How Should Regulations Address Frac Hits

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Fracturing in Horizontal Wells
Multi-Stage Fracturing in Horizontal Wells
## Average Completion Intensity Metrics for Horizontal Shale Wells

<table>
<thead>
<tr>
<th></th>
<th>Permian Basin</th>
<th></th>
<th>Rest of US Shale Oil</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2014 Q1</td>
<td>2017 Q1</td>
<td>CAGR</td>
<td>2014 Q1</td>
</tr>
<tr>
<td>Perforated lateral (ft)</td>
<td>5,913</td>
<td>7,551</td>
<td>8%</td>
<td>6,396</td>
</tr>
<tr>
<td>Proppant per well (thousand lbs)</td>
<td>6,285</td>
<td>14,553</td>
<td>32%</td>
<td>5,046</td>
</tr>
<tr>
<td>Frack Fluid per well (thousands of gallons)</td>
<td>6,888</td>
<td>16,422</td>
<td>24%</td>
<td>5,082</td>
</tr>
<tr>
<td>Proppant intensity (lbs/ft)</td>
<td>1,063</td>
<td>1,927</td>
<td>22%</td>
<td>789</td>
</tr>
<tr>
<td>Fluid Intensity (bbl/ft)</td>
<td>28</td>
<td>52</td>
<td>23%</td>
<td>19</td>
</tr>
</tbody>
</table>

Oil & Gas Financial Journal (June 2017)
Major Shale Formations in Lower 48 States

Lower 48 states shale plays

Source: U.S. Energy Information Administration based on data from various published studies. Updated: June 2016
Permian: Historic Conventional Formation and the Underlying Shale Formations
Permian: Multiple Stacked Shale Formations
Confinement Risks

Concerns:
1. Fracture Extends beyond zone of interest
2. Fracture network intersects a naturally occurring fault.
3. Fracture network intersects the drainage radius of a close proximity abandoned well.

Risk: Fluids migrate from zone of interest to aquifers or to the surface to create contamination.
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Existing Post-Event Remedies

1. Permit shields
2. Surface estate owner claims
3. Tort claims by third parties
4. Regulatory claims
   * RCRA/CERCLA
   * Discharges to water
   * Air emissions
   * Impacts on species and Protected resources
API Response

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EDF Model Regulatory Framework

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Further Proposed Response

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