

**ONTARIO ENERGY BOARD**

IN THE MATTER OF the Ontario Energy Board Act, 1998, S.O.1998, c.15, Schedule B;

AND IN THE MATTER OF an Application by Pembina Infrastructure and Logistics LP for a permit to drill hydrocarbon injection and withdrawal wells within the vicinity of the Moore 3-21-XII Designated Storage Area and to expand the storage capacity at the Corunna Storage Terminal;

AND IN THE MATTER OF Ontario Energy Board File Number EB-2015-0032

**Responses of Pembina Infrastructure and Logistics LP
to Interrogatories of Ministry of Natural Resources and Forestry dated June 17, 2016**

Interrogatory #1

Reference: With respect to Risk Assessment Cavern 45 Re-Drill dated April 20, 2016

**Question/
Request:**

- a) Please advise if the Risk Assessment provided any hazards where risks were deemed to unacceptable and have not yet been dealt with.
- b) As per Pembina NGL Corporation Corunna Storage Facility Cavern 45 Assessment of Neighboring Activities, please confirm that there are no expected adverse consequences on nearby storage natural gas storage facilities, nearby local subsurface aquifers and other cavern storage operations.

Response:

- a) The Risk Assessment Cavern 45 Re-Drill dated April 20, 2016 (the "Risk Assessment") did not identify any hazards where the risks were deemed to be unacceptable. The Risk Assessment identified two risks where mitigation was recommended. Upon receipt of approval, Pembina intends to fully implement these recommendations as part of the Cavern 45 Project.
- b) Confirmed. The conversion of Cavern 45 to a hydrocarbon storage cavern is not expected to have adverse consequences on any neighboring or nearby natural gas storage facilities, local subsurface aquifers or other storage cavern operations.

Interrogatory #2

Reference: With respect to the March, 2016 Geomechanical Review by Respec

**Question/
Request:**

- a) Please advise if there are any identified concerns with reference to Cavern 45 that would limit its size dimensions or distance to adjacent facilities?
- b) The CSA Z341 requires a minimum S:D ratio of 2:1. Respec concludes in its report that this may not be possible. Please provide your comments on the implications of not meeting this requirement.



- c) With respect to the distances between caverns (inter-cavern spacing), are there any issues identified that may impact planned storage operations? If yes, please provide what measures will be undertaken to address these issues.

Response:

- a) No there are not any identified concerns with reference to Cavern 45 that would limit its size dimensions or distance to adjacent facilities.
- b) Having reviewed the March, 2016 Geomechanical Review by Respec (the “Respec Report”), Pembina was unable to locate in the report the statement that the S:D ratio required by CSA Z341 would not be met as referred to in this Interrogatory.

The Respec Report concluded that Cavern 45 S:D Ratio is 2.55 to the closest cavern, Cavern 51. This is outlined in: the Cavern Metrics table contained in Section 5.17 (an excerpt is reproduced below); the Suspended Caverns Suitable for Conversion to Hydro Carbon Storage table in Section 6.2; and the ES-1 Summary of Sarnia Cavern Metrics (an excerpt is reproduced below) of the Respec Report. These references confirm that Cavern 45 will have a S:D ratio above 2.0 in ten years. Accordingly, Cavern 45 meets the required S:D ratio of 2:1 as per the CSA Z341 requirement.

Excerpt For Geomechanical review.

CAVERN METRICS

| | | |
|--|---------------------|------------------------|
| Most Recent Sonar Survey | Date | 7-May-2015 |
| | Total Volume | 277,811 m ³ |
| P:D_{min} (Adjacent Cavern) | Last Sonar | 1.55 (Cavern 51) |
| | 1-Jan-16 | N/A |
| | 1-Jan-26 | N/A |
| S:D_{min} (Adjacent Cavern) | Last Sonar | 2.55 (Cavern 51) |
| | 1-Jan-16 | N/A |
| | 1-Jan-26 | N/A |
| Maximum Cavern Diameter | 109 meters | Figure 5-63 |
| Minimum Web Thickness | 169 meters | Figure 5-64 |

Table 6-2. Suspended Caverns Suitable for Conversion to Hydrocarbon Storage

| Cavern I.D. | S:D Ratio | Roof Salt Thickness (m) | Cavern Diameter (m) |
|--------------------|------------------|--------------------------------|----------------------------|
| 12 | 2.05 | 63 | 59 |
| 45 | 2.55 | 14 | 109 |
| 71 | 2.33 | 53 | 78 |



Excerpt from the Geomechanical Report:

Predicted $S:D$ Ratio Relative to CSA Requirements ($S:D > 2$)

- $S:D > 2.0$ for the next 10 years ■
- $S:D > 2.0$ on 1-Jan-16, but be less than 2.0 in the next 10 years ■
- $S:D < 2.0$ on 1-Jan-16 ■

Table ES-1. Summary of Sarnia Cavern Metrics (Page 1 of 2)

| Cavern I.D. | Roof Salt Thickness (m) | Hydraulically Connected | Date (Result) of Most Recent MIT | Minimum S:D (1-Jan-16) | Uncased Borehole (m) | Overall Condition |
|-------------|-------------------------|-------------------------|----------------------------------|------------------------|----------------------|---------------------|
| 45 | 14 | No | N/A | 2.55 | 157 | Monitoring Required |

- c) No issues were identified that may impact planned storage operations.