Message

From: Keith Bowman [kbowman@capturepointsolutions.com]
Sent: 4/22/2022 4:54:08 PM
To: Ussery, Ian [Ussery.Ian@epa.gov]; Nick Jones [njones@capturepointsolutions.com]
CC: Krishnan Raghunathan [kraghunathan@capturepointsolutions.com]
Subject: RE: Core collection question

Good morning, Ian,

Ian, thanks for the detail of your reply and frankly your quick reply. We concur, a regional evaluation with site specific cores, open hole logging combined with post completion testing have to be spatially representative of the proposed CO2 storage reservoirs for robust modeling to occur! For us as additional data is acquired within a site, a geostatistical package will be reviewed for applicable merit and enhancement of the reservoirs' heterogeneity.

Nicks question was **not** referencing the Ex. 9 Wells in Osage County, Oklahoma. However, as a brief FYI to our proposed Ex. 4 CBI sequestration project, we are anticipating coring two out of the three proposed injection wells. Our regional work combined with a state-of-the-art logging suite, i.e., circumferential acoustic logging, magnetic resonance logging that will be typed to these cores along with a dipole sonic, high-density pump-in testing, etc. will greatly enhance the reservoir modeling accuracy. We are very fortunate to have the University of Oklahoma, Mewbourne School of Petroleum Engineering and Geological Engineering studying Ex. 9 Wells storage capacity for the entire state with a detailed emphasis on Osage County. OU is also giving their best efforts to find and copy the historical Ex. 9 Wells injection and production data from BIA in Osage. Oklahoma Geological Society is in the early stages of planning Ex. 9 Wells n-situ CO2 compatibility studies from a pilot injection project along the eastern Kay County line in Oklahoma. CapturePoint LLC has offered a Kay County shut-in Ex. 9 Wells well for these studies. OGS Seismicity department will be running a portable array over the Ex. 9 Wells in the summer of 2022. This data will be used for base line measurement. Understanding the background noise from an ongoing tertiary flood should aid in the detection of basement seismicity events. We have contracted seismicity experts to review and recommend our own continuous seismic array for monitoring Ex. 9 Wells injection and basement seismicity. Ian, are you at liberty to inform us the team members at Region 6 who would be reviewing our Arbuckle Class VI application?

Nick's question **was specific** to our ongoing application in Rapides Parish, Louisiana. The Ex. 9 Wells sands as are the Ex. 9 Wells are a regionally extensive and a well-studied reservoir group primarily because of their prolific hydrocarbon production history. At the Rapides site, we are proposing a Ex. 9 Wells coring program in the site's in-zone monitoring well #3 and for well #4 which is 1 of the 6 injection wells that will be drilled on the three proposed injection pads. Each injection pad will have a lower Ex. 9 Wells penetration, Wells #4, #7 & #10. These wells will have a state-of-the-art logging suite that will be typed to the cored wells of #3 and #4. Using the regional data as a baseline along with Triple Combo, High resolution resistivity FMI tool, Dipole sonic, Compensated Spectral Gama Ray, Elemental logging tool for mineralogy and the Nuclear Magnetic Resonance typed to core data from wells #'s 3, 4, 7 and 10 will give us an excellent data set for reservoir modeling and calibration. We are contemplating drilling and logging Well #7 first to enhance and refine the intervals to be cored in Well #4. My opinion from 40 years of working the gulf coast states, western Rapides and eastern Vernon Parishes are one of the better regional sequestration sites in Louisiana because of expansive storage capacity, no faulting in Cenozoic section, well density around 3 wells per township, no seismicity, etc. The only negative is lengthy pipelines are required to reach current emitters which can create significant economic limitations on any project. The Field of Dreams, "build it and they will come" are definitely one of our driving aspirations.

Thanks for your all you do and please advise with questions, comments, or concerns.
Keith

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From: Ussery, Ian <Ussery.Ian@epa.gov>
Sent: Thursday, April 21, 2022 9:37 AM
To: Nick Jones <njones@capturepointsolutions.com>
Cc: Krishnan Raghunathan <kraghunathan@capturepointsolutions.com>; Keith Bowman <kbowman@capturepointsolutions.com>
Subject: RE: Core collection question

Good morning Nick,

Sorry for the delayed response. We had to run this one around the section to develop a consensus.

The cores need to be representative enough to determine modeling parameters and build a robust model with heterogeneity. If the unit you all are coring is highly fractured in one area, not in another, or has karst in one area and not another, then it may give a poor picture of the operational reaction. The answer to how many is enough? It needs to be defined as enough to determine things like permeability, porosity, fracture pressure, physical or chemical characteristics of both the injection and confining zones, and the nature of fluids already in the injection zone.

Reservoir modeling software may account for the difficulty in obtaining deep geological data, but not sure if there is a minimum number of required wells to run the statistics. The Class VI modeler could try using a geostatistical package to define heterogeneity. T-PROGS is used for that purpose for groundwater models using borehole data.

If this is the Ex. 9 Wells there can be a lot of local variabilities. So, it depends.....on a different application, we are requesting that they try again because they didn't have enough core to justify what they wanted to do, and their model was over simple because of a lack of good core data.

Another factor to consider is the amount of data available from nearby wells. If there is extensive data from nearby wells, we expect fewer cores to be required to characterize the reservoir and the regional geology properly. If there is limited data or poor core quality, several core samples would be necessary to characterize the formation. Also, more data should be collected if the seismic data shows inconsistency.

The overall consensus would be to get data from one well at each pad at a minimum, allowing for linear interpolation or kriging.

From: Nick Jones <njones@capturepointsolutions.com>
Sent: Wednesday, April 20, 2022 2:19 PM
To: Ussery, Ian <Ussery.Ian@epa.gov>
Cc: Krishnan Raghunathan <kraghunathan@capturepointsolutions.com>; Keith Bowman <kbowman@capturepointsolutions.com>
Subject: Core collection question

Hi Ian, say quick question regarding coring requirements under the class VI rules. Our proposed project will entail 3 well pads spaced approximately 2,000 feet apart in a triangular fashion each containing two wells. Given the proximity of the pads, will the collection of core from each injection well be required to satisfy permit requirements? Will the collection

of whole core (collected core will be taken to account for all intended injection zones and the primary confining unit) from one of the injectors be sufficient?

Many thanks

-Nick

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