance survey is prepared and submitted to Pembina by a third party CP service provider.

Pembina employs Supervisory Control and Data Acquisition (“SCADA”) technology on all of its pipeline systems. The SCADA systems allow for continuous electronic monitoring and control of the pipeline systems from dedicated computer consoles located in our ECC. Trained Operators monitor the pipeline systems 24 hours per day, 365 days per year. The SCADA systems and associated leak detection software continuously monitor pipeline flow and operating conditions. More information on the SCADA system operation can be found in Attachment 6 to this report.

Pembina has processes in place to ensure that educational background, work experience, and training adequately prepare staff to manage the operations and integrity of Pembina’s pipeline systems. Some examples are:

- All pipeline personnel (field) have been trained in Ground Disturbance, and have certificates.
- Task Observations are done and documented on both employees and contractors.
- Standard Operating Procedures are developed and implemented on a daily basis.
- Station personnel are trained by supervisor personnel and experienced employees.
- Pipeline integrity related training is regularly provided to the field personnel by Pembina’s Integrity Technical Services department (i.e. defect assessment and repair manual, coating specification, etc.).

The topography surrounding the Swan Hills Laterals can be described as a hill-covered region covered with mixed forest. A majority of the area is dedicated to Crown Land with areas of light agricultural activity. There are 14 areas that represent increased slope stability likelihood within the Swan Hills Laterals. All of these locations have current monitoring programs and some degree of remediation and mitigation which may include deep horizontal drains and bringing sections of the pipe above ground.

(6) A copy of the latest cathodic protection survey report, Pipeline Regulation, Section 56 and refer to CSA Z662-07, Section 9.5 and CGA OCC-1, Section 4 and 6.

A copy of the Swan Hills District 2010 CP Survey Report is included as Attachment 9 to this report. The 2011 survey is complete and the final report is expected to be delivered by end of October 2011.

The Pipeline is receiving adequate levels of CP, as the structure-to-soil potential measurements at all test leads on the Pipeline are greater than the -850mV (IR free) criteria, as specified in CSA Z662-01, Section 9.5 and CGA OCC-1, Appendix B. Please Refer to Page 84 (Appendix 2, page 48-52) of the 2010 CP Survey Report for structure-to-soil potential data from Swan Hills Terminal to Moosehorn Junction. The Pipeline receives a detailed annual CP survey.

As per CGA OCC-1, Section 4 and 6, the impressed current sources are monitored and recorded monthly, and they are inspected and maintained yearly as part of a preventative maintenance program. Refer to pages 27, 28 & 30 (Appendix 1, pages 4, 5, 7) of the 2010 CP Survey Report for rectifier measurements recorded during the annual inspection. Also refer to page 6 of the 2010 CP Survey Report for discussion of the rectifier and ground bed inspection and maintenance. There are no critical bonds on the Pipeline.

(7) All third-party analyses and any engineering reports of any pipeline or equipment failures, if applicable. A copy of the report determining failure cause and/or mechanism from the lab analysis.

DNV completed a metallurgical analysis of the failure pipe in their Dublin, Ohio facility. A copy of the report is attached in Attachment 8 to this report.

(8) Results of an examination of the coating integrity to determine if recoating or coating repairs are required for any disbanded coating, holidays or blisters, wrinkling or tenting, mechanical damage by equipment or backfill material, cracking or spalling, missing coating or sleeves etc.

Using the Pembina Defect Assessment and Repair Manual, the coating was assessed on the failed joint of pipe. The coating consisted of single wrap polyethylene tape, and was found to be in generally poor condition, with disbondment at the overlaps, predominantly at the 3 and 9 o'clock positions on the Pipeline. The coating was removed from the entire joint, and the pipe was inspected. Due to the coating condition and circumferential SCC, the excavation was extended on the upstream and downstream side of the failed joint, until improved coating conditions and no additional circumferential SCC was found. A total of five joints adjacent to and including the failure joint were cut out and replaced with new pipe, coating with fusion bonded epoxy. However, subsequently it was determined to abandon this section of Pipeline as outlined above in Section 3.10 above.

(9) Should any corrosion imperfections exist address how the requirements of CSA Z662-07, Section 10.9.2 inclusive will be met.

The failure was caused by circumferential SCC. Some minor external corrosion defects were present on the joint of the failure. All corrosion passed CSA Z662-07 Section 10.9.2 criteria.

(10) Address how confirmation of long term integrity on the failed subject pipeline will be achieved and include a copy of any engineering reports or assessments. In addition, consider other pipelines within the system to ensure that a repeat event of this nature can be identified and prevented; refer to Directive 66: Requirements and Procedures for Pipelines, Appendix 2: “ERCB Pipeline Inspectors’ Guide to Corrosion Failure Procedures”. In addition, provide documentation confirming that the subject pipeline is in compliance with CSA Z662-07, Section 10.14.2.1.

To confirm long term integrity on the failed Pipeline Pembina has the following programs and inspection, monitoring and mitigation activities in place to address the threats below as outlined in CSA Z662-07, Section 10.14.2.1:

- (a) Mechanical Damage** – The Deer Mountain lateral transverses predominantly hilly Crown Land. Public awareness and stakeholder communications are employed as well as registration with the Alberta One-Call system, regular aerial patrol, and binding agreements with third parties working near or on the Swan Hills right-of-way to address the risk of third party damage.

Mechanical damage is detected through our ILI tools. Pembina’s Defect Assessment and Repair Manual addresses deformation reported from an ILI tool and/or identified in the field and specifies how they are to be repaired.

- (b) Mill defects** – Mill defects are managed through our ILI program. All mill defects are assessed against Pembina’s Defect Assessment and Repair Manual and repaired accordingly.

- (c) Corrosion** – Regularly scheduled Hi-Res MFL in-line inspections are the principle means by which Pembina characterizes external and internal corrosion on the Swan Hills Laterals. External corrosion is managed through our monthly rectifier readings, annual (on/off) CP surveys and our in-line inspections. Internal corrosion is monitored through periodic product sampling, mitigated through regular maintenance pigging and inspected/monitored through our in-line inspections. Any corrosion indicated on an ILI or measured on the pipeline is assessed against Pembina’s Defect Assessment and Repair Manual and repaired accordingly.

- (d) Stress Corrosion Cracking (SCC)** - The Deer Mountain Lateral is coated with polyethylene tape coating and as such, is susceptible to stress corrosion cracking. The Pipeline historically operates around 40% of specified minimum yield strength and is considered a lower risk to axially aligned SCC. It is deemed a higher risk to circumferentially aligned SCC due to the slope movement along the Pipeline. To inspect for the presence of both axially and circumferentially aligned SCC magnetic particle inspection (MPI) is performed at all ILI excavations. Direct assessment excavations will be performed based off of

numerous different integrity surveys (corrosion, deformation, slope, SCC soils, topography, etc). Pembina is currently evaluating an ultra-sonic crack detection tool as a means of detected circumferentially oriented cracks and plan on running an ultrasonic in-line inspection tool in early November.

- (e) **Coating damage** – Coating damage is managed through a combination of our mechanical damage program and our corrosion program. Coating condition is evaluated at all pipeline excavations. Any corrosion indicated from coating damage is assessed against Pembina's Defect Assessment and Repair Manual and repaired accordingly.
- (f) **Coating deterioration** – Coating deterioration is managed through a combination of our mechanical damage, corrosion and stress corrosion cracking program. Coating condition is evaluated at all pipeline excavations. Any corrosion indicated from coating deterioration is assessed against Pembina's Defect Assessment and Repair Manual and repaired accordingly.
- (g) **Unstable slopes** – Pembina currently monitors the Deer Mountain slope with geotechnical instruments. Slope inclinometers are utilized to log a differential slope profile at a unique location, and standpipe piezometers are read to track changes of the surface of the slope groundwater table. Measurements taken by these instruments have lead to remediation such as pipeline daylighting, stress relief and installation of horizontal drains to relieve the groundwater influence (designed to increase the overall stability of the slope). Through Pembina's geotechnical program active slopes are monitored, inspected and mitigated if warranted.
- (h) **The presence of low-frequency ERW**– The Deer Mountain Lateral was constructed of pre-1970's low frequency electric resistance welded ("ERW") pipe and can therefore be deemed susceptible to longitudinal weld type cracking. Magnetic particle inspection is performed at all ILI excavations, including 100 percent of the long seam and girth welds.

Pembina has also evaluated other pipelines within Swan Hills and other operating systems to ensure a repeat event can be identified and prevented. A susceptibility assessment has been performed and affected pipelines have been ranked accordingly ("high", "moderate", "low"). All pipelines within the system with high susceptibility to C-SCC have either been investigated or mitigated. Mitigation can consist of pipe replacement by horizontal directional drills, exposing and stress relief or exposing and

(11) Copy of personnel statements, if available.

Personnel statements were not provided for this incident. Daily incident action logs for command staff were prepared as per the incident command centre procedure.

(12) Digital pictures of the failure site and failed pipeline.

Please see Attachment 11 for these photos.

(13) Conclusions respecting the incident, with emphasis on:

13.1 How the knowledge gained from this incident will be shared with other operators

Pembina shares information regularly with other pipeline operators through its involvement in industry related groups such as the Canadian Energy Pipeline Association, Sundre Petroleum Operators Group and Western Canadian Spill Services. Information shared may include: pipeline integrity data, geotechnical data, environmental and logistical issues in working in the field, as well as communications and public notification initiatives.

13.2 Timeline to implement actions, including measurement points that will be used to ensure that actions are followed up, resulting in lasting improvement.

A series of actions associated with learnings from the Release are summarized in the below table. Due to the scope of the assessment work, some of the actions will extend into the first quarter of 2012:

Action	Commence Date	Completion Date
A back-to-service plan was accepted by to the ERCB for the Segment #3 (03-32 tie in to Swan Hills Terminal) to continue production from the Celtic 03-32 facility.	Sept. 2011	Sept.19, 2011 Complete
Approval granted by the ERCB to purge and clean Segments #1 & #2. Segment #2 will be abandoned immediately after. This work is scheduled to be completed by the end of October, 2011.	Sept. 2011	Sept. 29, 2011 Complete
Review Pembina's Segment Imbalance Protocol. Consider enhancements for more extensive review and approval on re-start procedures.	Nov. 1, 2011	Dec. 31, 2011
Consider incorporating geotechnical baseline data in regular duties for Pembina field staff to ensure periodic physical checks of areas are conducted.	Nov. 1, 2011	Mar. 31, 2012
Develop method to use geotechnical baseline data in future ECC console operator SCADA displays or reference notes for specific higher risk geotechnical segments of pipeline.	Nov. 1., 2011	Mar., 31, 2012

Ultrasonic crack detection tool to be run. Delivery of final report from tool vendor within 50 days of tool run.	Week of Nov.7, 2011	Dec. 22, 2011
Two direct assessment excavations begin in areas identified as high susceptibility to potential slope movement. Further excavations are dependent upon the result of initial digs.	Week of Oct.11, 2011	Jan.2012
Pembina analysis of direct assessment digs and ultrasonic crack detection results, and as necessary, back to service plan for Segment #1 of the Deer Mountain Lateral.	Nov.2011	Jan. 2012

Conclusion

Pembina trusts the information contained in this report and the associated attachments meets the needs of the ERCB in relation to assessment of Pembina's emergency response, clean-up, mitigation efforts and processes implemented to prevent a similar incident happening in the future.

If you have any questions, please contact me directly at (403) 691-7647.

Sincerely,

Pembina Pipeline Corporation

Glen Pullishy
Senior Manager, Operations
Conventional Pipelines Business Unit

Attachments

Cc:
Adam Payzant, St. Albert Field Centre, ERCB
Jennifer Stanier, Calgary, ERCB

List of attachments

- 1 Site overview
- 2 Release volume estimate
- 3 Corporate ERP and Moosehorn Site Specific Supplemental ERP
- 4 Communications summary
- 5 Remediation Action Plan
- 6 SCADA system description
- 7 Alignment Drawings
- 8 DNV Final Report
- 9 Cathodic Protection Survey Report
- 10 Wildlife Management Plan
- 11 Photos
- 12 AENV 7 Day Release Report
- 13 Remediation and Reclamation Proposal