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New Insights Regarding Aquifers in the Uinta Basin, Utah: Implications for Saline Water Disposal

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As Uinta Basin petroleum production has increased – natural gas alone increased 60% in the last 10 years – so has saline water production, increasing the need for economic and environmentally responsible disposal plans. Current water disposal wells are near capacity and permitting for new wells is delayed because of insufficient technical data regarding potential disposal aquifers and questions concerning contamination of fresh water sources. Many Uinta Basin operators claim that crude oil and natural gas production cannot reach its full potential until a suitable, long-term saline water disposal solution is determined.

Part one of our effort involves re-mapping the base of the moderately saline aquifer (BMSA) within the Uinta Basin using more robust data and more sophisticated GIS techniques than previous work. Regulators agree that below this boundary, saline water can be injected without damage to the overlying fresh water aquifers. Thus far we have compiled down-hole water chemistry data from over 1300 wells, mainly clustered in oil and gas fields. For areas where water quality information is not available, we have used refined techniques for determining the BMSA using geophysical logs from about 250 wells.

Part two of our project includes a detailed study of the Birds Nest aquifer, which is recognized as a possible large-volume saline water disposal zone. During the terminal stage of Eocene Lake Uinta, the saline mineral nahcolite formed within the deep-lake sediments (depocenter in central Uintah County) as isolated crystals, nodules up to one foot in diameter, and beds ranging from less than an inch to 2 feet thick. Post-deposition, the saline mineral shortite formed in fracture zones several feet thick. Examination of several cores reveals that the total thickness of the saline zone ranges from <100 feet on the basin margins to >300 feet in the basin's depocenter. More recently, the Birds Nest aquifer formed from the dissolution of the saline minerals. Core analysis reveals that in the basin's depocenter, the aquifer is divided into two or three stratigraphic zones of dissolution, each roughly 40 feet thick. Near the margin of the basin, the dissolution occurs in one zone about 60-80 feet thick. Ongoing research seeks to determine how these zones correlate throughout the basin and if the Birds Nest as a whole is vertically connected via fractures/joints (possibly gilsonite veins) to other water-bearing horizons.