

Moosehorn 8 inch Pipeline

Line Balance Data

Initial Release Estimate Calculation

Date	Daily PLM Balance (m3) ¹	Comments	
01-Jul-11	-4.1	Average flow rate was 1450 m ³ /d. Average imbalance was 2.2 m ³ /day or 0.15%.	
02-Jul-11	0.1		
03-Jul-11	-3.4		
04-Jul-11	-1.8		
05-Jul-11	-1.4		
06-Jul-11	-2.3		
07-Jul-11	-2.1		
08-Jul-11	-2.2		
09-Jul-11	-214.3	4-07 and 10-19 nitrogen purge completed on upstream gathering line, unrelated to July 19, 1011 release event	8" line not flowing due to blowing down nitrogen
10-Jul-11	-45.5	Nitrogen through balance meter	
11-Jul-11	-4.8	Average flow rate was 877 m ³ /day. Imbalance ranged from 0.6% to 3.9%.	
12-Jul-11	-8.3		
13-Jul-11	-14.0		
14-Jul-11	-19.7		
15-Jul-11	-22.1		
16-Jul-11	-25.2		
17-Jul-11	-28.3		
18-Jul-11	-25.0		
19-Jul-11	-4.0		Based on PLM current day balance, segment was shut in at 0742 hr

¹ Pembina system uses a 0.5% imbalance limit in leak detection protocol

Initial Estimate for Product Released based on Total Daily Segment Imbalance Data

Date	Daily PLM Balance (m ³) ¹
11-Jul-11	-4.8
12-Jul-11	-8.3
13-Jul-11	-14.0
14-Jul-11	-19.7
15-Jul-11	-22.1
16-Jul-11	-25.2
17-Jul-11	-28.3
18-Jul-11	-25.0
19-Jul-11	-4.0

Total -151.4 m³
Line Drain 52.5 m³ (maximum)
Total Volume -203.9 m³ (1283 barrels)

Imbalance volumes as shown by system for July 11 - 19, 2011 are 151.4 m³.

Calculated volume from the pipeline break point to the top of the hill towards the Swan Hills terminal is 52.5 m³.

$151.4 + 52.5 = 203.9 \text{ m}^3$ or 1283 barrels (rounded up to 1300 barrels to be conservative)

Step 1. For Detailed Calculation of Release Volume as of August 3, 2011

- On the morning of July 20, 2011 68.5 m³ of product was removed out of the 8" pipeline from the bottom of the hill to south of the break point and once we started pumping out the pipeline the break point total seepage stopped, so line was likely then fully drained.
- By dividing the 68.5 m³ of volume removed at the bottom of the hill from top of hill above the break point by the total capacity of that length of pipe and then applying that ratio to the 52.5 m³ calculated volume to come up with a reasonable figure of how much may have been in the pipe above the break point.
- The total distance from bottom of hill where we removed volume to top of hill above break point is approximately 4 kilometres.
- The total calculated capacity of that segment held 32.7 m³ per km x 4 km = 130.8 m³. Pembina recovered 68.5 m³ or $68.5/130.8 = 52.4\%$.

$52.4\% \text{ of the } 52.5 \text{ m}^3 = 27.5 \text{ m}^3$

$52.5 - 27.5 = 25.0 \text{ m}^3$ potential release from above the break point.

$151.4 + 25.0 \text{ or } 176.4 \text{ m}^3$ (1110 barrels.)

Step 2. Factor in recent historical background line imbalance date

For the period July 1 to July 8, 2011 with average flowrates of 1450 m³/day, average background line imbalance was 2.2 m³/day or 0.15%.

Therefore, over the 9 day period July 11 to July 19, 2011 the leaked volume may be overstated by 2.2 m³/day x 9 days = 19.8 m³.

Step 3. Calculation of Range of Potential Release Estimate

Maximum = 176.4 m³ from step 1 less the 19.8 m³ = 156.6 m³
= 156.6 m³ or approximately 985 barrels (1000 barrels)
Minimum = 176.4 m³ – 19.8 m³ = 156.6 m³

If most of the oil had actually drained from above and North of the actual break point then 25 m³ of potential release, as calculated in step 1 above for 176.4 m³ was not fully leaked
= 156.6 - 25 = 131.6 m³ (828 barrels) – use 800 barrels

Revised release range estimate = 800 to 1000 barrels as of August 3, 2011.