

March 11, 2016

7750-2800/2850-32640-02

Mr. Rod McDougall, P. Eng
Canadian Natural Resources Ltd.
Suite 2500, 855 – 2nd Street S.W.
Calgary, AB T2P 4J8

Dear Mr. McDougall:

**RE: WATER SOURCE AND PRODUCED WATER DISPOSAL WELL, AMENDMENT #1
CNRL SEPTIMUS A7-5-82-19 W6M; WA# 22061
SEPTIMUS FIELD - CADOMIN AND NIKANASSIN FORMATIONS**

On January 13, 2016, the Commission notified Canadian Natural Resources Limited (CNRL) of concerns regarding potential induced seismicity resulting from operations at the subject well. An NRCAN recorded, and felt, seismic event of magnitude 3.86 occurred on November 29, 2015, in proximity to the subject well. NRCAN previously detected a number of seismic events in the area of this well. Due to a location margin of error of several kilometers, and lack of other local activity, these events could likely be attributed to the operation of this specific well. A thrust fault has been mapped at the depth of the Cadomin formation at the location of the subject well. Casing deformation identified in this wellbore required the installation of a series of packers to isolate the effected portion of the well.

The Commission is concerned that continued disposal at recent rates and pressure have a likelihood of triggering additional events with potential associated loss of wellbore integrity and fluid containment. Following consultation with CNRL, the Commission is issuing the attached Order 13-02-004 Amendment #1, lowering the maximum injection pressure and requiring refined seismic monitoring, to evaluate the effectiveness of this mitigation measure.

Additional amendment or termination of this disposal approval may be required. Formation pore pressure, a trigger for induced seismicity, may be reduced by alternating utilization of this well for water source, as initially proposed.

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 13-02-004 AMENDMENT #1

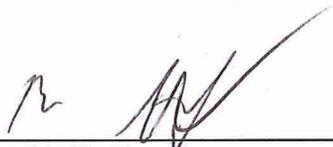
1. Under Section 75(1)(d) of the *Oil and Gas Activities Act*, the Oil and Gas Commission (Commission) designates the operation and use of a storage reservoir for the disposal of produced water, including flowback from fracturing operations, into the Cadomin and Nikanassin formations – Septimus field as a special project in the following area:

DLS Twp 82 Rge19 W6M Section 5 - Lsds 1, 2, 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, including well flowback completion fluids, only into the well CNRL Septimus A07-05-082-19 (Well Permit # 22061), Cadomin (1141.0 mKB to 1165.0 mKB) and Nikanassin (1269.0 mKB to 1280.0 mKB) formations.
 - b) Not exceed an injection pressure, measured at the wellhead, of 8,000 kPag or the pressure required to fracture the formation, whichever is lesser.
 - c) Inject only through tubing.
 - d) Continually measure and record the wellhead casing and tubing pressures.
 - e) Before July 1, 2016, install and fully activate a monitoring program to observe and record seismic events within a 5 km radius of the well CNRL Septimus A7-5-82-19; WA #22061, 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 March 15, 2016, install and fully activate an accelerometer at the well site able to record three components of ground acceleration with a detectability of 0.001g and with a minimum clip limit of 0.5g.
 - 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 Ron.Stefik@bcogc.ca, at 1 month intervals, commencing one month from the date that monitoring begins, or upon request. The Commission may make the results of seismic monitoring contained in the reports available to researchers on a confidential basis.
 - 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. Include tests on each of the 3 packers included in the completion of this well.
 - j) Include the disposal operating hours and the maximum injection pressure values on the monthly disposal statement.

- k) Report the disposal volumes on the monthly disposal statement to the Cadomin (90%) and Nikanassin (10%) formations.
- l) Cease injection upon reaching a maximum formation pressure of 11,760 kPaa.
- m) Conduct an annual reservoir pressure test on the formations 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.
- n) 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 original disposal.

ii) Perform a hydraulic isolation temperature log on the subject well if one has not been run in the last 5 years, within six months of the date of this Order and submit results to the Commission within 30 days of the completion of logging, and thereafter at an interval of not more than every 5 years, commencing from the date of initial disposal.
- o) 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 11th day of March 2016.

Advisory Guidance for Order 13-02-004 Amendment #1

- I. A production packer must be set above the injection interval and the space between the tubing and casing (including the space between the 3 packers) filled with corrosion inhibiting fluids, as per section 16(2) of the Drilling and Production Regulation.
- II. Annual packer isolation tests are required, as per section 16(3) of the Drilling and Production Regulation.
- III. Injected fluids must be metered, 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.