

January 30, 2020

8157-2800-32640-02

Deb Gogol, P.Tech (Eng.)
Sr. Engineering Technologist
Encana Corporation
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 A16-6-81-17 W6M; WA# 32483
TOWER LAKE FIELD – CADOMIN FORMATION**

Approval for disposal of produced water was issued for the subject well, Cadomin formation, on January 4, 2018. Disposal operations at this site have consistently been within the Order limits, with a total disposal volume of 358,285 m³.

Seismic events can occur as a result of disposal operations if fault orientation and rock stresses are favorable for movement. Recent seismic events near the subject well may be due to hydraulic fracturing or disposal activities. Installation of a near-field seismometer array and site accelerometer is required to accurately locate event hypocenters and enable study of the seismicity cause and potential mitigations. This Order amendment establishes the measurement and reporting criteria for seismic monitoring, with active monitoring commencing by January 31, 2020. Guidance for ground motion monitoring can be found here: <https://www.bccgc.ca/node/13256/download>.

Attached please find **Order 17-02-017 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.

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

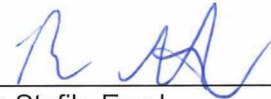
ORDER 17-02-017 Amendment #2

- 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 17 W6M Section 5 – Lsds 3, 4, 5, 6, 11, 12, 13 and 14

DLS Twp 81 Rge 17 W6M Section 6 – Lsds 9, 10, 15 and 16
- 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 A16-6-81-17; WA# 32483 – Cadomin formation (open hole from 1548.0 – 2548.0 mKB MD).
 - b) Not exceed an injection pressure, measured at the wellhead on the subject well, of 17,870 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 January 31, 2020, to observe and record seismic events within a 5 km radius of the well ECA HZ Tower A16-6-81-17; WA #32483, 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 January 31, 2020, within 2.5 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 $\pm 2g$. 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 13,510 kPaa, measured at 1317.4 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 ^{30th} day of January, 2020.

Advisory Guidance for Order 17-02-017 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.