



August 3, 2016

3520-4800-32640-02

Christine Beermann  
Field Regulatory Coordinator, Cardium  
Penn West Petroleum Ltd.  
Bay 203, 8026 Edgar Industrial Crescent  
Red Deer, AB T4P 3R3

Dear Ms Beermann:

**RE: PRODUCED WATER DISPOSAL SPECIAL PROJECT APPROVAL, AMENDMENT #1  
PENN WEST FIREBIRD a-98-D/94-H-02; WA# 19124  
FIREBIRD FIELD – HALFWAY FORMATION**

Approval for disposal of produced water, Order 05-02-004, was issued for the subject well, Halfway formation, on April 1, 2005. The Commission is presently amending disposal well approvals to conform to current requirements.

The subject well was drilled for the purpose of disposal in February 2005. The well has been disposing since November 2005 with a cumulative volume of 151,980m<sup>3</sup>. The reservoir pressure measured in March 2016 was at 116% of initial pressure, approaching the 120% fill-up pressure limit.

Attached please find **Order 05-02-004 Amendment #1**, designating an area in the Firebird field – Halfway 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 a maximum wellhead injection pressure, reservoir pressure fill-up limit, and continuous tubing and casing pressure monitoring. The required wellbore integrity testing, casing inspection log and hydraulic isolation log, must be performed during the 2016/17 winter access season. 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,

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

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

Attachment

**ORDER 05-02-004 Amendment #1**

- 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 Halfway formation – Firebird field as a special project in the following area:  
NTS 94-H-02 Block D Unit 98
- 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 Penn West Firebird a-98-D/94-H-02; WA# 19124 – Halfway formation (disposal perforations 1,158.0 – 1,163.0 mKB).
  - b) Not exceed an injection pressure, measured at the wellhead on the subject well, of 6,780 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 10,585 kPaa, measured at 1,160.5 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 prior to March 31, 2017 and submit results to the Commission within 30 days of the completion of logging. Thereafter, perform a CIL at an interval of not more than every 10 years.  
ii) Perform a hydraulic isolation temperature log on the subject well prior to March 31, 2017 and submit results to the Commission within 30 days of the completion of logging. Thereafter, perform a hydraulic isolation log at an interval of not more than every 5 years.
  - l) Not conduct a hydraulic fracture stimulation on any formation in the subject well without prior Commission approval.



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

DATED AT the City of Victoria, in the Province of British Columbia, this 3<sup>rd</sup> day of August, 2016.

Advisory Guidance for Order 05-02-004 Amendment #1

- 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 25<sup>th</sup> 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.