



APPLICATION GUIDELINE FOR UNDERGROUND STORAGE OF HYDROCARBONS

Background

Storage of natural gas in depleted high porosity/permeability reservoirs provides assured supply during peak demand periods. Traditionally, gas injected in summer is withdrawn to meet winter heating requirements. Storage projects in the Western Canadian Sedimentary Basin in the NE portion of the province utilize depleted hydrocarbon pools that have demonstrated geologic containment of fluid under pressure. The dominant underground gas storage project in the province, Aitken Creek, has been in operation since 1987.

Upon application to the Commission, an underground hydrocarbon storage project approval may be granted as a Special Project Order under Section 75 of the Oil and Gas Activities Act. The approval Order contains specific conditions to ensure that the project is operated safely and effectively, including; monitoring, measurement, testing and reporting requirements. This includes progress reports, submitted on a regular schedule, summarizing operations over the reporting period.

Section 80 of the Drilling and Production Regulation requires wells and facilities that form part of the storage project be constructed and operated in accordance with **CSA Standard Z341** "Storage of hydrocarbons in underground formations". The standard and its annex contain numerous stipulations regarding design and operation.

Subsurface tenure requirement for underground storage, the subject of Part 14 of the Petroleum and Natural Gas Act, is administered by the Titles Division of the Ministry of Natural Gas Development.

Application

An application to the Commission should contain, when applicable:

- the location, field and pool, and purpose/business case of the storage project, and projected date for commencement of operation.
- a table listing the sub-surface project land area, composed of complete gas well spacing areas.
- a map illustrating sub-surface tenure in the storage formation out to 3 kilometres from the boundary of the storage project, including; tenure type, tenure number and registered owner(s).
- a map of the surface area out to 3 kilometers from the boundary of the storage project showing; residences, surface infrastructure, geographic features and any public or First Nations lands.
- letter(s) of consent for inclusion in the project, from all registered sub-surface tenure

owners within the project area and formation.

Geology & Reservoir

- a geologic discussion of the genesis and lithology of the pool, trapping mechanism, average thickness, porosity, permeability, water saturation, temperature. Reference and summary of any core analysis utilized to provide description and parameters.
- maps of formation structural contours, pool net pay isopach, ϕ h.
- a description of nature and efficiency of the cap rock and base rock, with attention to faults and natural fractures.
- available 2-D or 3-D seismic interpretations.
- geologic cross-section(s) through the storage pool, including interpretation of any fluid interfaces.
- production history of the pool, including production graph(s) of fluid types, ratios and production totals.
- a representative sample compositional analysis of each of the fluids produced from the pool.
- the reservoir pressure history of the pool, in both table and graph format, with test date, type, well shut-in time, and a material balance plot. Value of pool initial pressure.
- native hydrocarbons remaining in the pool prior to start of initial injection, and proposal for production reporting until any remaining recoverable reserves are depleted.
- calculation of the formation fracture pressure of 1) the storage pool formation, 2) the caprock formation, with identification of the source of each of the variables used in the calculations.
- identification of any intended well stimulation program(s). If hydraulic fracture stimulation is proposed for any of the wells intersecting the storage pool, details of the proposed stimulation program and a report of the fracture simulation noting distance of frac height and depth growth.
- identification of hydrocarbon bearing reservoirs located at depths above and below the storage pool and any impacts of storage operation on the potential development and production from these resources.
- a summary of seismic activity history in the area, and comment on risk of seismicity to storage operation.

Wellbore Integrity

- a table of all wells intersecting the storage pool, regardless of current status, listing; full well name, Well Permit (WA) number, well bottom-hole location, current well status. Identify wells that will be operated as part of the storage project.

- a map illustrating the location, status and completion zones for all wells within 3 kilometers of the boundary of the storage project, including the location of wells planned to be drilled as part of the project.
- a wellbore diagram of each of the wells intersecting the storage pool, with details of; cement, casing, tubing and downhole plugs or equipment.
- a brief history of each of the wells that penetrate the pool, including; drilling, completion and activity history, commentary on integrity such as cement quality, cement squeezes or casing patches as potential leak path.
- identification of any surface casing vent flows or gas migration attributed to any of the wells intersecting the pool, and remediation that occurred.
- any wellbore integrity or hydraulic isolation logs, and interpretation reports, available for wells intersecting the pool.
- calculation of casing collapse and burst pressures of existing wells intersecting the pool, with applicable safety factors for current measured state of casing metal loss, or assumed loss based on age of casing.

Storage Operation

- source of storage gas and expected typical gas composition.
- the maximum proposed wellhead injection pressure.
- the maximum and minimum proposed storage cycle reservoir pressures.
- volume of gas stored at maximum storage pressure.
- proposed reservoir pressure testing frequency and number of wells tested per survey.
- a proposed program for surface casing vent flow testing.

Submit two copies of the application to the Supervisor, Reservoir Engineering Department of the Oil and Gas Commission in Victoria at the address noted above. Submit a third copy of the application to the Supervisor, Drilling & Production, at the Commission office in Kelowna. Notice of an application is posted on the Commission's website for a 21-day period to solicit any potential technical objections. During the period of public notice, the applicant is responsible for providing a copy of the application, upon request, to third parties. After the notice period has ended, a copy of the application may be requested from the Commission's Records Centre.