

Alberta Energy Regulator (AER)
Resources Applications
Oil and Gas Section
Suite 1000, 250 – 5th Street SW
Calgary, AB T2P 0R4

October 2, 2018

Attention: Resource Applications Group

RE: Subsurface Class Ib Disposal into 100/07-25-069-06W6/02 – Gold Creek Field

To whom it may concern,

In accordance with the *Oil and Gas Conservation Act Section 39(1) (c), (d)*, Alberta Energy Regulator (AER) *Directive 065: Resources Applications for Oil and Gas Reservoirs*, and AER *Directive 051: Injection and Disposal Wells – Well Classifications, Completions, Logging, and Testing Requirements*, Dragos Energy Corp. (Dragos) is applying for an AER Disposal Scheme Approval to dispose of Class Ib fluids into the Cardium formation at the above referenced location.

The proposed disposal well is located at 07-25-069-06W6 and has an approved AER well license No. 362945.

This application has been submitted prior to completing any downhole work on the Cardium. The required Directive 051 information such as a MWHIP and hydraulic isolation logging will be completed in conjunction with the re-completion and submitted as an amendment should the Directive 065 application be approved. For further information of clarification regarding the contents of this application. Please contact the undersigned.

Sincerely,



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CG Engineering Ltd.

AER Directive 065 & Directive 051 Application

Proposed Class Ib Disposal Scheme

On behalf of:
Dragos Energy Corp.

PROGRESS GOLDCK 7-25-69-6
UWI: 100/07-25-069-06W6/00

October 2, 2018

Submitted By: Shawn Cody, P. Eng

Petroleum Engineer | CG Engineering Ltd.

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Introduction

100/07-25-069-06W6 was originally drilled by Progress Energy Canada to a Total Depth of 1295.0 mKB in the Shaftsbury Formation. Prior to being Rig Released on December 21, 2006, 114.3 mm production casing was run and cemented to TD.

Dragos Energy Corp. is the current licensee of the wellbore 100/07-25-069-06W6/00, which is currently completed into the Dunvegan formation. Dragos is proposing to abandon the Dunvegan perforations as per Directive 020 (bridge plug capped with cement) and move up-hole to perforate the Cardium at 793.8 – 810.0m for water disposal.

As part of this application Dragos Energy Corp. is also proposing converting its existing wellbore at 100/16-24-069-06W6/02 (0.78 km away) into a Cardium monitoring well. This well is currently completed into the Dunvegan formation. These perforations would be abandoned in accordance with Directive 020 and re-completed up-hole into the Cardium formation. This well would be used to monitor pressure for the proposed disposal scheme within the Cardium formation.

4.1.3 Application Requirements for a Disposal Scheme - General Requirements

1) A description of the proposed disposal scheme:

a) Unique well identifier(s),

Proposed location is 100/07-25-069-06W6/00.

b) Disposal zone with zone top and base,

The disposal zone is the Lower Cretaceous Cardium Formation with a net porous interval of >18% porosity of 12m and total disposal zone thickness of 16.2m. The Cardium interval is between 793.8 - 810.0m.

c) Disposal perforations,

The Cardium zone has been proposed to be perforated at 793.8 - 810.0 mKB.

d) Disposal fluid class,

Class Ib type disposal fluid, produced water, specific common oilfield waste streams, and non-hazardous waste streams as described in AER Directive 051.

e) Anticipated daily disposal volume(s),

Estimated injection volume is 500 m³/day. Actual injection volumes will be determined by MWHIP and injection test results.

f) Depth of the production packer, and

The production packer will be set within 10m of the perforation interval (~784 mKB).

g) The base of the usable groundwater.

The base of useable ground water in 100/07-25-069-06W6 has been determined to be at -46.25 m asl (600 mKB) (Fig #1).

2) A statement on why the proposed well is suitable for disposal.

Wellbore 100/07-25-069-06W6 is suitable for disposal of Class 1b fluids within the porous and permeable Cardium zone. The Cardium interval between 793.8-810.0m is completely water bearing and aerially contiguous. The nearest hydrocarbon production is 35 miles to the South-West at the Wapiti. The proposed Cardium disposal zone is underlain by shales of the Kaskapau formation and overlain by tight sands and interbedded shales of the Cardium zone as well as shales of the Muskiki formation. The overlain and underlain tight shales and sands are vertically confining to any water disposal and will not have any adverse effects to ultimate hydrocarbon recovery in the immediate area.

Currently there are seven licensed Cardium Water Disposal wells within 10km of the proposed 7-25 location at;

1. 00/11-18-69-05W6/04 which to date has disposed of 1,522,696 m³ at 550 m³/day water (3.0 km from well center)
2. 02/11-18-69-05W6/03 which to date has disposed of 416,717 m³ at 700 m³/day water (3.0 km from well center)
3. 00/16-32-69-05W6/03 which to date has disposed of 91,216 m³ at 400 m³/day water (4.2 km from well center)
4. 00/04-07-70-05W6/03 which to date has disposed of 678,463 m³ at 750 m³/day water (4.6 km from well center)
5. 00/15-07-70-05W6/03 which to date has disposed of 1,094,118 m³ at up to 1000 m³/day water. (5.9 km from well center)
6. 00/03-26-69-05W6/03 which to date has disposed of 69,557 m³ at up to 300 m³/day water (7.5 km from well center)
7. 02/06-35-68-06W6/03 which to date has disposed of 31,105 m³ at 500 m³/day water (8.1 km from well center)

The viability of the Cardium is supported by favorable reservoir characteristics, parameters, reservoir confinement, absence of hydrocarbon of nearby production and the aerial extent of the Cardium aquifer.

3) A statement on why the proposed disposal is required.

The drilling and completions activity in this area has created a high demand for water disposal. Current disposal operators in this area are operating their wells at maximum capacity in order to try and meet this demand. There are large wait times for offloading at other disposal facilities in and around the Gold Creek Area. These facilities are operating at their maximum holding capacity causing operators to haul fluid long distances for disposal.

4) An indication of whether you have applied for or obtained approval for related surface facilities.

Dragos obtained a Directive 056 B090 Injection/disposal facility - water < 0.01 mol/kmol H₂S in inlet stream Facility License (F50986) from the AER September 24, 2018. See Figure #20.

5) Identification of the following reservoir properties and characteristics:

a) Fluid type currently in the disposal interval (i.e., water, gas, or oil),

Water Saturation for the Cardium is in excess of 90% and surrounding water disposals wells are clear indicators of water saturation in and around the proposed water disposal site.

b) Confinement strata,

The Late Cretaceous Cardium Formation, in the general vicinity of Gold Creek is made up of three Depositional environments; the lower Ram member, middle Moosehound member and the upper Cardium zone Member. For the purpose of this report it appears as though the Moosehound Member is not present and the Ram Member (hereafter referred to as Cardium) and the Cardium zone are present.

The Cardium is conformably underlain by the Kaskapau shales and capped by the Cardium zone which is interbedded tight sandstones and shales. The Muskiki is conformably overlaying the Cardium zone. With the shales above and below the Cardium, vertical confinement is assured and the wide spread porosity and permeability indicates a significant water aquifer reasonably large in areal extent suggesting excellent communication for successful water displacement. (Fig #3).

c) Porosity and permeability of the disposal zone

The Cardium Sandstone is a coarsening upward sand sequence, probably deposit as Lower and Upper shoreface in the 07-25-69-06W6 wellbore and the wells surrounding this location. This Cardium Sandstone, as its name implies, is dominated by quartz sands. Porosity in the 07-25 location is recorded at 12.0 m using a 12% cut-off, and averaging 18%.

In the offset 16-32-69-05W6 well, which is currently a Cardium Sandstone water disposal has porosity recorded at 13.0m, 1m more than the 7-25 location. Stratigraphic Cross Section A-A' indicates that the sands are continuous between 16-32 and 7-25, although, thinning slightly to 10m between the wells (Fig #2). Note: When Gamma Ray or Resistivity indicates the possibility of shale those are not included as part of the porosity.

The offsetting westward Cardium disposals generally have 18-21% porosity and are excellent water disposal locations.

d) Viscosity of the injected fluid and the reservoir fluid

The Cardium formation is water saturated and the injection fluid will be mainly produced water from oil and gas exploration and production operations. Therefore, the viscosity of the injection fluid will be similar to the reservoir fluids. Any other wastes accepted as per the 1b classification should have similar properties as well.

e) The distance between the proposed disposal well(s) and any hydrocarbon pool or accumulation

Wapiti Oil pool 35 miles to the South West is the nearest hydrocarbon producer and any water displacement into the Cardium at 7-25 will not affect any of the production.

Conservation

1) A discussion on hydrocarbon pools or accumulations within 1.6 km of the disposal well.

Since this proposed disposal well is more than 1.6 km from any potentially affected hydrocarbon pool or accumulation, this section has been omitted as per Directive 065, Section 4.1.3.

Hydraulic Isolation Requirements

1) Directive 051 Required Logs and Testing:

a) Step Rate Test & MWHIP Interpretation

A step rate test or DFIT and injection test will be run during the downhole completion of the Cardium to determine the MWHIP and overall injection capabilities of the well. The results of the step rate or DFIT will be submitted as an amendment to the Directive 065 approval.

b) Casing Inspection Log

A full length casing inspection log will be run during the downhole completion of the Cardium. The results will be submitted as a supplement to the Directive 065 approval.

c) Casing Pressure Integrity Test

A pressure test to a low of 1.4 MPa and a high of 7 MPa for 15 minutes will be conducted during completions operations.

d) SCVF Report

Tested for SCVF on April 21, 2017. No SCVF detected. See figure #18.

e) Cement Bond Log

A radial bond log will be run during the downhole completion of the Cardium. The results will be submitted as a supplement to the Directive 065 approval.

d) Hydraulic Isolation Log

A baseline and 30/60/90/120 minute temperature logs will be run during the downhole completion of the Cardium to prove hydraulic isolation. These will be submitted as a supplement to the Directive 065 approval.

f) Wellbore Schematic

A final wellbore schematic will be provided with the Directive 065 supplement.

g) Directive 51 – Well Summary for Injection or Disposal Sheet

To be provided with Directive 051 supplement.

Containment Requirements

1) A discussion of the geological setting of the proposed disposal zone, base, and caprock.

Vertical confinement is assured by the underlain shales of the Kaskapau and the tight sands and interbedded shales of the Cardium Zone along with the overlain shales of the Muskiki formations.

2) Geological Maps:

a) Structure and isopach maps of the proposed disposal zone, and

Structurally, the 7-25-69-06W6 location is situated at -130m 20m lower than the 16-32-69-05W6 Cardium Sandstone water disposal. Structure is generally downdip in a South direction at 50m per 3 miles or 17m per mile. See figure #2 & #3.

b) An isopach map of the confinement strata.

An isopach map of the Cardium zone has been attached (Fig #2) and a statement made on the confining strata. The number of nearby disposal wells proves that the Cardium is confined by an impermeable cap and base rock.

3) Interpreted and annotated log cross section or representative well log(s)

a) Stratigraphic interpretation of the zone(s) of interest,

See attachment #3 for a Cross Section of the Cardium formation.

b) Interpretation of the fluid interfaces present,

No fluid interfaces present as the Cardium zone is water saturated.

c) Completions and treatments to the wellbore(s), with dates,

See attachment #4 for general well information (completion section) which includes completions and treatment details with dates.

d) Cumulative production

See attachment #5 for Dunvegan production history.

e) Finished drilling date and kelly bushing (KB) elevation.

See attachment #4 for a copy of the well summary which includes KB elevation and finished drilling date.

4) Confirmation that all wells within the area of influence have been completed or abandoned in a manner that prevents the migration of the injected fluid or substance to another formation.

There are no wells within the calculated AOI, see figure #8.

Maximum Wellhead Injection Pressure Requirements

1) A statement of the proposed MWHIP and what it is based on.

Proposed maximum wellhead injection pressure based on Table 1, Appendix O = 3,700 kPa (751 – 800 m). This pressure will be amended from the theoretical or prescribed rate to actual step-rate injection test results carried out during the Cardium completion.

Notification, Equity, and Safety Requirements

1) Evidence of your right to dispose into the proposed zone

Dragos owns the Cardium mineral rights in section 25-69-6W6.

2) Notifications:

a) A map showing the boundaries of the disposal pool or the area within the disposal section and the offset section up to a 1.6 km radius with the requisite parties listed below displayed

Dragos has notified all mineral holders in the 1.6 km radius and currently owns the rights to the Cardium in section 25-69-6W6. Refer to Figures 8, 11, 14 & 15 for AOI map, line list, surface development map and notification letter.

b) A statement as to whether the parties shown on the map referred to in 2(a) have been notified about the application and, if so, include any statements of concerns received

Appropriate resident and industry notifications have been completed as part of this application. Notifications were sent out in June / July of 2018. See Figures 6, 7 & 14 for copies of the notification letters and Figure #11 for the line list. Pre-application concerns were identified by Inception Exploration Ltd (Inception) during the notification process. Dragos has attempted to mitigate these concerns and will be sending Inception a subsequent letter identifying our Notice of Application and directions on how to file a statement of Concern, see Fig # 21.

3) If the proposed injection fluid contains any H₂S, a statement indicating that notification of the scheme for emergency response plan (ERP) purposes has been made. Include the details of any outstanding concerns from the notified parties

Fluid production in the Gold Creek area is primarily from the Montney formations which can contain H₂S. However any sour loads that are received will be treated with H₂S scavenger during offloading and prior to injection. Any fluid that is being injected can be considered sweet fluid since it is pre-treated to remove any dissolved H₂S. The composition of the injected fluids will contain no more than 100 parts per million (ppm) of hydrogen sulphide in the vapour phase

4) For Class I wells, a statement as to whether the landowners/occupants within a 0.5 km radius of the proposed disposal well have been notified about the application and, if so, include any statements of concerns received.

There are no residents within 0.5 km, all landowners have been notified, see Fig #15 for map & Fig #11 for line list.

Additional Requirements for Class I Disposal

1) A discussion on the maximum expected area of influence surrounding the proposed well over the life of the scheme, including any pressure gradients that exist as a result of past or current production or injection operations.

The Area of Influence has been calculated at 0.736 km, see Figure #10.

2) An area review to ensure fluid containment. Offsetting wells must be investigated for hydraulic isolation of the disposal zone within the maximum expected area of influence surrounding the proposed well or a 1.6 km radius, whichever is greatest.

There are no wells within the predicted AOI. All wells within the 1.6 km radius are cased and cemented through the Cardium zone which would ensure hydraulic isolation and fluid containment. The only zones perforated within the 1.6 km radius are the Dunvegan, Charlie Lake and Falher. See Figure #9.

3) In the case of slurry fracture injection of sand, details of the surface elevation monitoring that will be done within 800 m of the proposed disposal well to monitor the impact of slurry fracture injection of sand above the formation fracture pressure

There will be no slurry fracture injection of sand above the formation fracture pressure.

Summary of Attachments

Fig #1 - BGWP
Fig #2 - Isopach Map
Fig #3 - Cardium Cross Section
Fig #4 - Well Ticket 7-25-69-6W6
Fig #5 - Dunvegan Production
Fig #6 - Resident Notifications
Fig #7 - Industry Notifications
Fig #8 - Disposal Map
Fig #9 - Well Investigation
Fig #10 - AOI Calculations
Fig #11 - Public Consultation Line List
Fig #12 - William Tyler Smith- Verbal- Letters Class B
Fig #13 - Douglas Lefebvre- Verbal- Letters Class B
Fig #14 - Public Consultation Letters
Fig #15 - DRAGOS GOLDCK 7-25-69-6-6M REV#2 FINAL (118-1375) Plan Package
Fig #16 - Enerfaqs package
Fig #17 - Titles
Fig #18 - 100-07-25-069-06W6 - 2017-04-21 - SCVF – 0362945
Fig #19 - 100-16-24-069-06W6 - 2017-04-21 - SCVF – 0271543
Fig #20 - IAR_3111192_5734676
Fig #21 - Inception Letter

If any additional information is required please contact the undersigned at (587) 538-0286 or Steve Laidlaw at (403) 869-9790.

Sincerely,



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