Class II Injection Wells Are an Integral Part of U.S. Oil and Gas Production

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Key Points on Produced Water Injection

- There are nearly 1 million oil and gas wells in the U.S. that generate a very large volume of produced water
- EPA discharge standards prohibit produced water discharges to surface water from most onshore wells
- Injection remains the primary option for managing onshore produced water
  - Inject to producing formation to produce more oil
  - Inject to non-producing formation for disposal
- The reuse of produced water for waterflooding preserves other freshwater sources and saves money for the industry
- Without the availability of Class II injection wells, the U.S. oil and gas industry would not be as productive and cost-competitive as they are
  - Through energy cost savings, this benefits U.S. consumers and manufacturers

Detailed Produced Water Inventory for the U.S.

- Clark, C.E., and J.A. Veil, 2009, *Produced Water Volumes and Management Practices in the United States* contains detailed produced water volume data for 2007
  - Total produced water = ~21 billion bbl/year = ~2.4 billion gals/day
  - Total volume injected = ~17.9 billion bbl/yr = ~2 billion gals/day

- New draft report completed this month for GWPC updating the volumes to 2012 year
  - Total produced water = ~20.5 billion bbl/yr = ~2.3 billion gals.day
  - Total volume injected = ~18.0 billion bbl/yr = ~2.1 billion gals/day

- More details this afternoon

History of Oil and Gas Injection Wells

- In the early years of oil and gas production, produced water was often dumped on the land or discharged into local streams and rivers
- Accidental water injection in Pithole City area of northern PA in 1865
  - Typically leaks from shallow water sands or surface water entering drilled wells
- Began with some regularity in 1920s
- First 5-spot flood initiated in 1924 in Bradford field in northern PA
- Spread to Oklahoma in 1931 and then to Texas in 1936
- Widespread application started in early 1950

Source: Exploring Oklahoma History website. This waterflood occurred in NE Oklahoma in 1931.

Source: Presentation by Dr. Abdus Satter; http://media01.commpartners.com/SPE/october_23rd_hybrid/handouts/AbdusSatter-WF-Slides.pdf

Safe Drinking Water Act Creates UIC Program

- Following expansion of water flooding and disposal well activities around the country, state agencies developed some early regulatory or oversight programs
- Congress passed the Safe Drinking Water Act in 1974, creating the Underground Injection Control (UIC) program, and directing EPA to establish requirements for state programs
- States are allowed to apply to EPA for authorization to take over primary regulatory authority to administer injection activities in their states (Primacy)
- States that do not apply or do not make a sufficient application are not eligible to administer the UIC program
  - In these cases, the EPA regional office maintains the UIC authority (Direct Implementation)

Two Options for Gaining State Primacy

- One very unique and important feature of the SDWA gave a second, more flexible way for states to apply for UIC Class II primacy

- Section 1422 – "The State (i) has adopted after reasonable notice and public hearings, and will implement, an underground injection control program which meets the requirements of regulations in effect under section 1421; and (ii) will keep such records and make such reports with respect to its activities under its underground injection control program as the Administrator may require by regulation.
  - Functionally this would need to mirror the EPA regulations

- Section 1425 – "the State may demonstrate that such portion of the State program meets the requirements of subparagraphs (A) through (D) of section 1421(b)(1) and represents an effective program (including adequate recordkeeping and reporting) to prevent underground injection which endangers drinking water sources"
  - Provides much more flexibility for states to develop alternate programs

EPA Definition of Class II Well

- 40 CFR 144.6 Classification of Wells

  (b) Class II. Wells which inject fluids:

  (1) Which are brought to the surface in connection with natural gas storage operations, or conventional oil or natural gas production and may be commingled with waste waters from gas plants which are an integral part of production operations, unless those waters are classified as a hazardous waste at the time of injection.

  (2) For enhanced recovery of oil or natural gas; and

  (3) For storage of hydrocarbons which are liquid at standard temperature and pressure.

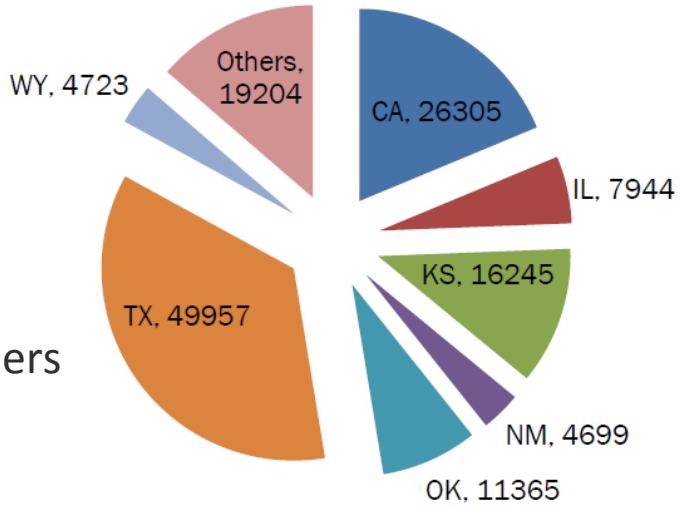
- Definition does not allow other fluids or materials to be mixed with oil and gas fluids for disposal
  - That changes the well classification
  - Example: Class I wells required by EPA Region 10 in Alaska

Hydraulic Fracturing Jobs are not Treated as Class II Wells

- Despite strong pressure from oil and gas opponents, nearly all types of hydraulic fracturing operations (frac jobs) are not considered to be Class II well activities and do not require a Class II UIC permit
- Stay tuned for ongoing EPA rulemaking activity concerning frac jobs using fluids that include diesel fuels

How Many Class II Wells Are There?

- Approximately 144,000 Class II wells in the U.S.
  - Majority in TX, CA, KS, and OK
- Enhanced Recovery
  - ~80% of all Class II wells (note: this applies to numbers of wells, not volume injected)
  - Water injection wells are most common, but also includes steam injection, water-alternating -gas (WAG), simultaneous water and gas (SWAG), CO_2 injection
- Disposal
  - ~20% of all Class II wells
  - Used only for disposal of fluids associated with oil and gas production (primarily produced water)
- Hydrocarbon Storage
  - Used to inject and remove liquid hydrocarbons from underground storage
  - Main examples is the Strategic Petroleum Reserve storage caverns
  - More than 100 wells in the U.S. (<0.1% of Class II)



Source: Presentation by Rick McCurdy, Chesapeake Energy, at an EPA Workshop

Difficult to Quantify Those Class II Wells Actually in Service or in Active Status

Use Texas as an example

- McCurdy presentation (see previous slide)
  - 49,957 Class II wells (no year given)
- Railroad Commission of Texas website
  - *"As of calendar year 2013, Texas has more than 50,000 permitted oil and gas injection and disposal wells with approximately 35,000 currently active as of calendar year 2013. Of these 35,000 active injection and disposal wells, about 7,500 are wells that are disposal wells and the remainder are injection wells."*
  - 35,000 wells in service – not sure about the other 15,000 wells
- 2012 figures provided by Leslie Savage for the Railroad Commission in November 2014
  - 32,178 Class II wells
  - She was unable to break out the number of disposal wells from the number of enhanced recovery wells
- EPA 2010 National UIC Inventory
  - 52,016 Class II wells

Why Are Class II Injection Wells Important for the Oil and Gas Industry?

- They provide an inexpensive and accepted practice for managing the large volume of produced water generated by oil and gas wells
  - Having injection wells locally available allows operators more certainty about water management practices and costs
  - If injection wells with adequate capacity are not locally available (e.g., Marcellus Shale in PA), the water management options are limited and costs are likely to rise
- Through enhanced recovery operations, they boost the U.S. oil production volume and increase the longevity of individual wells and fields
  - Although not always recognized as such, use of produced water for enhanced recovery is the oldest and by far the largest form of beneficial reuse of produced water

What are the Perceived and Real Concerns about Class II Injection Wells?

1. By lowering water management costs, Class II wells contribute to continued production of inexpensive oil and gas, which delays the transition to renewable energy sources.
2. Class II wells may inject poisons and toxic chemicals into the ground where they will contaminate drinking water supplies.
3. Class II wells may create too much air emissions and greenhouse gases through transfers and powerful pumps.
4. Injection into non-hydrocarbon bearing zones may remove the water permanently from the hydrosphere.
5. Class II injection wells may cause earthquakes.

- Other than #1, these are issues that GWPC, EPA, DOE, state agencies, and other GWPC partners have studied and evaluated.
- The following sessions in this conference and in future GWPC events will continue to discuss these issue.