

Produced Water – An EPA Perspective

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Topics

What is Produced Water

Drivers

EPA's National Perspective

EPA Regional Efforts

Conclusion





What is Produced Water?

- Water that is produced as a byproduct during the extraction of oil and natural gas
 - Chemicals found in oil
 - Downhole additives
 - Transformation by-products
 - Salts
 - Metals
 - Naturally occurring radioactive materials (NORM)
- Composition varies depending on activities at production well and across oil fields

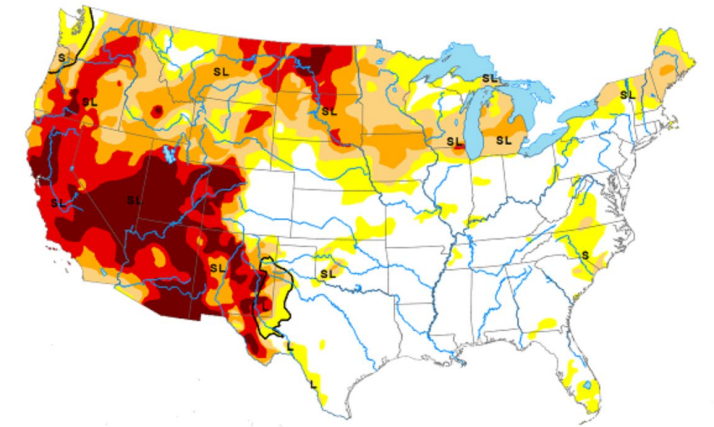
Drivers & Questions

- National Pollutant Discharge Elimination System (NPDES) Discharges
 - West of the 98th meridian: 40 CFR 435, Subpart E, “**good enough quality**” for use in wildlife propagation and agriculture
 - ~400 PW NPDES permits in R8
 - Typically, passive treatment to remove oil
 - Total dissolved solids (TDS) values from 1,000-5,000 mg/L when discharged
- The West is running out of water
- Is the water safe for intended use?
 - What is in the water?
 - Are there adverse effects for exposed animals and people?
- What are the best methods to evaluate composition and safety?



Map released: June 24, 2021

Data valid: June 22, 2021



Intensity and Impacts





National Program Perspective

- OW-OST - No current plans to update the following regulations
 - 40 CFR 435.50 – 435.52 Subpart E Agricultural and Wildlife Use Subcategory
 - Applicable to those onshore facilities located in the continental United States and west of the 98th meridian for which the produced water has a use in agriculture or wildlife propagation when discharged into navigable waters.
 - These facilities are engaged in the *production, drilling, well completion, and well treatment* in the oil and gas extraction industry.
 - The term “use in agricultural or wildlife propagation” means that the produced water is of **good enough quality** to be used for wildlife or livestock watering or other agricultural uses and that the produced water is actually put to such use during periods of discharge.



National Perspective Continued

- 40 CFR 437.20 – 437.26 Centralized Waste Treatment Point Source Category – Subpart B Oily Waste
 - Previous consideration of amending the source category to include acceptance of produced water.
- Regional Thinking
 - Some Regions are interested in finding ways to address perceived shortcomings in 40 CFR 435.
- State Actions
 - New Mexico and Texas have active consortia looking into produced water discharge that would conform to the requirements of 40 CFR 435.



EPA Regional/ORD Efforts

EPA Region 6 & 8 Produced Water Research

- **2017:** Regional Applied Research Effort (RARE) funding for project “Using a biosensor tool to evaluate the safety of produced water for beneficial reuse during drought conditions in the west”
- **2019:** RARE funding for project “Biosensor tool evaluation of produced water intended for beneficial use”
- **2020:** SSWR: Output 27/Product 1- Using gene expression profiling to minimize hazards and identify optimal treatment methods for produced water (Collaboration with Colorado School of Mines)
- **2021:** RARE funding for project: “Comprehensive toxicological evaluation of produced water intended for beneficial use”



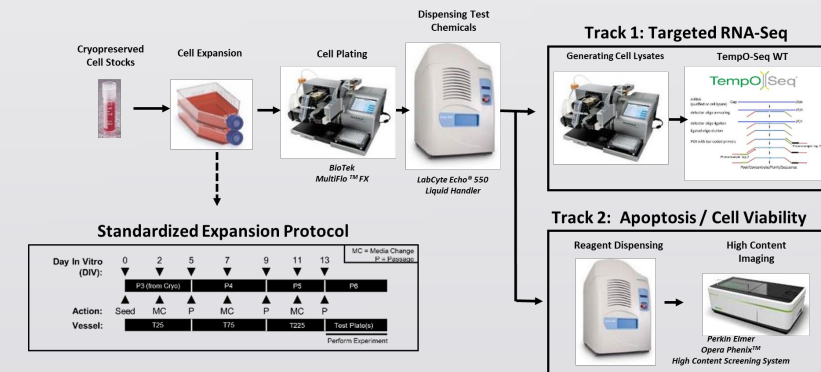
Current Research

- **Targeted and non-targeted chemical analysis**
 - Can identify potentially all nonvolatile components
 - Targeted analysis
 - Analytical standards exist for quantitation; only measures analytes on the targeted list
 - Non-targeted analysis
 - High resolution mass spec and chromatographic techniques to identify known and unknown analytes

- **Gene expression profiling in treated human cell lines**
 - Use raw water or extracts of the water
 - Examine changes in the expression of all genes
 - Can potentially examine all chemical targets
 - Molecular changes can be linked to predicted effects in humans and animals through the adverse outcome pathway (AOP) network
 - Can identify dilutions at which there are no effects



Experimental Workflow for High Throughput Transcript Profiling



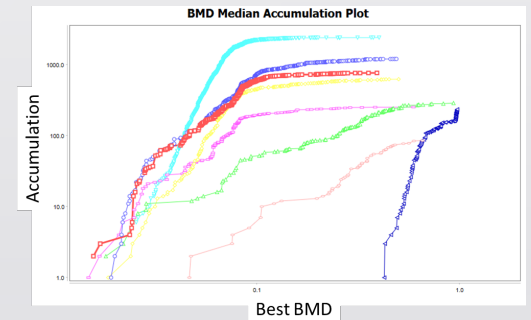
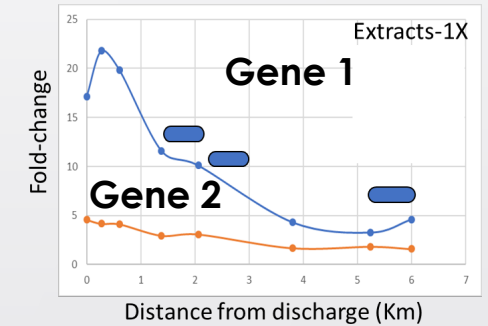
Produced Water Sampling Sites

- Wyoming – R8
- Montana – R8
- New Mexico, Texas – R6
- Colorado –R8 (SSWR Project with Colorado School of Mines)
- Pennsylvania – R3, USGS
- California



Preliminary Results

- Determined the effects of PW at the source and at different locations downstream
- Distance and wetlands are important to diminish responses
- Performed a concentration-response analysis of the water
 - Water samples further from the source exhibited decreases in the number of genes and pathways altered
 - Can identify dilutions in which there are no effects





Questions and Comments

My card...



**U.S. ENVIRONMENTAL
PROTECTION AGENCY**

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