

II. Explanation of Bottomhole Injection Pressure in Relation to Surface Injection Pressure

Determination of Wellhead Injection Pressures:

1. EVGSAU is a CO₂ WAG project whereby CO₂ injection is alternated with water injection. Due to the difference in densities between the two fluids and the operational need to maintain a constant bottomhole injection pressure between cycles, the surface injection pressure for CO₂ will be higher than that of water.
2. The wellhead injection pressure for water was established by subsequently amended NMOCD order R-5897 and applies to all the injection wells field wide. The permitted injection pressure granted is 1,350 psi at the surface for water. This equates to a bottomhole injection pressure of

$$BHIP_{water} = Surf. Inj. Pressure + Hydrostatic Pressure of water$$

$$BHIP_{water} = 1,350 \text{ psi} + 0.52 \times 8.7 \text{ ppg} \times 4,400 \text{ ft} = 3,340 \text{ psi}$$

3. The calculation of the surface injection pressure for CO₂ is as follows:
 - a) EVGSAU currently blends pipeline purchased CO₂ with recycled produced gas to inject a 90%+ CO₂ gas composition with minor components consisting primarily of methane. As a safety factor, a heavier composition of 100% CO₂ is used for this calculation.
 - b) With this injected composition, EVGSAU injected gas density is

$$\rho_{CO_2} = 48.6 \frac{\text{lb}}{\text{cuft}} \text{ or } 0.338 \frac{\text{psi}}{\text{ft}}$$

With top perforation in the San Andres being 4,400 ft., the hydrostatic pressure in the CO₂ injection well is

$$\text{Hydrostatic of CO}_2 = 0.338 \frac{\text{psi}}{\text{ft}} \times 4,400 \text{ ft} = 1,490 \text{ psi}$$

Therefore, the surface injection pressure for CO₂ is

$$\text{Surf Inj Pressure}_{CO_2} = BHIP - \text{Hydrostatic}_{CO_2}$$

Or

$$\text{Surf Inj Pressure}_{CO_2} = 3,340 \text{ psi} - 1,490 \text{ psi} = 1,850 \text{ psi}$$