



November 26, 2015

7750-2800-32640-02

Rod McDougall, Exploitation Engineer
Canadian Natural Resources Ltd.
Suite 2500, 855 2nd Street S.W.
Calgary, Alberta T2P 4J8

Dear Mr. McDougall,

**RE: PRODUCED WATER DISPOSAL SPECIAL PROJECT APPROVAL, AMENDMENT #2
CNRL SEPTIMUS G5-23-81-19 W6M; WA# 26299
SEPTIMUS FIELD – CADOMIN FORMATION**

Approval for disposal of produced water, Order 10-02-008, was issued for the subject well, Cadomin formation, on December 8, 2010. The Commission is presently amending disposal well approvals to conform to current requirements.

The subject well was drilled in May 2010 and commenced disposal in May 2011. On July 17, 2012, Order 10-02-008 Amendment #1 was issued for the well, raising the MWHIP from 13,000kPa to 17,300kPa. The amended MWHIP equates to a fracture gradient of 30.2kPa/m, and was based on an ISIP from the September 2010 hydraulic fracture operation performed on the Cadomin formation. The attached amended approval lowers this MWHIP value to a more conservative FG of 28kPa/m, based on OGC studies of fracture gradients in the area and decreased confidence in the higher values yielded by large fracture operations. The amended approval also stipulates a maximum reservoir pressure based on 120% of initial pressure, and other requirements for ongoing integrity testing.

Attached please find **Order 10-02-008 Amendment #2** designating an area in the Septimus field – Cadomin formation as a Special Project under section 75 of the *Oil and Gas Activities Act*, for the use of a storage reservoir for the disposal of produced water. This Order contains a number of detailed operational conditions. Additional general information regarding disposal wells is available on the Commission's website at <http://www.bccgc.ca/industry-zone/documentation/Subsurface-Disposal>.

In certain circumstances, disposal well operation may induce seismicity. The Commission advises that disposal well permit holders monitor seismic events in proximity to the well and be prepared to modify operations to mitigate induced seismicity. Permit holders may monitor seismic events through the Natural Resources Canada seismic monitoring network at <http://www.earthquakescanada.nrcan.gc.ca/recent/index-eng.php>.

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

Sincerely,

A handwritten signature in black ink, appearing to read 'Ron Stefik', written over a horizontal line.

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

Attachment

ORDER 10-02-008 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, into the Cadomin formation – in the Septimus field as a special project in the following area:

DLS Twp 81 Rge 19 W6M Section 23 - Lsds 3, 4, 5 and 6.

- 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 CNRL Septimus G5-23-81-19 W6M; WA# 26299 – Cadomin formation (disposal perforations 1034.0 – 1059.0 mKB).
- b) Not exceed an injection pressure, measured at the wellhead on the subject well, of 15,340 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) Cease injection and notify the Commission immediately if hydraulic isolation is lost in the wellbore or formation.
- f) Submit the annual packer isolation test report to the Commission within 30 days of the completion of the test.
- g) Include the disposal operating hours and the maximum injection pressure value on the monthly BC-S18 disposal statement.
- h) 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.
- i) Cease injection upon reaching a maximum formation pressure of 12,065 kPaa, measured at MPP.
- j) Maintain and manage the well head to prevent surface liquids from entering the well bore through the annulus outside or between casing strings.
- k) 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.
- l) 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 26th day of November, 2015.

Advisory Guidance for Order 10-02-008 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 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.