

Water for 2060 Produced Water Reuse and Recycling

In support of the Oklahoma Governor’s initiative, launched in December, to re-use or recycle water produced in oil and gas operations, the Produced Water Re-use and Recycling report assessed the potential alternatives to current practices of injecting produced water from oil and gas wells into disposal wells in Oklahoma.

To achieve this goal, a 17-member Produced Water Working Group (PWWG), led by the Oklahoma Water Resources Board, was tasked with studying and recommending alternatives to produced water disposal from oil and gas operations in Oklahoma. The PWWG met five times from early 2016 to early 2017 to discuss and develop its recommendations. The recommendations included in the report are part of a long term effort to improve water management in the state.

Produced Water Working Group Goals

Studying and Recommending alternatives to produced water disposal from oil and gas operations in Oklahoma.

Discussing opportunities and challenges associated with treating produced water for beneficial uses, such as industrial use or crop irrigation.

In support of the PWWG efforts, the technical study team investigated:

- Produced water production in 66 Oklahoma counties and water quality in 29 counties;
- The top 40 major water users in the state based on water permits;
- Typical water treatment costs for various volumes and treatment levels from eight selected companies.

Ten representative cases were developed and further assessed by coupling a potential produced water user or alternative disposal method to an existing adjoining produced water source and evaluating the economics of each case in order for the PWWG to prioritize and make recommendations. The costs for the 10 cases range from \$0.57 per barrel of water to more than \$7 per barrel of water.

Cost Estimates for Ten Produced Water Use Scenarios

New Case	Case Description	Total Capital (\$Millions)	Capacity BWPD	County	Assumed Wtr TDS (mg/L)	Normalized \$/BW
1	Typical Source and Dispose - STACK & SCOOP	NA	NA	Central OK	NA	1.09
2	Oil and gas re-use (treatment cost only)	NA	NA	State-wide	NA	0.57
3	Clean Brine Transfer & treatment	208	200,000	Alfalfa	213,000	1.03
4	Evaporation - low TDS (SCOOP & STACK)	NA	20,000+	Blaine	17,000	1.66
5	Evaporation - high TDS (Miss. Lime)	NA	20,000+	Alfalfa	213,000	1.79
6	Desalination for Surface Discharge	22	15,000	Beckham	9,000	3.58
7	Desalination for Power Use	88	130,000	Pawnee	125,000	4.37
8	Desalination for Power Use	95	230,000	Seminole	180,000	4.43
9	Desalination for Industrial Use	35	30,000	Grant	227,000	7.41
10	Desalination for Surface Discharge	38	30,000	Grant	227,000	7.49

Key Findings (ordered by viability and timeframe)

1. Produced water re-use by the oil and gas industry is the most viable cost-effective alternative due to minimal water treatment needs and thus low treatment costs. Increased inter-organizational planning and sharing of resources to improve re-use viability are required. The oil and gas industry has built limited water pipeline networks to date; however, planned cooperative expansion of the water distribution systems over time would reduce conveyance costs and further facilitate produced water use for hydraulic fracturing.
2. A special case of water re-use was evaluated using surplus produced water from the Mississippi Lime play area around Alfalfa County. This surplus could be gathered and conveyed to sites in Blaine County for oil and gas re-use. Although the project could be technically and commercially complex, the screening analysis shows it has potential to be financially competitive with current disposal methods. A more detailed evaluation is needed.
3. Evaporation techniques for produced water should be further investigated and developed. Due to low water treatment costs and potentially limited water conveyance requirements, evaporation technology could be a viable alternative to disposal.
4. Water treatment and desalination techniques of produced water should be further investigated and developed if the PWWG intends to reduce the majority of water produced in the state. Although current technologies are technically implementable, they appear impractical at this time.

Recommendations (abridged)

1. Reduce the challenges to water re-use through targeted regulations and legislation by:
 - a. Removing legal ambiguity about ownership of produced water when sold;
 - b. Establishing bonding requirements for water impoundments that are appropriate without being an impediment;
 - c. Evaluating technical standards or other data-driven risk strategies and financial assurance approaches to equitably manage risk and remove financial impediments to reuse project development;
 - d. Clarifying rules and ownership when water is transferred from one company to another;
 - e. Requesting delegation from the U.S. Environmental Protection Agency (EPA) to Oklahoma for permitting the discharge of treated produced water;
 - f. Considering methods that make obtaining right-of-way for pipelines that allow cost-effective transfer of recycled/re-used water easier as an alternative to impacts of trucking.
2. Further investigate methods to facilitate the re-use of produced water in oil and gas operations.
3. Study further the feasibility of transferring the Mississippi Lime area produced water to the STACK play (Case 3).
4. Conduct a more detailed evaluation of evaporation as an alternative to injection (Cases 4 and 5).
5. Identify research needs and potential funding partnerships to further accomplish the group's goals.
6. Continue the PWWG or subgroups to identify opportunities to continue cooperative planning and development of new techniques, infrastructure, water users, legislation and regulatory structure.
7. Support and build upon the Water for 2060 Advisory Council 2015 energy and industry water use sector water conservation findings and recommendations to the Governor and the Legislature.

