

FRACTURE GRADIENT AND MAXIMUM INJECTION PRESSURE



Fracture Gradient

Within the project AoR, there is a site-specific fracture gradient for the Upper Injection Zone, but not for the Lower Injection Zone or any of the confining zones. A step-rate test will be conducted as per the pre-operational testing plan (Attachment I) in the injection zones. A step-rate test was performed in the [REDACTED] with a resultant fracture gradient of 0.822 psi/ft in the Upper Injection Zone. Several additional wells in the [REDACTED] have formation integrity tests (FIT) or leak-off tests (LOT) performed at similar depth ranges to the project injection and confining zones. Tests from seven wells average 0.82 psi/ft from tests in the depth range of [REDACTED] TVD. For the computational simulation modeling and well performance modeling, a fracture gradient of 0.76 psi/ft was assumed for now as a safety factor.

Maximum Injection Pressure

CTV will ensure that the injection pressure is beneath 90% of the fracture gradient at the top of perforations in the injection wells. CTV expects to operate the wells with a planned bottom hole injection pressure well below the maximum allowable injection pressure calculated using the fracture gradient and safety factor.

Table 1 – Fracture gradient and maximum injection pressure for [REDACTED]

Injection Pressure Details	Injection Well 1 [REDACTED]
Fracture gradient (psi/ft)	0.76
Maximum allowable bottomhole injection pressure (90% of fracture pressure) (psi)	4,311
Elevation corresponding to maximum injection pressure (ft TVD)	6,302
Elevation at the top of the perforated interval (ft TVD)	6,302