BC Oil & Gas COMMISSION

June 26, 2015 4300-4100-32640-02

Florin Hategan, P.Eng.
Exploitation Engineer
Canadian Natural Resources Ltd.
Suite 2500, 855 2nd Street S.W.
Calgary, Alberta T2P 4J8

Dear Mr. Hategan:

RE: PRODUCED WATER DISPOSAL SPECIAL PROJECT
CNRL ET AL GRAHAM d-006-C/94-B-09; WA #8093
GRAHAM FIELD – BALDONNEL "A" POOL

Commission staff have reviewed your application dated May 26, 2015, requesting approval to disposal of produced water into the Baldonnel formation. Two potential disposal locations were considered for Baldonnel disposal through a pre-application process during the fall of 2014. The Commission agreed that the d-6-C location appeared to be the better disposal location with respect to reservoir quality.

Formation water associated with area gas production has been disposed in the Debolt formation through the well CNRL et al Graham d-A6-C/94-B-09 (WA 12191) since January 2002. Detection of seismic activity originating near the depth of the Debolt formation in the Graham field has necessitated investigation of other disposal opportunities, with termination of disposal into the Debolt.

The subject well d-6-C produced gas, at a high WGR, from September 1994 to May 2013. The muti-well Baldonnel "A" pool is significantly depleted, with cumulative production of $1.24e^6m^3$ gas and 365.6 e^3m^3 water. Pressure communication between wells appears limited, which may affect disposal success. Disposal at this location is not expected to negatively impact remaining gas recovery; however the Approval Order requires a report to the Commission one year following the initiation of disposal, to examine any effects.

Attached please find Order 15-02-011, designating an area in the Graham field, Baldonnel formation 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 includes a number of detailed operational conditions including: continuous tubing and casing pressure measurements, a maximum wellhead injection pressure, an ultimate reservoir pressure limit, as well as wellbore integrity monitoring and reporting requirements. Disposal wells are subject to regular field inspection and audit. Contravention of a condition of this Order may be subject to enforcement under section 62 of OGAA, or suspension or cancellation of the Order under section 75(2)(b).

Should you have any questions, please contact the undersigned at (250) 419-4430 or Michelle Gaucher at (250) 419-4482.

Sincerely,

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

Attachment

BC Oil & Gas COMMISSION

ORDER 15-02-011

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 Baldonnel formation – Graham field as a special project in the following area:

NTS Map 094 - B - 9 Block C Unit 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 et al Graham d-6-C/94-B-9; WA# 8093 – Baldonnel formation (disposal perforation 1441.0 – 1485.0 mKB MD).

b) Not exceed an injection pressure, measured at the wellhead on the subject well, of 10,100 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) Submit a report, within 60 days following one year from the date of commencement of disposal, on the Graham field Baldonnel "A" pool, which includes;
   i) gas and water production
   ii) reservoir pressure tests
   iii) disposal well injection data, with any noted effects on production

j) Cease injection upon reaching a maximum formation pressure of 19,700 kPaa, measured at MPP.

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 June, 2015.

Advisory Guidance for Order 15-02-011

I. A production packer must be set above the injection interval and the space between the tubing and casing 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.