



June 29, 2016

1260-4100-59240-09

Florin Hategan, P. Eng.
Exploitation Engineer
Canadian Natural Resources Limited
2500, 855 2nd Street SW
Calgary, AB T2P 4J8

Dear Mr. Hategan:

**RE: WATERFLOOD PRESSURE MAINTENANCE ORDER 09-09-002, AMENDMENT #3
BIRCH FIELD – BALDONNEL ‘C’ POOL**

Commission staff have reviewed the application, dated January 8, 2016, to convert the well CNRL HZ Birch d-29-I/94-A-13 (WA # 8014) to injector service.

The Birch field Baldonnel "C" oil pool commenced production in February 1979. A waterflood pressure maintenance project was approved in September 2009 with injection starting in May 2010. A review of reservoir performance confirms earlier indications that the Baldonnel formation is highly compartmentalized, with significant pressure variation between wells. Waterflood operation has shown limited overall oil recovery enhancement from the pool. The Commission is highly concerned regarding current elevated reservoir pressures in the vicinity of injector wells. Good reservoir management requires a limit on the ultimate reservoir pressure at the cessation of pool operation, with consideration of demonstrated potential for pool pressure equalization.

A recently submitted test on the well d-29-I indicates a pressure slightly below pool initial pressure. Conversion to injection will allow reallocation of injection volumes. It is the understanding of the Commission that injection at this location will result in suspension of injection into offsetting wells at high current reservoir pressure.

The following Orders are attached;

- 1) Order 09-09-002 Amendment #3 designating Pressure Maintenance Waterflood within the Birch field – Baldonnel "C" pool, as a Special Project under section 75 of the *Oil and Gas Activities Act*, and
- 2) Order 09-09-002 Amendment #3 - OTN approving Other Than Normal Spacing under section 65.1 of the *Petroleum and Natural Gas Act* for the subject area and formation.

This amended approval includes a recalculated maximum wellhead injection pressure, an ultimate pool pressure limit, restriction of injection for the purpose of oil recovery, reporting of injection water source, and a revised submission date for the annual progress report. Also included is a requirement for annual reservoir pressure tests on all injector wells. Casing vent flows, noted at various injection wells, must be monitored for any changes that may require immediate repair. This approval will be re-evaluated upon review of progress report results.

Please note that, as per section 75 of the *Drilling and Production Regulation*, a record of the volume of water injected must be included on a Monthly Injection or Disposal Statement (BC-S18). This statement 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, Engl
Supervisor, Reservoir Engineering
Oil and Gas Commission

Attachments

IN THE MATTER of an application from Canadian Natural Resources Limited (CNRL) to the Commission dated January 8, 2016 for the production of petroleum using pressure maintenance.

ORDER 09-09-002 AMENDMENT #3

- 1 Under Section 75(1)(a) of the *Oil and Gas Activities Act*, the Birch field – Baldonnel formation is designated as a special project for pressure maintenance for recovery of oil by water injection within the following area;

NTS 94-A-13 Block H - Units 52, 53, 62, 72-77, 82-88, 94-100
Block I - Units 4-10, 16-20, 28-30, 38-40, 48-50, 59, 60, 70, 80, 90
Block J - Units 1-3, 11, 12, 13, 21-23, 31-35, 41-45, 51-55, 61-64, 71, 81.

- 2 Under section 75(2) of the *Oil and Gas Activities Act*, I specify the following:

- a) The daily oil allowable is waived.
- b) All associated produced gas must be conserved.
- c) Water may be injected into the wells, b-86-H/94-A-13 (WA# 8157), b-98-H/94-A-13 (WA# 8259), d-18-I/94-A-13 (WA# 8244), b-19-I/94-A-13 (WA# 8246), b-29-I/94-A-13 (WA# 8014), and d-39-I/94-A-13 (WA# 8144).
- d) Inject only through tubing with a packer set as near as is practical above the injection interval.
- e) Not exceed an injection pressure, measured at the wellhead on the subject wells (C), of **14,500** kPa or the pressure required to fracture the formation, whichever is lesser.
- f) Not exceed an average pool pressure of 11,580 kPa (initial pressure) measured at MPP.
- g) The Permit Holder must conduct annual reservoir pressure (fall-off) tests on all injectors and two producers of the Baldonnel formation with a shut-in period of sufficient length to provide data for calculation of the reservoir pressure.
- 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) Include the injection hours and the maximum injection pressure value on the monthly BC-S18 form.
- k) Injection must cease upon termination of production from the pool.
- l) The permit holder must submit a Progress Report to the Commission for each 12 month period the project is in operation. The Progress Report must be filed by March 31st the following year and must contain the information specified in Pressure Maintenance Progress Report Requirements, attached to this Order.



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

DATED AT the City of Victoria, in the Province of British Columbia, this 6th day of July 2016.

Order 09-09-002 Amendment #3

Advisory Guidance for Order 09-09-002 Amendment #3

- 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.

IN THE MATTER of an application from Canadian Natural Resources Limited to the Commission dated January 8, 2016 for Other Than Normal Spacing.

ORDER 09-09-02-OTN AMENDMENT #3

- 1 Under Section 65.1(2) of the *Petroleum and Natural Gas Act*, Other Than Normal Spacing is approved within the Birch – Baldonnel “C” pool within the following area;

NTS 94-A-13 Block H - Units 52, 53, 62, 72-77, 82-88, 94-100

Block I - Units 4-10, 16-20, 28-30, 38-40, 48-50, 59, 60, 70, 80, 90

Block J - Units 1-3, 11, 12, 13, 21-23, 31-35, 41-45, 51-55, 61-64, 71, 81.

- 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 specified target area 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, EngL
Supervisor, Reservoir Engineering
Oil and Gas Commission

DATED AT the City of Victoria, in the Province of British Columbia, this 29th day of June 2016.