State Investigations of Oilfield Ground Water Contamination Incidents

And Their Role in Advancing Regulatory Reforms

Water Energy Sustainability Conference
Pittsburgh, Pennsylvania
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Scott Kell, Geologist
State Geologists conducting water well video survey
Background
The “Bainbridge Incident”

• Driving mechanism
• Home exploded in a “firey ball”
• High volume stimulation
• Conditions will last forever
• Metals > SMCL
Key Questions

• What are states actually finding through their ground water investigations?

• What are states doing in response to investigation findings and determinations?
State Investigations as Applied Science

- Qualified experts
- Evidence collected and analyzed according to standard methods
- Applies principals and methods generally accepted within specialized fields of science
- Sufficient facts and data to support “diagnosis”
- Subject to testing
Importance of Sound “Diagnosis”

- Targeted priorities
- Focused resources
- Appropriate remedy
- Prompt and effective response
Objectives

• Categorize state investigation findings

• Evaluate evolution of state regulations that protect ground water

• Measure state progress
Methods

• Incident classification scheme (seven phases)
• State file reviews
• Categorize state findings over time
Oil and Gas E&P Phases

1. Site Preparation
2. Drilling and Well Completion
3. Well Stimulation
4. Production, Treatment, Storage
5. Waste Management/ Disposal
6. Plugging and Restoration
7. Orphaned Wells/ Sites
Regulatory Reform

Before

After
Participating States
Context

- Demographics
- Climate
- Hydrogeology
- Ground water usage
- History and scale of oilfield E&P activities
- Scope and history of regulated activities
Early Industry Practices

Wood Co. Ohio

Spindletop Dome, Texas
Ohio: Completed
Texas: Ongoing
Ohio Fresh Ground-Water Withdrawals by User Category
(Million Gallons per Day)

Legend

<table>
<thead>
<tr>
<th>User Category</th>
<th>Mil. Gallons per Day</th>
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<tr>
<td>Public</td>
<td>488</td>
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<td>Domestic</td>
<td>146</td>
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<tr>
<td>Irrigation</td>
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<td>Livestock</td>
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<tr>
<td>Aquaculture</td>
<td>3.6</td>
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<tr>
<td>Industrial</td>
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<tr>
<td>Mining</td>
<td>112</td>
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<tr>
<td>Thermoelectric</td>
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Ohio Oil and Gas E&P Activities (1983-2007)

- >33,000 wells drilled
- ~28,000 wells plugged
- Producing wells increased by 73% (high of 64,830 in 1991)
- >222 million bbls. of oil
- >3.2 tcf of natural gas
- >202 million bbls. brine disposed
### Total Incidents by Phase

<table>
<thead>
<tr>
<th>Phases</th>
<th>Number of Incidents</th>
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<tr>
<td>Abandoned Sites</td>
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<tr>
<td>Drilling &amp; Completion</td>
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<tr>
<td>Well Stimulation</td>
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<td>Production/ Workover/Waste Storage</td>
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<td>Management/ Disposal</td>
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<td>Plugging &amp; Abandonment</td>
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Hydraulic Fracturing Operation

Geauga County, Ohio
Incidents Caused by Regulated Activities by Year and Key Regulatory Reforms

- Class II UIC Primacy
  - Authority to order water supply replacement
  - Produced water tracking
  - Established deep injection of produced water as preferred disposal method
- Closure of all produced water earthen pits
  - Reserve pit construction standards
- Annular disposal mechanical integrity test
- Annular disposal rules
- Orphan well emergency program
- Urban drilling rules

Legend
- Green: Plugging & Abandonment
- Orange: Off-Site Waste Management/Disposal
- Teal: Production/Workover
- Purple: Waste Storage Treatment
- Pink: Well Stimulation
- Red: Drilling & Completion
- Blue: Site Preparation

Year

Total Number of Incidents
Drivers of Regulatory Reform

• Federal environmental laws (SDWA, CWA, RCRA, etc.)
• GWPC Peer Reviews of state UIC Programs
• STRONGER Reviews of state waste management practices
• Heightened citizen expectations
• State ground water investigations