

April 18, 2018

6230-4535-59240-09

Brittany Jorgensen, P.Eng.
Exploitation Engineer
Canadian Natural Resources Lim.
2500, 855 – 2nd Street S.W.
CALGARY, AB T2P 4J8

Dear Mrs. Jorgensen:

**RE: PRESSURE MAINTENANCE WATERFLOOD SPECIAL PROJECT – AMENDMENT #4
OTHER THAN NORMAL SPACING ORDER – AMENDMENT #4
MUSKRAT FIELD – BOUNDARY LAKE “A” POOL**

The Commission has reviewed the static gradient test for well CNRL et al Muskrat A3-13-87-18 (WA 9446) dated April 6, 2018 and found that the measured pressure exceeded the initial reservoir pressure by about 71 percent. The well A3-13 was suspended from injection service in October 2017. The wellbore integrity of the well CNRL Muskrat B7-13-87-18 (WA15459) has been verified, as per the requirement of condition (e) of Order 01-09-005 Amendment #3.

The following Orders are attached;

- 1) Order 01-09-005 Amendment #4 designating Pressure Maintenance Waterflood within the Muskrat field – Boundary Lake “A” pool, as a Special Project under section 75 of the *Oil and Gas Activities Act*, and
- 2) Order 01-09-005 Amendment #4 - OTN approving Other Than Normal Spacing under section 65.1 of the *Petroleum and Natural Gas Act* for the subject area and formation.

Well A3-13 has been removed from the wells approved for injection service under condition 2 (c). The Commission requires well A3-13 to be included in the annual pressure test program for this pool until the pressure approaches the initial average value. The Muskrat field – Boundary Lake ‘A’ pool is not exempt from annual pressure testing, CNRL must take yearly reservoir pressures from a minimum of 25 percent of the wells in the pool.

Please note that, as per section 75 of the *Drilling and Production Regulation*, a record of the volume of water injected for each well must be included on a Monthly Injection or Disposal Statement (BC-S18), which must be submitted to the Commission no later than the 25th day of the month in which activity occurred.

Should you have any questions, please contact Petra Kriescher-Trudgeon at (250) 419-4415 or the undersigned at (250) 419-4430.

Sincerely,



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

Attachments

ORDER 01-09-005 Amendment #4

- 1 Under section 75(1)(a) of the *Oil and Gas Activities Act*, the Muskrat field – Boundary Lake “A” pool is designated as a Special Project for the recovery of oil utilizing pressure maintenance waterflood within the following area;
Twp 87 Rge 18 W6M NE/4 Section 12, Sections 13, 14 and NE/4 Section 15.
- 2 Under section 75(2) of the *Oil and Gas Activities Act*, I specify the following:
 - a) The project daily oil allowable is 166.0 m³
 - b) All associated produced gas must be conserved.
 - c) Water may be injected into the wells CNRL et al HZ Muskrat A7-14-87-18 (WA 10801), and CNRL et al Muskrat B7-13-87-18 (WA 15459)
 - i. For wells injecting other than fresh water, inject only through tubing with a packer set as near as is practical above the injection interval.
 - ii. Not exceed an injection pressure, measured at the wellhead of 12,400 kPa or the pressure required to fracture the formation, whichever is lesser.
 - d) Not exceed an average pool pressure of 11,588 kPaa measured at 565 meters subsea.
 - i. The reservoir pressure must be measured at well CNRL et al Muskrat A3-13-87-18 (WA 9446) annually.
 - e) Cease injection into a well listed in (c) and notify the Commission immediately if hydraulic isolation is lost in the wellbore or formation.
 - f) Submit the annual packer isolation test report for wells listed in (c) to the Commission within 30 days of the completion of the test.
 - g) Include the injection hours and the maximum injection pressure value for wells listed in (c) on the monthly BC-S18 form.
 - h) Injection must cease upon termination of production from the pool.



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

DATED AT the City of Victoria, in the Province of British Columbia, this 18th day of April 2018.

Advisory Guidance for Order 01-09-005 Amendment #4

- 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 injection 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 injection operations suspended as per section 21.1 of the Drilling and Production Regulation.

ORDER 01-09-005 Amendment #4 - OTN

- 1 Under Section 65.1(2) of the *Petroleum and Natural Gas Act*, Other Than Normal Spacing is approved within the Muskrat field – Boundary Lake “A” pool within the following area;
Twp 87 Rge 18 W6M NE/4 Section 12, Sections 13, 14 and NE/4 Section 15.

- 2 Under section 65.1(3) of the *Petroleum and Natural Gas Act*, I specify the following:
 - a) the target area for an oil well completed within the project area is not nearer than 100 m to the sides of the Other Than Normal Spacing area,
 - b) an oil well completed outside the target area specified in paragraph (a) may be subject to an off-target production penalty,
 - c) oil wells drilled within the specified project area are not subject to spacing requirements.



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

DATED AT the City of Victoria, in the Province of British Columbia, this 16th day of April 2018.