

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

$$\rho_{CO2} = 48.6 \frac{\text{lb}}{\text{cuft}} \text{ or } 0.338 \frac{\text{psi}}{\text{ft}}$$

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

$$\text{Hydrostatic of CO2} = 0.338 \frac{\text{psi}}{\text{ft}} \times 4,400 \text{ ft} = 1,490 \text{ psi}$$

Therefore, the surface injection pressure for CO2 is

$$Surf Inj Pressure_{CO2} = BHIP - Hydrostatic_{CO2}$$

Or

$$Surf Inj Pressure_{CO2} = 3,340 \text{ psi} - 1,490 \text{ psi} = 1,850 \text{ psi}$$