



July 20, 2017

5500-6200/7400-32640-02

Stephen Penner  
Exploitation Engineering Technologist  
Canadian Natural Resources Limited  
2100, 855 – 2<sup>nd</sup> Street SW  
Calgary AB, T2P 4J8

Dear Mr Penner,

**RE: PRODUCED WATER DISPOSAL SPECIAL PROJECT APPROVAL; AMENDMENT #1  
CNRL LADYFERN c-A82-G/94-H-1; WA# 14923  
LADYFERN FIELD – BELLOY AND DEBOLT FORMATIONS**

Approval for disposal of produced water was issued for the subject well, Belloy and Debolt formations, on March 4, 2002. Two separate approvals were issued, one for each formation; Order 02-02-003 for Belloy disposal, Order 02-02-004 for Debolt disposal. The Commission is presently amending disposal well approvals to conform to current requirements.

The subject well was initially completed in the Belloy and upper Debolt for disposal purpose. Disposal has been occurring into both zones since March 2002, with a total volume of 525,650 m<sup>3</sup> to date. Casing inspection and temperature logging performed in February 2017 indicates good quality casing and good hydraulic isolation of disposal fluids.

Initially separate approvals were issued for each disposal zone. The standard procedure for commingled disposal approvals is to issue one approval for both zones combined, specifying the percentage allocation to be reported to each zone. For this reason the two approvals have been amalgamated into one. Attached please find **Order 02-02-003 Amendment #1**, designating an area in the Ladyfern field – Belloy and Debolt formations 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 continuous tubing and casing pressure monitoring requirements, a maximum wellhead injection pressure and an ultimate reservoir pressure limit. **Order 02-02-004**, previously only Debolt disposal, is hereby terminated. Additional general information regarding disposal wells is available on the Commission's website at <http://www.bcogc.ca/industry-zone/documentation/Subsurface-Disposal>.

In certain circumstances, disposal well operation may induce seismicity of values that require modification of operations to mitigate.

Disposal of fluid with high total dissolved solids content requires adjustment of the wellhead injection pressure to remain below formation fracture pressure

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

Sincerely,

A handwritten signature in black ink, appearing to read 'R Stefik'.

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

Attachment

ORDER 02-02-003 Amendment #1

- 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 Belloy and Debolt formations – Ladyfern field as a special project in the following area:

NTS 94-H-01 Block G Unit 82

- 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 Ladyfern c-A82-G/94-H-01; WA# 14923 – Belloy (perforations 1292 – 1309 mKB) and Debolt (perforations 1319 – 1322 mKB) formations.
- b) Not exceed an injection pressure, measured at the wellhead on the subject well, of 8,690 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) Report the disposal volumes on the monthly disposal statement 8% to the Belloy formation and 92% to the Debolt formation.
- i) Conduct an annual reservoir pressure test on the unsegregated 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, annotated to the Debolt formation.
- j) Cease injection upon reaching a maximum formation pressure of 11,940 kPaa, measured at 1307 mKB.
- 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.  
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.
- l) Not conduct a hydraulic fracture stimulation on any formation in the subject well without prior Commission approval.



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

DATED AT the City of Victoria, in the Province of British Columbia, this 20<sup>th</sup> day of July, 2017.

## Advisory Guidance for Order 02-02-003 Amendment #1

- 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 25<sup>th</sup> 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.