Abstract: Produced Water Opportunities – turning a liability into an asset.

By Speaker – Geoffrey Thyne ,Company – ESal, Job Title – Chief Technology Officer

Produced water is the major product of hydrocarbon production. Produced water management in unconventional reservoirs has become a significant component of operational costs. Locations in Oklahoma and Texas have seen injection wells trigger seismic activity leading to regulatory restrictions. In Oklahoma this problem was addressed by limiting injection permits. If this model is extended to the Permian basin, we will face production limitations where disposal capacity exceeds production volumes. Water treatment and beneficial use are emerging options but developing sufficient capacity requires infrastructure investment, technology and social acceptance not currently available.

This research used various sources including published literature and government reports to examine the volumes and composition of produced water. In particular, the options for handling the large volumes and high salinity of produced water were investigated to try and better understand the problem. There are no standard methodologies or practices currently in operation that can both meet current and future needs in a economic and sustainable fashion.

The data show that oil and gas activity creates 13MM bbl per day of liquid hydrocarbons but also produces over 66 MM bbl of brine. These brines can be very saline with salinities as high as 375,000 ppm but for the most part are less than 200,000 ppm. The chemical composition of the brines is dominated by Na and Cl regardless of the proximity to salt strata. Nor is there a consistent pattern of increasing salinity with depth or age. The minor components include potassium, calcium, magnesium, sulfate and bicarbonate. These components are controlled by water-rock equilibrium and rapidly reach constant amounts during burial. The pH in the reservoir is a function of local mineral equilibria dominated by feldspar-clay equilibria at higher temperatures.

While conventional activity essentially recycles the produced water, unconventional activities cannot use this strategy and are driven to use subsurface disposal for most produced water with some recent efforts at reuse. Unconventional operations are more efficient in terms of water production than conventional operations with a 50% increase in oil production since 2012 with only a 15% increase in produced water volume. However, water management is still between 5 and 15% of D&C costs. Other options to manage unconventional brines include treatment to discharge, evaporation and beneficial reuse. If the primary option, disposal by injection, is curtailed by seismic activity the other options will have to expand to maintain production. Valorization has emerged as another option. Dissolved components such as lithium and other critical elements can occur in produced water at concentrations that permit profitable extraction.