

Case 21996- Answers for Examiner Post Hearing, 7-7-21

1. Is the well construction for the injection wells the same or has anything changed?

For both wells, the perforations, wellbore casing and cement construction have not changed.

2. Will injection be through unlined tubing?

Yes, injection will be through unlined tubing for both wells.

3. How was the max pressure calculated for produced gas and CO2? Also, provide clarification on max produced gas pressure- Is it 4350 psi or 4250 psi?

Here are the steps used to calculate the Maximum Surface Pressure for produced gas and CO2 injection. The Maximum surface pressure is 4250 psi for produced gas and 2200 psi for CO2.

Cedar Canyon 16 State 7H and 12H Calculation for Surface Injection Pressure Limit

For Water Injection: 1720 psi

The calculation for surface pressure limit: $0.2 \text{ (psi/ft)} * \text{TVD (ft)}$ of shallowest perforation. This is based on “The permitted injection pressure is limited to 0.2 psi/ft. to the uppermost perforation” (NMOCD UIC Manual Section III.A.2)

Well	TVD (ft)	Max Water Injection THP, psi
Cedar Canyon 16 State 7H	8644	1720
Cedar Canyon 16 State 12H	8635	1720

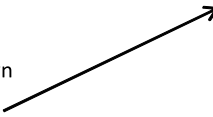
For Produced Gas: 4250 psi

For CO2: 2200 psi

The calculation procedure is shown below:

- Based on the surface pressure limit for water and assuming fresh water gradient (0.433 psi/ft). The Bottom Hole Pressure Limit is $(0.2 + 0.433) * \text{TVD (ft)}$ of shallowest perforation (or 0.63 psi/ft)
- The composition for the proposed injection produced gas is shown in the table. While CO2 injection case composition is only CO2.
- A Petroleum Expert Prosper[®] Model was used to calculate the surface pressure with tubing ID, reservoir depth, injection gas composition and the BHP limit calculated in the step 1. The lowest surface injection pressure was used for both wells.

Component	%
Nitrogen	1.62
H2S	0.00
Methane	77.19
CO2	0.19
Ethane	12.58
Propane	5.73
i-Butane	0.58
n-Butane	1.33
i-Pentane	0.25
n-Pentane	0.24
Hexanes+	0.29
Total	100.00



* Prosper Model is industrial standard nodal analysis software for pressure calculation includes phase behavior change, friction loss.

Well	TVD (ft)	Max Inj BHP	Max Gas Inj THP, psi	Max CO2 Inj THP, psi
Cedar Canyon 16 State 7H	8644	5472	4250	2200
Cedar Canyon 16 State 12H	8635	5466	4250	2200

