



June 17, 2019

7820-4580-32640-02

Donald Zinger
Completions Consultant
Leucrotta Exploration Inc.
700-639 5th Avenue SW
Calgary, AB T2P 0M9

Dear Mr. Zinger:

**RE: PRODUCED WATER DISPOSAL SPECIAL PROJECT APPROVAL; AMENDMENT #2
LEUCROTTA SILVERBERRY 06-16-88-20 W6M; WA# 3076
SILVERBERRY FIELD – NORTH PINE “A” POOL**

The Commission has reviewed groundwater monitoring and sampling results submitted up to quarter 4 of 2018 submitted pursuant to requirements outlined in Special Project Approval Order 14-02-009 Amendment #1, Appendix A. Based on a review of these data, and with consideration of all previous analytical and groundwater monitoring results, and analysis of produced water for disposal at the well, Appendix A has been amended to require annual groundwater sampling and water level measurements from the monitoring wells at the site. Please note that the Commission may, at any time, require additional sampling, further investigation and/or reporting respecting groundwater conditions at the site.

Attached please find **Order 14-02-009 Amendment #2**, designating an area in the Silverberry field – North Pine ‘A’ pool 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 the updated Appendix A as well as updates to existing conditions to refer to Petrinex, where applicable. Additional general information regarding disposal wells is available on the Commission’s website at <http://www.bcogc.ca/industry-zone/documentation/Subsurface-Disposal>.

Please note that disposal of fluid with high total dissolved solids content requires adjustment of the wellhead injection pressure to remain below formation fracture pressure, as per order condition 2(b).

Should you have any questions regarding groundwater monitoring requirements, please contact Laurie Welch at (250) 980-6066. For questions regarding the remainder of the Order, please contact Kathryn Archibald at (250) 419-4406 or Ron Stefik at (250) 419-4430.

Sincerely,

A handwritten signature in blue ink, appearing to read 'R. Stefik', written over a horizontal line.

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

Attachments

ORDER 14-02-009 Amendment #2

- 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 North Pine 'A' pool – Silverberry field as a special project in the following area:
DLS Twp 88 Rge 20 W6M Section 16 - Lsds 3, 4, 5 and 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 Leucrotta Silverberry 6-16-88-20; WA# 3076 – North Pine 'A' pool (disposal perforations 1404.5 – 1407.3 mKB).
 - b) Not exceed an injection pressure, measured at the wellhead on the subject well, of 14,600 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 in Petrinex.
 - 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 11,560 kPaa, measured at 1405.9 mKB.
 - j)
 - 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 an annual hydraulic isolation temperature log on the subject well and submit results to the Commission within 30 days of the completion of logging.
 - k) Not conduct a hydraulic fracture stimulation on any formation in the subject well without prior Commission approval.
 - l) Conduct a groundwater monitoring program as detailed in Appendix A.
 - m) Once annually, sample the disposal fluid, analyze for the same suite of parameters as groundwater monitoring wells in Appendix A, and submit composition analysis, indicating the disposal well as the sample source.



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

DATED AT the City of Victoria, in the Province of British Columbia, this 17th day of June, 2019.



ORDER 14-02-009 Amendment #2

PAGE 2

Advisory Guidance for Order 14-02-009 Amendment #2

- 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 via Petrinex not later than the 20th 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.

Appendix A – Groundwater Monitoring Requirements

Leucrotta Silverberry 6-16-88-20 (WA 3076) Produced Water Disposal

The following groundwater monitoring program is to be conducted on three groundwater monitoring wells, identified as “MW14-01”, “MW14-02S”, and “MW14-02D”, previously installed and sampled as per requirements outlined in Order 14-02-009 Appendix A, issued on September 30, 2014.

Groundwater Monitoring Requirements

1. The collection of groundwater samples from the three monitoring wells at the site on an annual basis, starting summer or fall season 2019, and analysis for general water chemistry parameters including Total Dissolved Solids (TD), cations and anions, and pH. Groundwater samples shall be collected using standard environmental sampling and handling protocols consistent with previous sampling.
2. Manual measurement of static water levels in the monitoring wells at least once annually OR continued monitoring of groundwater levels in the monitoring wells using a pressure transducer.
3. Groundwater monitoring reports shall be prepared by a qualified professional and submitted to the Commission on an annual basis. Reports shall document the field methods undertaken, document the groundwater monitoring results (corrected for barometric pressure) and analytical results, and include tabular comparison to previous sampling and monitoring results.
4. Additional documentation and/or further sampling or investigation may be required by the Commission based on a review of submitted monitoring documentation and/or other well information.

Submission of Documentation

Groundwater Monitoring Reports for the long term groundwater monitoring/sampling program (3, above) shall be submitted to the Commission annually. For each report:

- Sampling procedures and date shall be documented and any relevant site observations should be noted.
- Monitoring and sampling results shall be presented in tabular form with appropriate BC comparison criteria.
- Tables shall be presented to allow for comparison of groundwater sampling results over time at same well.
- Laboratory analytical reports for the sampling shall be appended to the report.
- Laboratory analytical reports may be requested by the Commission at any time prior to the submission of the annual report.