BC Oil & Gas COMMISSION

July 20, 2016 8135-2010-32640-02

Matt Desroches, P.Eng.
Exploitation Engineer
Murphy Oil Company Ltd.
4000, 520 – 3 Ave SW
Calgary, Alberta T2P 0R3

Dear Mr Desroches,

RE: PRODUCED WATER DISPOSAL SPECIAL PROJECT APPROVAL
MURPHY HZ SWAN d-B40-A/93-P-09; WA# 24391
SWAN LAKE FIELD – PADDY-CADOTTE FORMATION

The Commission has reviewed Murphy's application, dated June 20, 2016, for produced water disposal into the subject well, Paddy and Cadotte formations. The subject well produced gas from the Montney formation between April 2009 and May 2016. The Montney formation was abandoned on May 20th and the Paddy and Cadotte formations were completed for disposal. Tests provided to support the application show good wellbore integrity, and assurance that the disposal fluids are contained to the proposed disposal formations.

It is noted that the Paddy and Cadotte formations have been combined into one formation (the Paddy-Cadotte zone, formation code '2010') for the purposes of regulating disposal and source water wells in the area. Therefore disposal reporting is for a single combined zone.

Attached please find **Order 16-02-003**, designating an area in the Swan Lake field – Paddy-Cadotte 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 contains a number of detailed operational conditions, including continuous wellhead measurements, a maximum wellhead injection pressure, and an ultimate reservoir pressure limit. 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. 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 Michelle Harding at (250) 419-4493 or the undersigned at (250) 419-4430.

Sincerely,

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

Attachment

BC Oil & Gas COMMISSION

ORDER 16-02-003

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 Paddy-Cadotte formation – Swan Lake field as a special project in the following area:

NTS 93-P-09 Block A Unit 40

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 Murphy Hz Swan d-B40-A/93-P-09; WA# 24391 – Paddy-Cadotte formation (disposal perforations 1,266.4 – 1,318.0 mKB).

b) Not exceed an injection pressure, measured at the wellhead on the subject well, of 18,620 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 11,815 kPaa, measured at 1292.2 mKB.

j) Maintain and manage the well head to prevent surface liquids from entering the well bore through the annulus outside or between casing and conductor 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 20th day of July, 2016.

Advisory Guidance for Order 16-02-003

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.