

October 4, 2019

6460-4520-59240-09

Michael Reinhart, P.Eng.
Production Engineer
PENGROWTH Energy Corporation.
1600, 222 - 3rd Ave SW
Calgary, AB T2P 0B4

Dear Mr. Reinhart:

**RE: PRESSURE MAINTENANCE WATERFLOOD ORDER 96-09-002 AMENDMENT #5
OTHER THAN NORMAL SPACING ORDER AMENDMENT #5
OAK FIELD – CECIL “E” POOL**

The Commission is presently reviewing and amending waterflood approvals to conform to current requirements. The Oak Cecil ‘E’ pool operating conditions were last amended in February 2001.

The Oak field Cecil “E” oil pool commenced production in March 1993. A pressure maintenance waterflood project was approved in March 1996, with injection starting in May 1996. The pool currently has two active wells, one injector and one oil well. A review of reservoir performance indicates that the waterflood was successful in stabilizing the GOR, achieving an average monthly voidage replacement ratio of 0.96 and cumulative oil recovery of approximately 48 %. Over the last four years an average VRR of 1.62 m³/m³ was reached. The Commission is concerned regarding a possible high pressure zone near the injector and requests that Pengrowth take a reservoir pressure at the injector. Good reservoir management requires a limit on the ultimate reservoir pressure at the cessation of pool operation, with consideration of demonstrated potential for pool pressure equalization.

The following Orders are attached;

- 1) Order 96-09-002 Amendment #5 designating Pressure Maintenance Waterflood within the Oak field – Cecil “E” pool, as a Special Project under section 75 of the *Oil and Gas Activities Act*, and
- 2) Order 96-09-002 Amendment #5 - OTN approving Other Than Normal Spacing under section 65.1 of the *Petroleum and Natural Gas Act* for the subject area and formation.

This amended approval includes a maximum wellhead injection pressure (MWHIP), an ultimate pool pressure limit, restriction of injection for the purpose of oil recovery, the submission of a packer isolation test and a static gradient test pressure. Also included is a requirement for annual reservoir pressure test on the injector. Three wells previously approved for injection service have been removed in this order.

Please note that, as per section 75 of the *Drilling and Production Regulation*, a record of the volume of water injected and the MWHIP must be included on a Monthly Injection statement to the Commission via Petrinex not later than the 20th day of the month following the reported month.

Should you have any questions, please contact Petra Kriescher-Trudgeon at (250) 419-4415 or the undersigned at (250) 419-4430.

Sincerely,



Ron Stefik, EngL
Supervisor, Reservoir Engineering
Oil and Gas Commission

Attachments



ORDER 96-09-002 – Amendment #5

1. Under Section 75 (1) (a) of the *Oil and Gas Activities Act*, the Commission designates by Order the development and production of petroleum and natural gas from a pool using pressure maintenance waterflood enhance recovery scheme within the Oak field – Cecil “E” pool following area;

DLS Twp 86 Rge 18 W6M NW/4 Sect 17, Sect 20, W/2 Sect 28, S/2 and NE/4 Sect 29, SE/4 Sect 32 and Sect 33.

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:
 - a) The project oil production for a month shall be based on the previous month's voidage replacement.
 - b) All associated produced gas must be conserved.
 - c) Water may be injected into the injection wells Pengrowth et al Oak 9-29-86-18 (WA 8256), interval 1248.2 – 1251.2 mKB, and Pengrowth et al Owl 13-17-86-18 (WA 9329), interval 1287.8 – 1290.8 mKB.
 - i) Inject only through tubing with a packer set as near as is practical above the injection interval.
 - ii) Not exceed an injection pressure, measured at the wellhead of 11,460 kPa or the pressure required to fracture the formation, whichever is lesser.
 - d) An annual reservoir pressure must be obtained from the injectors listed in (c), and submitted to the Commission within 60 days via e-submission
 - e) Not exceed an average pool pressure of 12,591 kPa measured at 555.0 meters subsea for the wells listed in (c).
 - f) Cease injection for a well listed in (c) and notify the Commission immediately if hydraulic isolation is lost in the wellbore or formation.
 - g) Include the monthly injected volume, injection hours and the maximum injection pressure value for the wells listed in (c) via Petrinex.
 - h) Injection must cease upon termination of production from the pool.

Advisory Guidance for Order 96-09-002 – Amendment #5

- 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 completed and 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 injection statement must be submitted to 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 injection operations suspended as per section 21.1 of the Drilling and Production Regulation.



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

DATED AT the City of Victoria, in the Province of British Columbia, this 4th day of October 2019.



ORDER 96-09-002 Amendment #5 - OTN

1. Under Section 65.1(2) of the *Petroleum and Natural Gas Act*, Other Than Normal Spacing is approved within the Oak field – Cecil “E” pool within the following area;

DLS Twp 86 Rge 18 W6M NW/4 Sect 17, Sect 20, W/2 Sect 28, S/2 and NE/4 Sect 29, SE/4 Sect 32
and Sect 33.

2. Under section 65.1(3) of the *Petroleum and Natural Gas Act*, I specify the following:
 - a) the target area for an oil well completed within the project area is not nearer than 100 m to the sides of the Other Than Normal Spacing area,
 - b) an oil well completed outside the specified target area may be subject to an off-target production penalty,
 - c) oil wells drilled within the specified project area are not subject to spacing requirements.

A handwritten signature in blue ink, appearing to read 'Ron Stefik'.

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

DATED AT the City of Victoria, in the Province of British Columbia, this 4th day of October 2019.