

**APPLICATION GUIDELINE FOR: DEEP WELL DISPOSAL OF PRODUCED WATER
DEEP WELL DISPOSAL OF NONHAZARDOUS WASTE**

Well Type	Waste Types Allowed	Required Approval
Produced Water Disposal	Produced water, completion fluids including recovered frac water	BCER Special Project
Non-Hazardous Waste Disposal	Completion fluids including recovered frac water, boiler blowdown water, tank wash water, rig wash, spent glycols, drilling waste leachate, as well as produced water.	BCER Special Project & EMA Permit

Produced water from oil and gas wells must be disposed into a subsurface formation via an approved disposal service well, as per Section 7(1) of the Oil and Gas Waste Regulation. Produced water is defined to also include recovered fluids from well completion or workover operations (including flowback fluids from fracture stimulations); therefore this application/approval applies for disposal of water associated with hydrocarbon production, flowback fluids, or a combination of both.

Non-hazardous waste (NHW) generated from oil and gas industry activities may be disposed into deep formations. Non-hazardous (formerly termed non-special) waste covers waste materials that are not classified as “hazardous” under the Hazardous Waste Regulation. Examples of non-hazardous wastes that may be disposed include boiler blowdown water, tank wash water, rig wash, spent glycols, drilling waste leachate, etc. NHW disposal requires both an ERAA Section 75 approval as well as an EMA (Environmental Management Act) Permit. If an operator will only be using the disposal well for fluids generated by their own operations, the Regulator’s Waste Management and Reclamation Branch handle the EMA Permit. If the facility is to handle 3rd party wastes, the Ministry of Environment and Climate Change Strategy administers the permit under the EMA.

Detailed information regarding water service wells can be found on the Regulator’s website here: [Summary information Water Source and Disposal Wells](#). A proposal to dispose into a deep water-saturated formation must be shown to have no adverse effects on hydrocarbon potential or usable water in the surrounding area. A proposal to use a depleted pool must demonstrate containment.

An application for disposal well approval, as a Special Project under Section 75 of the Energy Resource Activities Act should contain, when applicable:

GENERAL INFORMATION

- Well permit number, well name and location (surface and bottom, if different) of the proposed disposal well.
 - Indicate if the well is deviated or horizontal.
- Discussion and justification for disposal of produced water in the proposed well at the selected location, as expanded below.

WELL CHRONOLOGY

- Chronological summary of well events including drilling, rig release, completion and activity history. Include any production and re-completion, logging or testing work to prepare the disposal zone. Specify dates, durations, depths and outcomes as well as indicating which section of the application contains the test results. Table format preferable.
- Report of the disposal-well completion, including; wellbore schematic, existing and new completion intervals, squeeze details, casing and tubing details and packer depth.

CASING, CEMENTING AND HYDRAULIC ISOLATION

- Full length casing inspection log, required for any existing well greater than 10 years old being converted for disposal service. Include log interpretation. A recent log may be suitable if well has not undergone significant changes since conducted.
- Cement integrity/inspection logs (radial log displaying 3' amplitude, 5' VDL and cement map with non-pressure pass and pressure pass) – less than 10 years old.
- Evidence of hydraulic isolation of the disposal zone, typically a temperature log. Alternatives may be proposed by operator.
- Before disposal operations begin, a pressure integrity test is required. This is standard pressure testing requirement when any completion or workover is conducted on a well. The casing or casing/tubing annulus must be pressure tested to a minimum pressure of 7,000 kPa for 10 minutes prior to the commencement of injection or disposal operations. (See the [Oil and Gas Activity Operations Manual](#) requirement for activating suspended wells and for suspending wells). A pressure test is considered successful if the pressure does not vary by more than three per cent during the test period. This pressure test is required before disposal begins but is not the same requirement as the annual packer isolation test.
- Table of surface casing vent flow (SCVF) test history including test dates and results. Must have tested in past 12 months.
- Type of inhibitor fluid in annulus.
- Map illustrating the status, completion zones for all wells within three kilometers of the disposal well.
- Table listing wellbores within three km radius ordered by proximity to disposal location (including WA# and distance to disposal well). For wells that penetrate the disposal zone, provide casing age, OD, grade, weight, collapse and burst pressures. Include a comment on each well's cement coverage of the disposal zone (review drill reports for cement returns to surface, logged or estimated cement top, cementing problems recorded, un-cemented intervals, annulus hold/float, hold/plug down records, abandonment plugs, etc.).
- A statement confirming area wellbores (as tabulate above) have been reviewed and a discussion of whether wellbores in the area pose a risk for loss of containment of disposal fluid due to inadequate cement or casing strength. Disposal fluid loss to groundwater receptors or surface is the main consideration, however crossflow to other subsurface porous zones should also be considered.

GEOLOGY

- Discussion of the relevant geology and rock properties of the reservoir formation. Include:
 - average porosity
 - permeability
 - water saturation
 - gas-oil contact
 - gas-water contact
 - oil-water contact
- Cross-sections, structural contour and isopach maps with details of top and base of pay and net pay.
- Reservoir seals - discussion of the reservoir bounding base and caprock, including; rock properties, continuity and thickness, evidence of fracturing and effective pool boundaries.
 - Include caprock formation fracture pressure, if available
- Aquifer details - stratigraphic traps, dip and strike and estimates of the volume and areal extent of the aquifer.
- Maps showing known faults within 20 km of the proposed disposal location. Include 2 or 3-D seismic mapping, showing structures and faulting for the area.
- A map and table of seismicity within a 20 km radius, including magnitudes. Events with a magnitude of less than 2.0ML may be excluded. The [BCER's Northeast BC Seismicity App](#) and Natural Resources Canada's website are potential sources for this information.
- Discuss core sample and image log with respect to natural fractures,

RESERVOIR

- If depleted pool, include the producing history of the proposed disposal well and other wells in pool. As well, address remaining reserves, economic factors and rationale for pool selection.
 - Initial reservoir pressure, citing data source, dates and calculations to convert to depth of disposal well.
 - Proposed wellhead & bottom hole injection pressure, and formation fracture pressure (based on ISIP).
 - Detailed report of one of the following:
 - Step-rate injectivity test performed to ascertain fracture pressure of the formation. Must conform to test methods as outlined in SPE Paper 16798 Systematic Design and Analysis of Step-Rate Tests to Determine Formation Parting Pressure (FPP). Also available for reference is the US [Environment Protection Act \(EPA\) guidance for Step-Rate Testing](#).
 - Mini-frac or DFIT stimulation of proposed well. Determine and interpret ISIP, closure and if possible, reservoir pressure. BCER calculation of maximum allowable wellhead injection pressure will include bottom hole ISIP, hydrostatic head, friction losses and a safety factor.
- NOTE:** Valid fracture pressure test design is of utmost importance. If a clear break and creation of a fracture is not noticeable, from either of the above methods, or if the well goes on vacuum before closure, the test will be invalid. A low, conservative wellhead injection pressure will be applied to the disposal approval order.
- Expected injectivity performance (rate and injection pressure) and life, based on maximum limiting average reservoir pressure value (120 per cent of P_i) and available voidage capacity.
 - Results of production testing for hydrocarbon potential in the proposed disposal zone

- Analysis of water in the disposal formation and typical analysis of the water to be disposed. Included description of sources and compatibility.
- Source of fluids to be disposed
- Proposed well testing schedule to monitor reservoir pressure in the disposal formation.

FACILITIES AND MEASUREMENT

- Identify method/type/facility for metering of injection fluid and continuous measurement and recording of wellhead injection and casing pressures.

GROUNDWATER

- Base of groundwater depth, using the methodology outlined in [INDB 2016-09 Technical Guidance for Determining the "Base of Usable Groundwater"](#)
- Discussion of groundwater sensitivity (i.e., receptors) within a three km radius of the disposal well. Applicants can use the [BC-ER Groundwater Review Assistant tool](#) to provide details about groundwater aquifers, freshwater wells, capture zones, surface waters, and more.
- Discuss the Casing, Cementing and Hydraulic Isolation findings and the Geology conditions relative to the groundwater sensitivity (i.e., receptors) within a three km radius of the disposal well. Applicant must consider elevations at the disposal well relative to elevations of water wells, aquifers, base of usable groundwater, surface water bodies, etc.

NOTE: Pro-active monitoring of penetrated shallow aquifers is recommended practice. Though not required at present, a groundwater monitoring program may be a requirement of a Special Project Order for the disposal well, and it is advisable to include a monitoring plan in the application if relevant risks have been identified.

IF AMENDMENT APPLICATION

- Provide current approval number and data of approval, maximum wellhead pressure, approved injection perf depths, a plot of disposal volumes and pressure history.

TENURE (Mineral)

- Map illustrating mineral tenure and registered owners, in the disposal formation, within a 3-kilometre radius of the proposed disposal well.

LETTERS

Provide written statements from subsurface tenure owners who may be affected, indicating their reaction to the proposed water-disposal scheme. Examples of such statements are provided here [Consent to Inclusion in a Reservoir Project](#) or here [No Objection to Reservoir Project](#). These statements may be required or optional/recommended depending on the circumstances, see Section 3.3 of the [Water Service Wells Summary Information](#) document for details.

APPLICATION PROCESS

The application should be submitted to the Supervisor of the Reservoir Engineering Department of the BC Energy Regulator in Victoria via email at Reservoir@bc-er.ca. Notice of an application is posted on the [Regulator's website](#) for a 21-day period to solicit any potential technical objection. The applicant is responsible for providing a copy of the application, upon request, to third parties during the period of public notice. After the notice period ends, a copy of the application may be requested by the [Regulator's Data Centre](#).

NON-HAZARDOUS WASTE

If non-hazardous waste products will contain 3rd party waste, the usual situation for disposal service companies, the applicant must obtain the EMA permit from the Ministry of Environment and Climate Change Strategy. Once an ERAA Section 75 approval has been obtained from the Regulator allowing disposal of non-hazardous waste, the proponent can then apply to the Ministry for an EMA effluent permit for the disposal facility. Further information and guidance for EMA applications to the Ministry can be found on the [Waste discharge authorizations page of the Ministry website](#).

If the non-hazardous waste application is only for the applicant's disposal product (will not include products originating from other companies), the application may be submitted to the Regulator, at waste.mangement@bc-er.ca.

Note that both an EMA Permit and an ERAA Section 75 special project approval are required for deep disposal of non-hazardous waste.