

April 24, 2020

8157-2800-32640-02

Deb Gogol, P.Tech (Eng.)
Sr. Engineering Technologist
Ovintiv Canada ULC
500 Centre Street SE, PO Box 2850
Calgary, Alberta T2P 2S5

Dear Ms. Gogol,

**RE: PRODUCED WATER DISPOSAL SPECIAL PROJECT
APPROVAL AMENDMENT #2
ECA HZ TOWER A5-11-81-18 W6M; WA# 32377
TOWER LAKE FIELD – CADOMIN FORMATION**

Approval for disposal of produced water was issued for the subject well, Cadomin formation, on August 31, 2017. Disposal operations at this site have consistently been within the Order limits, with a total disposal volume to-date of 342,775 m³.

Seismic events can occur as a result of disposal operations if fault orientation and rock stresses are favorable for movement. Recent low level seismic events near the subject well may be due to disposal activities at this well.

Attached please find **Order 17-02-011 Amendment #2** designating an area in the Tower Lake field, Cadomin 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 amendment establishes the measurement and reporting criteria for seismic monitoring, with active monitoring commencing by April 30, 2020. The existing near-field seismometer array and accelerometer are capable of accurately locating event hypocenters and will enable study of the seismicity cause and potential mitigations. Guidance for ground motion monitoring can be found here: <https://www.bcogc.ca/node/13256/download>. No other conditions of the Order have been modified.

Should you have any questions, please contact Michelle Gaucher at (250) 419-4482 or the undersigned at (250) 419-4430.

Sincerely,



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

Attachment

ORDER 17-02-011 Amendment #2

- 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 Cadomin formation – Tower Lake field as a special project in the following area:
DLS Twp 81 Rge 18 W6M Section 11 – Lsds 1, 2, 3, 4, 5, 6, 7 and 8
- 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 ECA HZ Tower A5-11-81-18; WA# 32377 – Cadomin formation (open hole from 1563.0 – 2534.0 mKB MD).
 - b) Not exceed an injection pressure, measured at the wellhead on the subject well, of 18,000 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) Install and fully activate a monitoring program, by April 30, 2020, to observe and record seismic events within a 5 km radius of the well ECA HZ Tower A5-11-81-18; WA #32377, that:
 - i) is capable of real-time monitoring;
 - ii) has a magnitude detection of 2.5Mw and greater;
 - iii) has hypocenter accuracy to within ± 500 metres;
 - f) Install and fully activate an accelerometer, by April 30, 2020, within 5 km of the wellsite able to record three components of ground acceleration with a minimum detectability of 0.8%g and a dynamic range of +/- 2g. For each event of 0.008g and above or felt event, the SEED file containing instrument response and waveform from 30 seconds before the observed event and 60 seconds after, must be submitted.
 - g) Report the results of seismicity monitoring in items 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 Ron.Stefik@bcogc.ca and Jeff.Johnson@bcogc.ca. at 1 month intervals, commencing one month from the date that monitoring 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) Conduct and submit an annual Surface Casing Vent Flow test to the Commission within 30 days of the completion of the test.
 - k) Include the disposal operating hours and the maximum injection pressure value on the monthly Petrinex disposal report.
 - l) Conduct an annual reservoir pressure test on the formation in the subject well, 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.
 - m) Cease injection upon reaching a maximum formation pressure of 13,070 kPaa, measured at 1327.9 mKB TVD.

- n) 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.
- o) 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.
- p) Not conduct a hydraulic fracture stimulation on any formation in the subject well without prior Commission approval.



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

DATED AT the City of Victoria, in the Province of British Columbia, this 24th day of April, 2020.

Advisory Guidance for Order 17-02-011 Amendment #2

- 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 via Petrinex not later than the 20th 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.