

## Produced Water Treatment for Beneficial Uses

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### **Abstract**

The Permian Basin, a major oil and gas producing region, faces significant challenges in managing high Total Dissolved Solids (TDS) produced water. Traditional disposal by deep well injection is becoming limited due to increasing observations of seismicity. This study evaluates opportunities and challenges for desalination and treatment of the produced water for beneficial reuse. The focus is on the performance of Mechanical Vapor Compression (MVC) desalination of hypersaline solutions and includes experimental observations from pilot plant studies and Aspen+ simulations of the fate of contaminants including ammonia and trace organics. Targeted analysis of specific contaminants was supplemented with non-targeted analysis of MVC desalinated waters to identify potential contaminants of concern. Potential beneficial uses are also explored including industrial reuse and agricultural irrigation.

This study provides valuable insights into desalination processes for treating high-TDS wastewater, examining both specific energy consumption (SEC) and component distribution. The results show substantial carryover of both ammonia and volatile organics and the need for post desalination treatment for most beneficial uses. The study shows, however, that beneficial reuse of the water is possible and that avoidance of the cost of disposal provides a significant economic advantage to desalination of these water. The findings could have significant implications for design and operation of MVC and other thermal desalination systems in the Permian basin including pre- and post-treatment requirements.