



December 9, 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, Incident Investigator, Field Surveillance and Operations Branch
Emergency Management Group

Re: Incident Investigation: Pipeline Failure
Licensee Name: Pembina Pipeline Corporation ("Pembina")
Company Code: 0205
Incident Location: 11-07-067-09W5
Licence No. 2349, Line No. 10, Segment ID 6072
FIS Incident No.: 20111497
Response to the Energy Resources Conservation Board ("ERCB") Additional
Information Request Dated November 8, 2011

Mr. Temple,

Attached is Pembina's response to the additional information requested by the ERCB on November 8, 2011. This information is supplemental to the material provided to the ERCB on October 19, 2011 (the "Oct 19 Submission").

During the course of responding to and conducting clean-up activities, Pembina worked collaboratively with the ERCB, Alberta Environment and the local authorities. Pembina ensured that stakeholders and aboriginal communities were notified of the release and kept up to date on our activities. Site visits were completed by a number of local aboriginal communities. Oil spill specialists were engaged to ensure best practices were employed to contain the release and clean-up the affected area.

Prior to the pipeline being shut-in and the release being reported, Pembina employed its Segment Imbalance Response Protocol (the "Protocol"). Other pipeline operators have met with Pembina's Edmonton Control Centre ("ECC") group to review the Protocol and have adopted a number of the Protocol details into their plans.

The Protocol has been reviewed and updated to ensure that any pipelines showing a volume imbalance and that may also require a shut-down are adequately checked and inspected prior to restarting of such pipelines. The field operations personnel employed a number of

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procedures to assess the likelihood of a release, and these procedures have also been reviewed. Updates to field operating procedures will ensure that in the unlikely event of a similar occurrence, that proper steps are quickly taken to determine whether or not a release has occurred and where it is located.

Pembina remains committed to continuously improving its systems, operating processes and emergency response protocols. In review of this incident Pembina has made a number of commitments to improve its processes, as also set out in the Oct 19 Submission. The table below summarizes the status of these actions.

Action	Target Completion Date	Status
Back-to service plan presented for Segment 3 (3-32 tie to Swan Hill Terminal ("SHT")).	September 2011	Complete.
ERCB approval to purge and clean Segments 1 ¹ and 2 ² .	September 2011	Complete.
Review the Pembina Protocol and consider enhancements for more extensive review and approval on re-start procedures.	December 31, 2011	Complete, updates to the revised Protocol currently circulated internally for review.
Develop a method to use geotechnical baseline data in future ECC Console Operator Supervisory Control and Data Acquisition ("SCADA") displays or reference notes for specific higher geotechnical risk pipeline segments.	December 31, 2011	Complete, incorporated into the revised Protocol and currently circulated internally for review. Reference notes will be used within revised Protocol and copy that ECC Shift Foreman have for immediate use.
Consider incorporating geotechnical baseline data into regular duties for Pembina field staff to ensure periodic physical checks are conducted.	January 31, 2012	Geotechnical baseline data is distributed.
Complete ultrasonic crack detection and direct assessment excavations.	November 2011	Pembina updated the ERCB on November 2, 2011 that the relevant portions of the pipeline will be replaced instead of assessed for re-start.
Based on slope survey	Complete mitigation by	Please see Attachment F

¹ Segment 1 is from Moosehorn Junction to the 2-33 Crossover.

² Segment 2 is from the 2-33 Crossover to the 3-23 Tie-in.



completed in 2011, formulate recommendations for inspection, monitoring and mitigation of geotechnically hazardous areas.	December 31, 2012	<p>and G, for a representative sample of information collected on geotechnical issues on an annual basis for all pipeline systems.</p> <p>Pembina recently completed the last year of a 4 year program to baseline inspect all right-of ways for Geotechnical threats.</p> <p>During this process Pembina has discovered 22 exposed water crossings and self disclosed these to the ERCB and has completed mitigation measures on 3 locations to date.</p> <p>Pembina is planning to have mitigation activities for all operating pipeline exposures completed by the end of 2012.</p>
Back-to-Service plan for Segment 1 created and presented to ERCB.		Meeting held with ERCB on December 1, 2011 to review Pembina's short term and long term plans.
Abandon Section 2.	March 2012	Pembina intends to notify on the abandonment in early 2012.
Replace Segment 3 with 300 m of new 4 inch pipe.	Spring 2012	D56 notification and consultation underway.

Pembina trusts that the information contained in these responses 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 from happening in the future.

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If you have any questions, please contact Laura Lunt directly at (403) 231-7528.

Sincerely,

A handwritten signature in cursive script, appearing to read "Paul J. Murphy".

Paul J. Murphy
Vice President, Conventional Pipelines

cc: Adam Payzant, St. Albert Field Centre, ERCB (via e-mail, responses only)
Tom Pesta, Calgary Office, ERCB (via e-mail, responses only)
Quinn Eastlick, Calgary Office, ERCB (via e-mail, responses only)

**PEMBINA PIPELINE CORPORATION
RESPONSES TO
ERCB ADDITIONAL INFORMATION REQUEST
DATED NOVEMBER 8, 2011**

1. The segment was shut in at 07:42 on July 19th, 2011 and the location of the leak was discovered at 18:30 that day.

(a) Questions related to Leak Detection and Leak Response

i. What triggered the shut down at 07:42? Provide the “Leak Detection Protocol Manual” referenced in Attachment 6.

Response:

What triggered the shut down at 07:42?

On July 9, 2011 the 4-7 Lateral (see defined in 1(a)(iii)) was completely purged with nitrogen. The segment was shut-down due to insufficient cover and Pembina’s concern about high flood levels in the Swan River. This nitrogen purge created a pipeline system imbalance until approximately 17:00 on July 11, 2011.

Since the July 11, 2011 imbalance, the ECC closely monitored the pipeline system operations.

On July 15, 2011 at 06:29 the ECC shut-down the pipeline due to concerns over a 24 hour segment imbalance of 2.14%. Field operations personnel were contacted, as per the Protocol and completed pressure checks on five associated operating laterals. The field operations personnel deemed it appropriate to re-start the pipeline at 22:42 on July 15, 2011.

From July 16, 2011 to July 18, 2011, the ECC continued to notice a volume imbalance. In the meantime, field operations and the ECC were investigating the reasons and made backpressure adjustments on the control valve located at the end of the lateral at the SHT. They also completed valve inspections, proved the balance meter at SHT, and checked above ground piping at SHT for leaks.

On the morning of July 19, 2011, the ECC Foreman reviewed the 24 hour segment imbalance which showed an increase to 2.6%. Based on this information the ECC shut-down the pipeline at 07:42.

Leading up to the shut-down of the pipeline, the Protocol (May 14, 2010 version), was implemented. The Protocol flow chart was included in Section 2.3 of the Pembina Corporate Emergency Response Plan (“ERP”), submitted as Attachment 3 to the Oct 19 Submission.

Please see attached hereto as Attachment A, the Protocol flow chart in place at the time of the incident and the explanatories to the relevant References of the Protocol flow chart.

The Protocol is followed by the ECC and field operations personnel when a segment imbalance has either been detected or any concern is reported to the ECC. The Protocol outlines the steps and items that the ECC and field personnel should consider when assessing the segment imbalance.

Reference B – Relates to considerations for determining whether the leak alarm is caused by something that can be rationally explained.

Reference C – Relates to steps to go through to scrutinize all SCADA alarms and events to determine if there is any evidence of a potential product release.

Reference D – Relates to checks in the SCADA and leak detection system for evidence of a potential product release, and other data leading up to the alarm.

Reference E – Relates to review of gathered information with the ECC Shift Foreman and if the possibility of a product release can't be dismissed, to then consider a leak probable.

Reference F – Relates to a checklist of all the equipment that should be shut-down.

1 The segment was shut in at 07:42 on July 19th, 2011 and the location of the leak was discovered at 18:30 that day.

(a) Question related to Leak Detection and Leak Response

ii. Attachment 3, the ERP section 2.3 has a copy of the “segment imbalance protocol” chart; provide references B, C, D, E, F.

Response:

Please refer to the response set out in 1(a)(i) and Attachment A, for the relevant B, C, D, E, F references requested.

- 1 The segment was shut in at 07:42 on July 19th, 2011 and the location of the leak was discovered at 18:30 that day.

(a) Question related to Leak Detection and Leak Response

- iii. Describe the pipeline segment that is included in the balance calculations (include a pipeline map if necessary). Where are the different laterals and measuring points affecting the segment calculations?

Response:

Describe the pipeline segment that is included in the balance calculations.

The pipeline segments that were included in the balance calculations are noted on the map attached hereto as Attachment B.

Where are the different laterals and measuring points affecting the segment calculations?

There are seven (7) laterals with Lease Automated Custody Transfer ("LACT") units which includes a reporting meter at each LACT unit and a balance measuring point at the SHT. The laterals for this 8 inch (219.1mm) pipeline system are as follows:

NAME	LOCATION	NPS DIAMETER
"4-9 Lateral"	4-9-70-10W5M	163.8mm
"10-28 Lateral"	10-28-69-10W5M	114.3mm
"4-7 Lateral"	4-7-69-8W5M	168.3mm
"10-19 Lateral"	10-19-68-8W5M	114.3mm
"10-17 Lateral"	10-17-68-10W5M	168.3mm
"10-32 Lateral"	10-32-67-9W5M	88.9mm
"3-32 Lateral"	3-32 -66-9W5M	88.9mm

1 The segment was shut in at 07:42 on July 19th, 2011 and the location of the leak was discovered at 18:30 that day.

(a) Question related to Leak Detection and Leak Response

iv. What are the alarm/threshold limits for imbalance for different time periods? Attachment 2 indicates daily PLM imbalance limit of 0.5% in leak detection protocol. What is the weekly and monthly imbalance limit? Was the weekly imbalance limit exceeded on July 18 or prior to July 18th? Explain how the weekly balance was handled after the nitrogen purge on July 9th and 10th. What action is required if any imbalance limit is exceeded? Are hourly balances conducted?

Response:

What are the alarm/threshold limits for imbalance for different time periods?

The alarm and threshold limits for imbalances are as follows:

- For potentially catastrophic events, the alarms are set at 5 minute intervals with +/- 20% imbalance limits;
- For potentially “medium” sized events, the alarms are set at 60 minute intervals with +/- 5% imbalance limits; and
- For potentially “small leak” events, the alarms are set at 24 hour intervals with +/- 0.5% imbalance limits.

Attachment 2 indicates daily PLM imbalance limit of 0.5% in leak detection protocol. What is the weekly and monthly imbalance limit?

The Pembina pipeline leak detection system Pipe Line Monitoring (“PLM”) software polls data from the SCADA system at two minute intervals. The PLM system monitors past data for 5 minute, 60 minute or 24 hour periods.

The operators at the ECC monitor this information 24 hours a day, 7 days a week.

The alarm limits are dynamic since they are based on actual throughput volumes of the pipeline at time of measurement. The detection protocol does not use weekly or monthly imbalance limits, because of the continuous monitoring by the ECC.

The ECC uses trending to monitor all pipeline segments based on the 5 minute, 60 minute and 24 hour data period to detect any unusual segment imbalances or potential integrity violations. Monitoring based on these shorter levels/intervals allows for the most effective monitoring. Therefore, weekly or monthly imbalances are considered second and third levels of analysis and not used in any decision making process.

Was the weekly imbalance limit exceeded on July 18 or prior to July 18?

For the reasons stated above, the weekly and monthly imbalances were not considered in this instance.

On July 18, 2011 the 24 hour imbalance was -25.0 m³ and the delivery meter at the SHT was proved at 09:27 and the new metering factor was entered into the SHT Programmable Logic Controller ("PLC") at that time.

The recalculated imbalance improved only marginally from -25 m³ to -20 m³. Field operations personnel elected to monitor further improvements to the imbalance data and on July 18th completed other meter valve checks and conducted inspections for potential leaks in the above ground piping at the SHT.

In retrospect the subject SHT meter should have been replaced once proving made only a marginal difference.

Explain how the weekly balance was handled after the nitrogen purge on July 9th and July 10th?

On July 9, 2011, as part of Pembina's geotechnical hazard management program, the 4-7 Lateral connection into the 219.1mm pipeline system and crossing the Swan River at 06-34-68-9W5M was shut-down due to concerns of insufficient cover. As part of the shut-down, the line was fully purged with nitrogen and the ECC noted a 24 hour imbalance of approximately 0.54%. The nitrogen recovery was continuously monitored by the ECC using pressure trends.

Decisions were made based on the 24 hour imbalance calculations as the nitrogen in the system continued to affect the line metering, but cleared up by July 11 at 17:00.

What action is required if any imbalance limit is exceeded?

The Protocol is to be followed, and daily pipeline integrity reports are filed and emailed within Pembina to field operations and Calgary personnel.

Are hourly balances conducted?

Yes.

1 The segment was shut in at 07:42 on July 19th, 2011 and the location of the leak was discovered at 18:30 that day.

(a) Question related to Leak Detection and Leak Response

- v. The SCADA indicated significant daily imbalances from July 11 of 0.6% to 3.9%. What is Pembina's procedure to allow restart of a pipeline after a shut down due to an imbalance indication? The released volume calculation (Attachment 2) includes a sum of the daily imbalances from July 11 until the shut down on July 19th. This suggests the worst case scenario that the leak may have occurred on July 11th. Please provide any documentation which supports the decisions to keep the pipeline operating from July 11th. What pipeline segments were included in the operational pressure test, how long was the hold period and what instruments were used to detect a pressure change? Given the known size of the crack, please correlate the test pressure the accuracy of the instruments and the pressure hold period, and comment on the results. Comment on the pipeline right of way condition and any factors which may hinder the visual detection of leaks by a helicopter patrol.**

Response:

What is Pembina's procedure to allow restart of a pipeline after a shut down due to an imbalance indication?

The earlier version of the Protocol allowed re-start of a pipeline after shut-down due to an imbalance indication as per the Protocol Reference G, by the ECC operator conversing with the appropriate senior field operations personnel. They discuss the steps taken to investigate and if/when the field operations personnel are satisfied that a re-start is justified, then the re-start process is initiated.

As indicated in the Oct 19 Submission, Pembina considered improvements related to its re-start procedures. As a result, under the current revised Protocol, the ECC Supervisory staff has to receive approval from Pembina management to re-start a pipeline after a shut-down due to an imbalance indication.

Please provide any documentation which supports the decisions to keep the pipeline operating from July 11th.

As noted in 1(a)(iv), after the nitrogen purge event at a location on the upstream gathering line connecting into Moosehorn Junction the ECC noted a 24 hour imbalance of approximately 0.54%. No need to shut-down the line was determined, since the metering and density issues noticed at the SHT aligned with the planned nitrogen purge. However, the recovery after the nitrogen purge was continuously monitored at the ECC using pressure trends.

What pipeline segments were included in the operational pressure test, how long was the hold period and what instruments were used to detect a pressure change?

On July 15, 2011, Pembina conducted a stand-up pressure test on the following five operating laterals:

- 4-9 Lateral;
- 10-28 Lateral;
- 10-17 Lateral;
- 10-32 Lateral; and
- 3-32 Lateral.

The 4-7 Lateral and the 10-19 Lateral were not operational from July 9, 2011 onwards due to insufficient cover and high flood levels on the Swan River.

Manual pressure gauges were installed and monitored on the LACT unit discharge and lateral connections into the 8 inch Mainline. The manual pressure gauge accuracy is +/- 1% of full scale (10,000 kPag in this case). The pressure transmitters were calibrated in April and October 2011. The calibration records can be found in Attachment D. In addition, some pressures were monitored by the ECC. The pressure was held and monitored for at least 1.5 hours.

In review of the incident, Pembina realizes that there needs to be a consistent field operations process for completing stand-up pressure tests and recording of the data. Pembina undertakes to provide the ERCB a draft of such process by January 31, 2012.

Given the known size of the crack, please correlate the test pressure, the accuracy of the instruments and the pressure hold period, and comment on the results.

Pembina is not able to answer this question, without an understanding of the exact existing soil conditions along the pipe outside the crack and is unable to comment on any potential correlation.

Comment on the pipeline right of way condition and any factors which may hinder the visual detection of leaks by a helicopter patrol.

The pipeline was flown by regular aerial patrol on July 7, 2011 and saw nothing unusual. There was no report generated from this flight since the aerial patrol company only reports on exceptions.

The pipeline right-of-way was flown by helicopter at 16:52 on July 15, 2011.

At the time of the flight, conditions were clear. No areas of concern were identified and for this reason, a report was not generated.

If there was a visible leak it is very likely that persons on the helicopter flight would have picked up the leak since the images from the aerial patrol on July 20, 2011 show a distinct darkened area.

Please see attached hereto as Attachment C a copy of a photograph taken during the helicopter over flight of July 20, 2011, showing the visible darkened area.

1 The segment was shut in at 07:42 on July 19th, 2011 and the location of the leak was discovered at 18:30 that day.

(a) Question related to Leak Detection and Leak Response

vi. Provide the report on the last leak test results prior to the failure.

Response:

The last leak test occurred on September 29, 2010. The simulation report and associated screen shots of the alarm tables are attached hereto as Attachment D.

Pembina can confirm that in this instance the Protocol was successfully implemented.

In the simulation report, for the alarm tables please note the Short Term 1 (ST1) which is the 5 minute level and the Short Term 3 (ST3) which is the 60 minute level. In this test the ST3 is the first and leading indicator telling the ECC Console operator there is a possibly of an integrity issue. The Long Term 3 (LT3) is the 24 hour level which also showed an alarm on this test.

1 The segment was shut in at 07:42 on July 19th, 2011 and the location of the leak was discovered at 18:30 that day.

(a) Question related to Leak Detection and Leak Response

vii. What steps does the Console Operator take to respond to an imbalance indication and shut down the pipeline? Does the console Operator have the authority and corporate support to shut down the pipeline?

Response:

What steps does the Console Operator take to respond to an imbalance indication and shut down the pipeline?

The Console Operator uses the Protocol as a guide.

As per the Protocol Reference B, the operator notifies the ECC Shift Foreman to discuss the trending and recommended course of action. If the discussion results in a shut-down decision, the line is shut-down by the ECC and field operations are contacted.

Further discussions take place between the ECC Console Operator and ECC Shift Foreman and applicable field operations personnel on investigating possible causes for the line imbalance/line integrity issue and the trending characteristics.

If the investigation shows further reason(s) for concern, discussions also include the ECC Supervisor(s)/Manager along with more senior field and head office operations personnel.

Does the Console Operator have the authority and corporate support to shut down the pipeline?

Yes.

1 The segment was shut in at 07:42 on July 19th, 2011 and the location of the leak was discovered at 18:30 that day.

(a) Question related to Leak Detection and Leak Response

viii. From the report to Alberta Environment (Attachment 12) the leak was discovered by an ATCO representative who notified a Devon Energy representative who in turn notified Pembina. What prevented Pembina from discovering the leak prior to third party notification at 18:30, almost 10 hours after the shut down of the pipeline?

Response:

Please note that the pipeline was shut-in by the ECC at 07:42 on July 19, 2011, at least ten hours prior to the referenced third party notification at 18:30 on the same date. In essence, out of the ordinary circumstances and a lack of immediate further follow-up physical investigations (even though the pipeline was already shut-in), prevented Pembina from discovering the leak prior to third party notification.

As further set out in this submission, Pembina has taken steps to avoid any potential reoccurrence of a similar event.

Initiatives/Actions taken by Pembina

The following is the sequence of events that took place on July 19, 2011 after shut-in took place at 07:42:

- At 08:43 the ECC operator emailed the ECC Supervisor and the District Manager that the pipeline segment was shut-in due to segment imbalance concerns.
- At 08:53 the ECC Supervisor emailed the field operator for the Swan Hills Area, and the ECC supervisors (which included the District Manager). The ECC Supervisor requested a reply related to the shut-in segment.
- At 11:58 the District Manager, who was the designate for the Swan Hills Area Supervisor (who was on vacation), emailed, while in the field, the ECC Supervisors and Swan Hills field operators to advise on the course of action related to checking the flow meters at the SHT. However, during the morning, the designated field operator became ill and went home sick, and did not review the email to him in a timely manner.
- At 15:25 the ECC Supervisor emailed the ECC operators and ECC Supervisors that the segment should remain shut-in unless directed by the District Manager or by the field operator.
- At 18:30, at least 10 hours after the pipeline was shut-down, a third party industry counterpart made an odor concern report to Pembina operations.

Pembina supports the actions of the ECC, and acknowledges the lack of confirmation that field staff received notification of the segment imbalance and shut-down of the pipeline in this instance. Pembina has revised the Protocol to include not only a notification of Field and ECC Supervisory Staff (please note Reference G in the Protocol), but now also requires absolute confirmation by direct phone contact that field operations personnel have received the relevant notification.

1 The segment was shut in at 07:42 on July 19th, 2011 and the location of the leak was discovered at 18:30 that day.

(a) Question related to Leak Detection and Leak Response

ix. Pembina's letter of October 19th suggests that Pembina is considering review of Pembina's "segment imbalance protocol" and consider enhancements for more extensive review and approval on re-start procedures." Provide more details on Pembina's reasons for this work and the scope of the review being considered.

Response:

Pembina reviews all incidents internally to understand such incidents and learn what contributed to any incidents. Based on this review, Pembina fully considers what it learns and implements any improvements to continuously improve its processes and procedures.

As a result of this incident, Pembina has improved and revised its Protocol.

Under the revised Protocol the ECC is now required to make direct phone contact with the field operations personnel and to ensure confirmation of receipt of notification. In addition, Pembina improved the Protocol by now requiring that all future pipeline re-start decisions be made by Pembina management, in full consultation with the ECC and Pembina Field Operations personnel. Management may require that the pipeline be fully ground-truthed before re-start.

1 The segment was shut in at 07:42 on July 19th, 2011 and the location of the leak was discovered at 18:30 that day.

(a) Question related to Leak Detection and Leak Response

- x. Pembina's letter of October 19th suggests that Pembina is considering incorporating geotechnical baseline data into Pembina field staff duties and Console Operator SCADA displays or reference notes. Please explain how the geotechnical baseline data would be used and how it would improve existing operations for leak prevention or leak detection.**

Response:

Review of geotechnical baseline data has been incorporated into the revised Protocol.

It acts as an information resource for both the ECC Console Operators, ECC Shift Foreman and field operations personnel to assist Pembina in making decisions on any additional investigation that may be required, identifying any potential impacts on the local environment and in contemplating any shut-down and re-start decisions.

The geotechnical information will also be used by field operations personnel to monitor areas during routine operations and assist them in identifying any changing conditions that may potentially affect a pipeline segment's overall integrity.

- 1 The segment was shut in at 07:42 on July 19th, 2011 and the location of the leak was discovered at 18:30 that day.**

(a) Question related to Leak Detection and Leak Response

- xi. The released volume calculation (Attachment 2) assumes that the drained volume was equally distributed over the 4 km length of the pipe resulting in a drainage percentage of 52%, however it is possible that the drained volume of 68.5m³ could have come only from the portion below the break. In this alternate scenario, the drainage percentage would be $68.5 / (130.8 - 52.5) = 87.5\%$ applying this percentage to the volume above the leak results in $52.5 \times 0.875 = 45.9$ m³ potentially available for drainage at the leak location. Therefore, maximum volume adjusted for error is 151.4 (imbalances) $- 19.8$ (error) $+ 45.9 = 177.5$ m³. Minimum volume assuming no leakage from above the leak would be $151.4 - 19.8 = 131.6$ m³. Therefore, revised range would be 131.6 (about 800 barrels) to 177.5 (about 1100 barrels). Please comment.**

Response:

The scenario suggested above is possible. However, it is Pembina's assessment that it is not likely, based on the information obtained during the line drain on the morning of July 20, 2011.

At that time, the line drain occurred by using a vacuum truck at the crossover point at LSD 10-18-67-9W5M. Once the line drain work commenced, it was observed at Break Point #1 location (please see the Attachment B map) that the volume of liquid flow at Break Point #1 started to subside and completely stopped before the full 68.5 m³ was taken from the pipe.

Due to the area topography, the complete 130.8 m³ of calculated line capacity for that 4 km of length could not be expected to be completely drained due to low spot holding traps.

Based on this observation and the regional topography, Pembina believes that its method of calculating the estimated release volume remains reasonable.

1 The segment was shut in at 07:42 on July 19th, 2011 and the location of the leak was discovered at 18:30 that day.

(b) Questions related to Previous Actions

- i. The pipeline on the north slope of the Moosehorn River was replaced in 2007 (129 m). Was the pipe exposed or removed? If the pipe was exposed or removed, what inspection and evaluation was done on the pipe, what were the findings?**

Response:

Was the pipe exposed or removed?

The pipe from the north slope of the Moosehorn River was removed and replaced in 2007.

If the pipe was exposed or removed, what inspection and evaluation was done on the pipe, what were the findings?

Circumferential stress corrosion cracking ("SCC") was discovered by magnetic particle inspection ("MPI") during an investigation of a metal loss indication in 2007.

Accordingly, the entire slope (129 metres) was replaced.

1 The segment was shut in at 07:42 on July 19th, 2011 and the location of the leak was discovered at 18:30 that day.

(b) Questions related to Previous Actions

- ii. On Page 16, under coating deterioration, in handling corrosion, a reference is made to Pembina's Defect Assessment and Repair Manual ("the Manual"). Provide a copy of the manual.**

Response:

Please see attached hereto as Attachment E a copy of the Manual.

1 The segment was shut in at 07:42 on July 19th, 2011 and the location of the leak was discovered at 18:30 that day.

(b) Questions related to Previous Actions

iii. What precautions does Pembina take in operating a pipeline with low frequency ERW seam?

Response:

On select pipelines fatigue-reducing operating procedures have been established to limit cyclic loading.

During integrity excavations additional conservatism is factored into the defect assessment process.

Pembina has developed procedures that limit grinding to 20% of the measured wall thickness in the long seam of pipe manufactured prior to 1970. (Please note section 5.5.2.1 (k) of the Manual attached hereto as Attachment E).

- 1 The segment was shut in at 07:42 on July 19th, 2011 and the location of the leak was discovered at 18:30 that day.

(b) Questions related to Previous Actions

- iv. In Line Inspection, how was the tool and frequency selected for the internal and external inspection of the pipeline? What were the findings of the 2010 inspection?

Response:

How was the tool and frequency selected for the internal and external inspection of the pipeline?

The inline inspection ("ILI") frequency on the pipeline is five (5) years. The inspection frequency was determined by feature correlation of consecutive tool runs.

What were the findings of the 2010 inspection?

From features identified on previous tool runs a comparison growth rate was estimated and applied to all features to determine the minimum length of time for any feature to reach a predicted rupture repair ratio ("RPR") less than 1.0 (RPR85dL value \leq 1.0 burst pressure/specified minimum yield strength ("SMYS")) and/or features reaching a depth of 70%. The 2010 magnetic flux leakage ("MFL") tool identified 7663 features which were mainly external metal loss. The table set out below has a summary of the features identified by the ILI.

Metal Loss Anomalies	7,583		
Corrosion Clusters		1542	20%
Internal Corrosion		40	0.55%
External Corrosion		5853	76%
Manufacturing Anomaly		65	0.85%
Metal Loss Under a Repair		83	1.1%
Deformation Anomalies	80		
Deformation – Dent Anomalies		38	0.5%
Deformation with Metal Loss		42	0.6%
TOTAL	7663	7663	100%

All features were assessed and repaired (if required) in accordance with CSA Z662 and the Manual.

1 The segment was shut in at 07:42 on July 19th, 2011 and the location of the leak was discovered at 18:30 that day.

(b) Questions related to Previous Actions

v. During the 2011 excavations, was magnetic particle inspection for SCC performed? If yes, what were the findings?

Response:

As a result of the 2010 ILI runs, 44 excavations were identified to take place on this pipeline system.

In 2011, MPI was performed at all 44 excavations and no SCC was found.

- 1 The segment was shut in at 07:42 on July 19th, 2011 and the location of the leak was discovered at 18:30 that day.**

(b) Questions related to Previous Actions

- vi. There are 14 areas that represent increased slope stability likelihood and have increased monitoring programs. What evaluation was done on the pipe at these locations to determine if SCC is present and what are the results?**

Response:

In the Oct 19 Submission letter Pembina noted fourteen areas of increased slope stability likelihood. In responding to this question we reviewed our data and were incorrect with the reference of fourteen and only have twelve areas identified with increased likelihood of slope instability. These twelve locations are listed in the document attached hereto as Attachment F.

Pembina has conducted on-site geotechnical investigations for all slopes. For some slopes, the geotechnical investigations have been conducted as many as 39 times. Slope Indicators have been installed at nine of the fourteen slopes to characterize and track ground movement at select sites.

Attachment F sets out the pipeline name, the location, the geotechnical monitoring, mitigation program, last inspection date and information related to the integrity digs to determine if SCC is present.

During the last eight years, pipeline segments in seven locations have been replaced and plans have been identified to replace certain pipeline segments and/or the SCC risks to the pipeline was mitigated. There are two locations where integrity excavations are planned for Q1 2012, and one integrity dig program planned for 2013. There were two locations where integrity digs were completed in 2011 and no SCC was found.

1 The segment was shut in at 07:42 on July 19th, 2011 and the location of the leak was discovered at 18:30 that day.

(b) Questions related to Previous Actions

vii. What inspections or Direct Assessment was done on this pipeline for SCC? What was the SCC monitoring and mitigation program? Provide details of all SCC investigation work and results.

Response:

What inspections or Direct Assessment was done on this pipeline for SCC?

As per response 1(b)(v), the 2010 ILI runs identified 44 excavations on this pipeline system. During 2011, MPI was performed at all 44 excavations and no SCC was found.

What was the SCC monitoring and mitigation programs?

Since 2000, Pembina's inspection and monitoring program on this pipeline has consisted of conducting MPI at all integrity dig sites to investigate for the presence of SCC. From the integrity excavations there has only been one reported dig that showed SCC. This was in 2007 as discussed in section (i) above.

Provide details of all SCC investigation work and results?

As noted in 1(b)(i) the only reported integrity dig with SCC was in 2007 and the pipeline segment was replaced.

1 The segment was shut in at 07:42 on July 19th, 2011 and the location of the leak was discovered at 18:30 that day.

(b) Questions related to Previous Actions

viii. How was the severity of SCC assessed? What criteria were used for removal of found SCC?

Response:

How was the severity of SCC assessed?

Prior to 2010 the Manual (attached hereto as Attachment E) specified how SCC, was to be assessed and repaired as follows:

- All examination was to be performed by a Canadian General Standards Board Level II inspector.
- During integrity excavations, visual inspection of coating condition was noted for areas requiring further investigation.
- To detect the presence of SCC, the inspection technique carried out was wet florescent magnetic particle in accordance with ASTM E709-95.
- Canadian Energy Pipeline Association ("CEPA") SCC guidelines for evaluation and CSA Z662 for repair of SCC were followed. SCC was repaired by grinding up to a maximum of 40% wall thickness, sleeve or cut-out as required.
- Grinding is carried out in increments of approximately 10%. Ultrasonic testing was continuously used and the readings recorded to monitor the actual wall thickness remaining after each grinding interval.

What criteria were used for removal of found SCC?

- Wet fluorescent magnetic particle inspection was used to confirm the complete removal of SCC.
- In cases where SCC is completely removed by grinding <40% of the wall thickness, an RSTRENG calculation is used on the grind area to calculate predicted burst pressure to determine if additional repair methods are required. In cases where SCC remains after grinding up to 40% wall thickness, sleeve or cut-out repair methods are employed.

- 1 The segment was shut in at 07:42 on July 19th, 2011 and the location of the leak was discovered at 18:30 that day.**

(b) Questions related to Previous Actions

- ix. Page 16 of the October 19th letter, the last line above point (11) is not complete, please provide the missing information.**

Response:

The last sentence in the paragraph should read:

All pipelines within the system with high susceptibility to SCC have either been investigated or mitigated. Mitigation can consist of pipe replacement by horizontal directional drills, exposing and stress relief or exposing and recoating with a superior coating.

1 The segment was shut in at 07:42 on July 19th, 2011 and the location of the leak was discovered at 18:30 that day.

(b) Questions related to Previous Actions

- x. Pembina evaluated other pipelines within Swan Hills and all pipelines with high susceptibility to C-SCC have either been investigated or mitigated. What investigations were done and what were the results? Were investigations done in the areas that were mitigated?**

Response:

What investigations were done and what were the results?

There are four other areas within the Swan Hills region that are known to have slope instability concerns:

- In 2011 one location had integrity digs completed and no SCC was found.
- In 2012 there is an integrity dig planned at one location.
- In two locations there is a pipe above ground and one location that the pipeline was replaced in 2004 and SCC is not of concern due to the coating being yellow jacket.

Please see attached hereto as Attachment G a copy of a table setting out further details related to the four other areas in the Swan Hills region that have known slope instability concerns.

Were investigations done in the areas that were mitigated?

Please refer to the Swan Hills Other Areas of Slope Instability document in Attachment G for the geotechnical monitoring and mitigation done on each of the four other areas within the Swan Hills region that Pembina is monitoring.

- 1 The segment was shut in at 07:42 on July 19th, 2011 and the location of the leak was discovered at 18:30 that day.**

(c) Questions related to Future Actions

- i. Segment 1. Letter of November 2 suggests that Segment 1 will be replaced by a new 8 inch pipeline. What precautions will be taken during the design, construction and operation of the replacement pipeline to ensure integrity threats will be addressed?**

Response:

The Segment 1 pipeline replacement, suggested in the ERCB November 2 letter, will be designed, constructed, and operated in accordance to CSA Z662-11 as well as Pembina Engineering Specification and Operating Procedures.

The Pipeline will be protected with a fusion bond epoxy coating system that will minimize the likelihood of SCC developing.

Pembina will continue to monitor potential slope movement that could contribute to stress on the pipeline.

Pembina is also investigating the installation of strain gauges directly to the pipe that will provide indication of pipe stress.

- 1 The segment was shut in at 07:42 on July 19th, 2011 and the location of the leak was discovered at 18:30 that day.**

(c) Questions related to Future Actions

- ii. Segment 3. What precautions will be taken during the design, construction and operation of the replacement 4 inch pipe to ensure all integrity threats will be addressed?**

Response:

The Segment 3 pipeline replacement will be designed, constructed, and operated in accordance with CSA Z662-11 as well as Pembina Engineering Specification and Operating Procedures.

The Pipeline will be protected with a coating system (fusion bond epoxy or extruded polyethylene) that will minimize the likelihood of SCC developing.

As presented to the ERCB during the August 18, 2011 back to service discussion, the relatively flat terrain associated with Segment 3 of the pipeline minimized the potential stresses on the pipeline due to slope movement.

1 The segment was shut in at 07:42 on July 19th, 2011 and the location of the leak was discovered at 18:30 that day.

(c) Questions related to Future Actions

iii. Describe the SCC direct assessment excavation program, including criteria for selecting dig site and timing of the digs.

Response:

Pembina's SCC direct assessment program follows in large part the CEPA Recommended Practices for Managing Circumferential SCC. The program was developed and ready to be executed in November 2011. The direct assessment program will not be executed due to the decision to abandon the existing pipeline and to replace the pipeline with a new pipeline.

Please see attached hereto as Attachment H, details of the study and criteria for selecting dig sites.

- 1 The segment was shut in at 07:42 on July 19th, 2011 and the location of the leak was discovered at 18:30 that day.**

(c) Questions related to Future Actions

- iv. How will the severity of the SCC be assessed (depth and length)? What criteria will be used for the removal of found SCC?**

Response:

How will the severity of the SCC be assessed (depth and length)?

The direct assessment program will not be executed due to the decision to abandon the existing pipeline and to replace it with a new pipeline.

The manner in which Pembina assesses the severity of SCC is described in detail in Section 5.3.14 of the Manual attached hereto as Attachment E.

What criteria will be used for the removal of found SCC?

If found, SCC needs to be removed. Section 5.4.3 of the Manual and Table 10.1 of CSA Z662 sets out the information that defines the criteria for repairing crack-like defects, including SCC repairs.

2. Questions related to Emergency Response Plan (“ERP”)

- i. Please provide Pembina’s emergency procedures for the Crisis Communications Team.**

Response:

In Pembina’s Corporate ERP there are four designated Incident Command System (“ICS”) roles that are responsible for ensuring that Pembina’s Crisis Communications Team is engaged in an emergency. The ICS roles are as follows:

- Calgary On-Call Person
- Incident Commander Support
- Public Information Support
- Public Information Officer

The list of duties for each ICS role can be found in Section 4 of the ERP included as Attachment 3 of the Oct 19 Submission.

In addition to the ICS roles, the Crisis Communications Team maintains its own specific Crisis Communications Plan. The Crisis Communications Plan is attached hereto as Attachment I. The Crisis Communications plan designates roles and procedures within the team itself. This document is reviewed, revised and updated at least annually, to ensure it meets industry best practices and regulatory compliance.

2 Questions related to Emergency Response Plan (“ERP”)

- ii. **Is the phone number for Incident Commander Tim McAfee considered to be Pembina’s 24-hour emergency number? If not, please provide the 24-hour emergency contact number.**

Response:

The supplemental Emergency Response Plan Moosehorn Junction Response was prepared specifically for the Moosehorn spill (“Moosehorn ERP”). The Moosehorn ERP was included in the Oct 19 Submission as Attachment 3.

The number provided on the front page of the Moosehorn ERP is the incident commander’s cell number and not the 24-hour emergency number.

The 24 hour emergency number is set out in the ERP, the Moosehorn ERP and is posted on all Pembina pipeline crossing signs.

The 24 hour emergency number is 1-800-360-4706. Calls to this line are routed to the ECC.

2 Questions related to Emergency Response Plan (“ERP”)

- iii. **In Section 2.4, page 2-5, Pembina’s Incident Response Table indicated that the ERCB is only to be notified of an alert level incident if the public or media is contacted. Is this referring to the ERCB Communication group or the ERCB in general? Are Pembina’s personnel expected to contact the local ERCB Field Centre at all levels of incidents?**

Response:

Is this referring to the ERCB Communication group or the ERCB in general?

Please note that Pembina relied upon the information set out in ERCB Directive 71 Appendix 4, Table 4 Incident Response. The notification refers to the ERCB in general (i.e. the local ERCB field centre is to be notified).

Are Pembina’s personnel expected to contact the local ERCB Field Centre at all levels of incidents?

As set out in the ERP, the Liaison Officer is required to confirm the level of any incident with the appropriate government authority before the level is announced.

All affected persons and the media must be kept informed of the status of an emergency.

Pembina’s expectation is that personnel are to contact the appropriate government authority at Level 1, 2 or 3 incidents to review and confirm the appropriate emergency level, and at a minimum the ERCB field centre will be contacted at an Alert level if the public or media are contacted.

Pembina may choose to notify the ERCB field centre at an Alert level even if the public or media are not contacted. This reporting protocol was complied with on this incident.

2 Questions related to Emergency Response Plan (“ERP”)

- iv. In its summary of the event, Pembina indicates that the release was discovered on July 19, 2011 at 18:30 hours and the emergency equipment was dispatched at 20:00 hours that same day. Why was the ERCB Field Office not notified until 06:50 hours on July 20, 2011?**

Response:

Pembina initiated its ERP immediately upon discovery of a product release on the Pembina right-of-way and immediately exerted its efforts towards establishing control and containment of the release. The response operations centre was established at 19:00 and 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.

Pembina's emergency responder training consistently and clearly identifies the importance of immediate notification of the appropriate authorities. Pembina emphasises the importance of this.

While undertaking a concerted effort to organize and implement a significant spill response and cleanup operation, Pembina clearly did not follow its own ERP in promptly contacting the regulatory agencies including the ERCB until 06:50 on July 20, 2011 as would normally be expected and required.

Because of the unique culmination of the events in this specific incident and having implemented improvements in execution of its ERP process, Pembina believes that it has now put procedures in place that would prevent a similar culmination of events to take place.

Pembina recognizes that delegating certain responsibilities may have prevented the delay in notification to the ERCB and Pembina confirms that it understands the importance of early notification to the ERCB.

2 Questions related to Emergency Response Plan (“ERP”)

v. Please describe Pembina’s procedures for standing-down an incident.

Response:

Personnel continually monitor an emergency situation, and discuss if/when it can be downgraded. This discussion is held between the Incident Commander, the Operations Section Chief and the Liaison Officer in the field and they may include the Emergency Operations Manager in Calgary.

Pembina contacts the ERCB and the ERCB Field Centre. The ERCB has to confirm the appropriateness of any decision to change any emergency status and public announcement. Once downgraded, any government agencies and stakeholders contacted during the escalation of the situation must also be notified of the change in status.

Pembina received phone confirmation from the ERCB on Sunday July 24, 2011 that the ERCB had reduced the emergency level from a Level 1 to an Alert level.

INDEX OF ATTACHMENTS

Attachment A	Pembina Segment Imbalance Response Protocol
Attachment B	Pipeline Segment Map
Attachment C	Photo taken during helicopter over flight of July 20, 2011
Attachment D	Simulation Report and associated screen shots of the alarm tables
Attachment E	Pembina's Defect Assessment and Repair Manual
Attachment F	Swan Hills Areas of Slope Instability
Attachment G	Swan Hills Other Areas of Slope Instability
Attachment H	Direct Assessment Dig Program Overview
Attachment I	Crisis Communications Plan