

August 10, 2018

8135-4100-32640-02

Tyson Trail, E.I.T.
Production Engineer, Montney Asset
Murphy Oil Canada
4000, 520-3 Avenue SW
Calgary, AB T2P 0R3

Dear Mr Desroches:

**RE: PRODUCED WATER DISPOSAL SPECIAL PROJECT APPROVAL, AMENDMENT #3
MURPHY HZ SWAN c-39-A/93-P-09; WA# 24405
SWAN LAKE FIELD – BALDONNEL FORMATION**

The Commission has received the application, dated August 2nd, 2018, requesting to adjust the 9,000 m³ annual disposal volume limit for the subject well, required under Order 09-02-003 Amendment #2 condition 2h)ii). Approval for disposal of produced water, Order 09-02-003, was issued for the subject well, Baldonnel formation, on March 24, 2009. Order 09-02-003 Amendment #1 was issued on May 13, 2016 to bring the approval up to current standards, and to specify a volume limit for continuous disposal. On February 1, 2017, the approval was amended again to alter the volume limit for the 2017 calendar year to 12,000 m³, with a 9,000 m³ limit for subsequent years.

A fall-off test from October 2017 showed that the reservoir pressure had fallen to 116.6% of initial pressure after 64 days of shut-in. A total of 11,981 m³ of water was disposed into the well in 2017, a significant decrease from 30,310 m³ in 2016 and 48,646 m³ in 2015. The lower reservoir pressure may be attributed to the lower injection rates and periods of rest in between injection periods, allowing pressure to dissipate at a rate suitable to the formation.

Attached please find **Order 09-02-003 Amendment #3**, designating an area in the Swan Lake 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. The Advisory Guidance section of the Order includes references to Drilling and Production Regulation requirements that apply to disposal wells. Condition 2f) sets a maximum formation pressure limit, replacing the volume limit from Order 09-02-003 Amendment #2. Murphy is expected to manage the annual volumes to ensure this pressure limit is upheld. This Order may be modified or terminated if conditions change, based on annual performance monitoring data.

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,

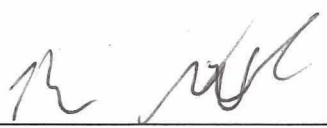


Ron Stefik, Eng.L.
Supervisor, Reservoir Engineering
Oil and Gas Commission

Attachment

ORDER 09-02-003 Amendment #3

- 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 Baldonnel formation – Swan Lake field as a special project in the following area:
NTS 93-P-09 Block A Unit 39.
- 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 c-39-A/93-P-09; WA# 24405 – Baldonnel formation (disposal perforations 2250.0 – 2560.0 mKB MD).
 - b) Not exceed an injection pressure, measured at the wellhead on the subject well, of 12,330 kPag or the pressure required to fracture the formation, whichever is lesser.
 - c) Continually measure and record the wellhead casing and tubing pressures electronically.
 - d) Cease injection immediately and notify the Commission if hydraulic isolation is lost in the wellbore or formation.
 - e) 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.
 - f) Cease injection upon reaching a maximum formation pressure of 23,470 kPaa, measured at 2135.0 mKB.
 - g)
 - 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.
 - h) 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 10th day of August, 2018.

Advisory Guidance for Order 09-02-003 Amendment #3

- I. A production packer must be set as near as is practical 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, and failures repaired without unreasonable delay, 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, indicating the quantity of fluid injected, the maximum wellhead injection pressure and the total monthly operating hours, 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.