

Application Checklist for CO₂ Sequestration under *Directive 065*

Last Updated November 2022

This checklist is provided as a summary of what the AER expects to be included in a CO₂ sequestration application. It is not necessarily comprehensive. Applicants are expected follow all application requirements in *Directive 065*.

Crown Authorization

- ☐ Evidence that you have the right to inject captured CO₂ for sequestration into the proposed zone (i.e., a valid Crown agreement or authorization to sequester CO₂).

Notification

- ☐ A map illustrating notifications, including unit operator, approval holder of schemes, all well licensees including abandoned wells, and mineral lessees and lessors as required in table 1 of the directive.
- ☐ A statement as to whether the parties shown on the map referred to above have been notified about the application and, if so, include any statements of concern received.
- ☐ A statement indicating that notification of the scheme for emergency response plan (ERP) purposes has been made. See *Directive 071: Emergency Preparedness and Response Requirements for the Petroleum Industry* for requirements.

Description of Proposed CO₂ Sequestration Well

- ☐ Unique well identifier (surface and bottom, if different) of the proposed CO₂ sequestration well, and general drilling, completion, and activity history.
- ☐ Sequestration zone with zone top and base, perforations, and depth of the production packer. Note that the packer is expected to be within 15 metres (TVD) above of the top of injection perforations unless technically justified. The length of open casing below the bottom perforations must not extend beyond 15 metres (TVD) unless technically justified.
- ☐ The base of the usable groundwater – available for locations across Alberta by using the Base of Groundwater Protection Query Tool on the AER's Systems & Tools on the AER website, www.aer.ca.
- ☐ Provide a statement on the details of an AER-approved, up-to-date emergency response plan (ERP) that the applicant maintains in the area of the proposed operation.

- ☐ Anticipated daily volumes to be disposed and confirmation that the CO₂ sequestration will not impact hydrocarbon recovery.
- ☐ Proposed maximum wellhead injection pressure (MWHIP); unless the default table MWHIP is requested, provide a detailed report of a step-rate injectivity test (SRT) or other acceptable test, such as a minifrac (also referred to as DFIT or diagnostic fracture injection test and described in *Directive 040: Pressure and Deliverability Testing Oil and Gas Wells*, section 4.7, “Fall-Off Tests”), or a technically justified location analogue, performed to determine fracture (formation parting) pressure. An SRT should include the following information:
 - ☐ evidence that shows the time steps were of equal duration
 - ☐ evidence that pressures are moving toward stabilization (radial flow) at the end of each stage
 - ☐ the wellbore schematics of the proposed injection well or analogue well
 - ☐ the directional survey for the proposed well or analogue well
 - ☐ the SRT data in both graphical and tabular form
 - ☐ submission of any continuous pressure and injection data collected
 - ☐ calculation of an MWHIP with a discussion on the appropriate safety factor to ensure fluid containment; discussion should include the potential fracturing of the storage formation and the caprock due to dynamic changes in the thermal gradient over the life of the scheme, including monitoring of the injectivity

Notes on step-rate injectivity tests (SRTs):

- Data is commonly acquired at the wellhead but preferably should also do so with bottomhole pressure recorders.
- The safety factor must be applied at the bottomhole formation parting pressure.
- If bottomhole pressure recordings are used for MWHIP determination, corrections for hydrostatic and friction losses should be appropriately accounted for.
- When density or significant viscosity differences exist between the test fluid and that proposed for CO₂ fluid, the results of the test should be adjusted for differences in hydrostatic and friction pressures.
- Early-time injection period should be sufficient to overcome wellbore storage effects and achieve radial flow conditions.
- SRT data conducted after a hydraulic fracture stimulation may be inconclusive or using data from hydraulic fracture stimulation using proppant may not be acceptable for determining formation parting pressure.

- Note that for injectivity tests, to measure the formation parting pressure, if the total water injection volume is more than 500 m³, applicants should follow the [Temporary Injection](#) application process.

Discussion and Justification to Support Proposed Sequestration Operations

- ☐ reservoir geology, history, and containment requirements
 - ☐ A geological discussion should include geological setting, continuity, areal extent, thickness and lithology of the proposed sequestration zone; reservoir properties, including average porosity, water saturation, permeability, and any contacts (gas-oil, gas-water, oil-water); and regional cross-sections, structural contour, and isopach maps.
 - ☐ A discussion of the geological setting of the bounding formations, base and caprock, including rock properties, continuity, areal extent, integrity, thickness, and evidence of fracturing or faulting.
 - ☐ Confirmation that all wells within the area of influence defined by the MMV and the risk assessment surrounding the proposed CO₂ sequestration wells have been completed or abandoned as per *Directive 020* and in a manner that ensures hydraulic isolation of the proposed disposal zone.
- ☐ CO₂ sequestration applications should follow all the appropriate section requirements in *Directive 065*, Unit 4 Disposal/Storage, including section 4.1.5 Additional Requirements for Class III Disposal unless otherwise expressed in section 4.1.6 Application Requirements for CO₂ Sequestration Schemes and section 4.1.7 Application Requirements for Carbon Sequestration
- ☐ Analysis of the native reservoir fluids
- ☐ Analysis and description of the impact of the CO₂ fluid on the reservoir rock matrix (geochemistry), native fluid (compatibility), and the pressure variations subjected to the sequestration zone requires that you address phase behaviour, CO₂ trapping mechanisms (stratigraphic and structural, residual, solubility, and mineral trapping), reservoir pressures, and migration issues.
- ☐ Injectivity of the sequestration formation, proposed daily maximum injection rate, cumulative sequestration volume, and expected life of the scheme
- ☐ CO₂ properties, including composition, viscosity, density, formation volume factor, compressibility factors, and phase behaviour through the range of pressure and temperatures to which the injected

CO₂ will be subjected to, including a pressure-temperature diagram, confirmation of the CO₂ dense phase at reservoir conditions, and formation water relative permeability curves.

Conservation

- ☐ The AER may not approve a CO₂ sequestration scheme for the disposal of captured carbon dioxide into an underground formation unless the applicant satisfies the AER that the injection of the captured CO₂ will not interfere with the recovery or conservation of oil or gas, or an existing use of the underground formation for the storage of oil or gas.

CO₂ sequestration amendment applications can be submitted to request the following changes:

- revise assessed MWHIP
- change the perforation interval within the same formation
- change the injection packer setting depth
- amend or rescind scheme-specific operating conditions
- updates to MMV and closure plans
- rescind a CO₂ injection well
- a post-drill application after a pre-drill optional two-step application process
- terminate the scheme

Applicants must apply for approval transfers using the requirements in *Directive 065*, Unit 5, “Approval Transfers,” and the Transfer of Approval Form in appendix D.

Directive 051 Applications

Meeting *Directive 051* requirements is a condition of *Directive 065* applications.

- ☐ *Directive 065* scheme approval requires that a well to be used for CO₂ sequestration meet the *Directive 051* Class III well requirements prior to the well going on injection. It is necessary to ensure that the integrity of the wellbore will prevent migration of injected fluids to other zones and protect the groundwater interval.
- ☐ The *Directive 051* application should include the recent completion logging, testing requirements, and associated discussion for the proposed disposal well.
- ☐ *Directive 051* requirements for any additional logging or monitoring will also be reflected on your *Directive 065* scheme approval.