

November 29, 2017

0320-4100-32640-02

Dave Kelly, P. Geo
Senior Geologist
Canbriam Energy Inc.
2100, 215 – 2nd Street S.W.
Calgary, Alberta T2P 1M4

Dear Mr Kelly,

**RE: PRODUCED WATER DISPOSAL SPECIAL PROJECT APPROVAL
CANBRIAM HZ ALTARES d-76-H/94-B-08; WA# 31916
ALTARES FIELD – BALDONNEL FORMATION**

The Commission has reviewed Canbriam Energy Inc.'s application, dated October 12, 2017, for produced water disposal into the subject well, Baldonnell formation. Commission and Canbriam staff reviewed technical details of the application during a meeting on October 30th. The subject deviated well (not horizontal) was purpose-drilled in March 2017 for disposal into the Baldonnell and Upper Charlie Lake formations. Canbriam completed three zones in the wellbore, indicated as Baldonnell, Upper Charlie Lake Marker 1, and Upper Charlie Lake Marker 3. As the Upper Charlie Lake Marker 3 zone did not accept fluids upon test, Canbriam intends to abandon this zone, and it is not included within this approval. Upon Commission review, the two injection intervals are both identified within the Baldonnell formation.

Attached please find **Order 17-02-015**, designating an area in the Altares field – Baldonnell formation as a Special Project under section 75 of the *Oil and Gas Activities Act*, for the operation and use of a storage reservoir for the disposal of produced water. This Order contains a number of detailed operational conditions, including a maximum wellhead injection pressure, a requirement for continuous tubing and casing pressure monitoring, and an ultimate reservoir pressure limit. The pressure testing frequency is set to every 6 months, based on the performance of the nearby Baldonnell water disposal well Canbriam Altares B15-1-85-26 WA# 27473, which reached maximum pressure in less than one year. Continuous seismic monitoring is required; to monitor for potential reservoir pressure response, and provide information should seismic events occur. Seismic events of concern attributed to this well may result in an amendment to this Order to alter disposal operations, or termination of this Order.

For the inspection requirement of Order condition 2o), please arrange via email to OGCPipelines.Facilities@bcogc.ca.

Please note that disposal of fluid with high total dissolved solids content requires adjustment of the wellhead injection pressure to remain below formation fracture pressure, as per condition 2(b).

Should you have any questions, please contact Michelle Harding at (250) 419-4493 or Ron Stefik at (250) 419-4430.

Sincerely,



Ron Stefik, Eng.L.
Supervisor, Reservoir Engineering
Oil and Gas Commission

Attachment

ORDER 17-02-015

- 1 Under Section 75(1)(d) of the *Oil and Gas Activities Act*, the Commission designates the operation and use of a storage reservoir for the disposal of produced water, including flowback from fracturing operations, into the Baldonnel formation – Altares field as a special project in the following area:
NTS 94-B-08 Block H Unit 76
- 2 Under section 75(2) of the *Oil and Gas Activities Act*, the special project designation in this Order is subject to the following conditions. The Permit Holder shall:
 - a) Inject produced water only into the well Canbriam HZ Altares d-76-H/94-B-08; WA# 31916 – Baldonnel formation (disposal perforations 1600.0 – 1653.0 mKB MD).
 - b) Not exceed an injection pressure, measured at the wellhead on the subject well, of 12,020 kPag or the pressure required to fracture the formation, whichever is lesser.
 - c) Inject only through tubing with a packer set as near as is practical above the injection interval.
 - d) Continually measure and record the wellhead casing and tubing pressures electronically.
 - e) Continually observe and record seismic events within a 5 km radius of the well Canbriam HZ Altares d-76-H/94-B-8; WA #31916, using a monitoring program that;
 - i) is capable of real-time monitoring;
 - ii) has a magnitude detection of 1.5Mw and greater;
 - iii) has hypocenter accuracy to within ± 500 metres;
 - f) Before commencing disposal operations, install and fully activate an accelerometer within 1 km of the wellsite able to record three components of ground acceleration with a minimum detectability of 0.005g and a dynamic range of $\pm 2g$.
 - g) Report the results of seismicity monitoring in Item e) and f), including date, time, location, magnitude, ground acceleration and depth of seismic events, to the Oil and Gas Commission (Commission) via email to Reservoir@bcogc.ca, at 1 month intervals, commencing one month from the date that disposal begins, or upon request.
 - h) Cease injection and notify the Commission immediately if hydraulic isolation is lost in the wellbore or formation.
 - i) Submit the annual packer isolation test report to the Commission within 30 days of the completion of the test.
 - j) Include the disposal operating hours and the maximum injection pressure value on the monthly BC-S18 disposal statement.
 - k) Conduct a reservoir pressure test on the formation in the subject well once every 6 months commencing from the date of initial disposal, with a shut-in period of sufficient length to provide data for calculation of the reservoir pressure, and submit a report of the test within 60 days of the end of the test.
 - l) Cease injection upon reaching a maximum formation pressure of 18,840 kPaa, measured at 1570.1 mKB TVD.

- m) i) Perform a casing inspection log on the subject well and submit results to the Commission within 30 days of the completion of logging, at an interval of not more than every 10 years, commencing from the date of initial disposal.
- ii) Perform a hydraulic isolation temperature log on the subject well and submit results to the Commission within 30 days of the completion of logging, at an interval of not more than every 5 years, commencing from the date of initial disposal.
- n) Not conduct a hydraulic fracture stimulation on any formation in the subject well without prior Commission approval.
- o) Complete an inspection, satisfactory to the Commission, within 4 weeks of initial disposal operations.



Ron Stefik, Eng.L.
Supervisor, Reservoir Engineering
Oil and Gas Commission

DATED AT the City of Victoria, in the Province of British Columbia, this 29th day of November, 2017.

Advisory Guidance for Order 17-02-015

- I. A production packer must be set above the injection interval and the space between the tubing and casing filled with corrosion and frost inhibiting fluids, as per section 16(2) of the Drilling and Production Regulation.
- II. Annual packer isolation tests are required to be submitted, as per section 16(3) of the Drilling and Production Regulation.
- III. Injected fluids must be metered and the injection pressure measured at the wellhead, as per section 74 of the Drilling and Production Regulation.
- IV. A monthly disposal statement must be submitted to the Commission not later than the 25th day of the month following the reported month, as per section 75 of the Drilling and Production Regulation.
- V. Seismic events must be reported and disposal operations suspended as per section 21.1 of the Drilling and Production Regulation.