Moving Beyond Induced Seismicity in the Permian

Water Solutions for the Future

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TOPICS

• Why is there so much water?
• Where can we put it when done?
• What does that do?
• Are there alternatives?
• How do we do it?
THE PERMIAN BASIN

BUSIEST OIL PATCH IN THE US

HOSTS MORE THAN HALF THE RIGS IN THE US
PRODUCTION GENERATES PRODUCED WATER
FRACKING HAS LED TO A BUSINESS EXPLOSION IN THE PERMIAN BASIN
FRACKING HAS LED TO A BUSINESS EXPLOSION IN THE PERMIAN BASIN

Texas, By Itself, Is Now The World’s Third Largest Oil Producer

5 Millions Barrels/Day
THIS IS HOW WATER TRADITIONALLY GETS TO FRACK SITES
WATER USE PER WELL IS RAPIDLY INCREASING

- First fracked wells required about 1 million gallons
- 10 million gallons per well is now common
- 100 million gallons is forecast
WHY IS PER-WELL WATER USAGE RAPIDLY INCREASING?

Laterals are growing in length....
WHY IS PER-WELL WATER USAGE RAPIDLY INCREASING?
NESTED LOCATION
WHAT DO WE DO WITH OUR WASTES?

OIL AND GAS WASTE FLUIDS HAVE HISTORICALLY BEEN DISPOSED IN CLASS II INJECTION WELLS
BASICS OF DEEP WELL INJECTION
“EARTHQUAKES CAUSED BY HUMAN ACTIVITY”

Oklahoma: Earthquakes measuring > 3.0 surged from two in 2008 to about 900 in 2015

In the Permian Basin, earthquakes >2.5 have tripled to more than 60 in a year
2009–19 Oklahoma earthquake swarms

This article is about earthquakes in Oklahoma and vicinity since 2009. For other pages related to Oklahoma earthquakes, see Earthquakes in Oklahoma.
Central U.S. Earthquakes 1973 - 8/2018

852 M≥3 Earthquakes 1973 - 2008
3427 M≥3 Earthquakes 2009 - 8/2018
“It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is the most adaptable to change.” – Darwin
PRODUCED WATER TREATMENT
PRODUCED WATER TREATMENT
INTEGRATED TREATMENT SYSTEM
MOBILE TECHNOLOGY
TREATMENT TECHNOLOGY

Minimum Frack Quality ➔ Ag Surface Irrigation Discharge
WATER MIDSTREAM

Water Midstream is all about transfer and storage of massive amounts of water for oil and gas industry use.
IT’S ALL HAPPENING IN THE PERMIAN BASIN, BUT THE INDUSTRY AND TECHNOLOGY IS EXPECTED TO SPREAD TO THE OTHER SHALE BASINS IN THE US
THE IDEA IS TO STRATEGICALLY CONNECT PIPELINES AND SURFACE IMPoundMENTS TO VASTLY IMPROVE WATER DELIVERY EFFICIENCY AND ALSO WATER RECYLING
AND GET THE TRUCKS OFF THE ROAD!
ACTIVE PIPELINES—PERMIAN BASIN
SURFACE IMPOUNDMENTS ARE AN IMPORTANT PIECE OF THE PUZZLE
WATER MIDSTREAM UTILIZES SURFACE IMPOUNDMENTS

• The surface impoundment liner designs are very similar to landfills
• Similar materials and designs using geosynthetics and sumps

Required Services:
• Permitting
• Surveying
• CQA
• Construction Oversight
• Regulatory Liaison
WATER MIDSTREAM NEEDS PERMITTING

- Permitting requires site characterization
- Permits are very similar to RRC surface waste disposal permits
LINEAR PERMITTING
COMMERCIAL WATER MIDSTREAM IMPOUNDMENTS MAY REQUIRE GROUNDWATER MONITORING

- Well Installation
- Sampling, analysis and reporting
500,000 BBL SURFACE RECYCLED FRAC WATER IMPOUNDMENT IN PERMIAN BASIN
INSERT

SHAMELESS PLUG
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