EMERGING CHALLENGES IN PRODUCED WATER MANAGEMENT

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WHAT IS PRODUCED WATER?

- Energy resource extraction processes use water for drilling and other purposes.
- Petroleum formations are a complex mixture of oil, natural gas, and brackish water.
- Wastewater from operations and the formation is generated along with oil and gas.
- **Produced water**: All water that is returned to the surface from an oil and gas well.
OIL AND GAS FORMATION

OCEAN
300-400 million years ago
Tiny sea plants and animals died and were buried on the ocean floor. Over time, they were covered by layers of silt and sand.

OCEAN
50-100 million years ago
Over millions of years, the remains were buried deeper and deeper. The enormous heat and pressure turned them into oil and gas.

Sand, Silt, & Rock
Today, we drill down through layers of sand, silt, and rock to reach the rock formations that contain oil and gas deposits.

http://2.bp.blogspot.com/-cdtGjsLHegE/VbjBk1qGU5I/AAAAAAAABPs/Xef6n4bKmWU/s1600/oil_gasFormation.jpg
OIL AND GAS RECOVERY

https://4.bp.blogspot.com/-mODl8R-hry0/VyXxGZyy2ZI/AAAAAAAAADR0/8WUOAaPDew4YHvwpNSElluHQu9E1tuXWgCLcB/s320/x.jpg
PETROLEUM RECOVERY LIFE CYCLE

- Primary Recovery—formation under pressure (<10%)
- Secondary Recovery—water used to drive petroleum to production wells (majority of production)
- Enhanced Recovery—other technologies sometimes used
HYDRAULIC FRACTURING

- Uses water at high pressure to create fractures in the source rock
- Proppant (sand) is carried by the water to keep fractures open
- Large quantities of water used to increase reservoir conductivity/economic viability of the operations

http://www.goldmanprize.org/blog/lois-gibbs-leads-national-anti-fracking-campaign/
UNCONVENTIONAL RECOVERY

- Source rocks have low permeability
- Hydraulic Fracturing—increases permeability
- Horizontal Drilling—decreases drilling costs
- Hence, the Shale Gas and Tight Oil Boom
RESURGENCE IN OIL & GAS PRODUCTION

- Natural gas sources
  - Co-produced with oil and coal
  - Conventional gas wells
  - Shale gas wells
- Tight oil and shale gas production resulting from new technology has dramatically increased US production
SUMMARY

- Oil and gas production is critical to Oklahoma and the global economy
- Produced water is generated with oil and gas
- Managing produced water is not a new issue, but it is growing with other water challenges and the Oklahoma oil and gas resurgence
- Recycling produced water provides a way to reduce the impacts of oil and gas production
- Social, legal, and technical expertise is needed to solve emerging problems in produced water management
- Multidisciplinary research teams are needed to overcome challenges associated with reuse