A Screening-Level Assessment System for Classifying Hydraulic Fracturing Fluid Additives

WaterTech 2013
Banff, AB

Donald B. Davies, Ph.D., DABT
Intrinsik Environmental Sciences Inc.
April 12, 2013
Topics

• Background
• The SYSTEM
• Lessons learned
• Next steps
Acknowledgements
Shale Gas – Tight Gas

• The new oil & gas frontier. Global in scope.
• Driven by advances in drilling/completions technology.
• Typical plays involve multi-well pads, extended-reach horizontal wells, and multiple fracks along each horizontal leg.
• Fracking involves pressurized injection of water, proppants, and chemical additives into shale formations to stimulate the flow of gas and increase recovery.
• “New” technology has spawned a host of issues and concerns.
Non
au
Gaz de Schiste
Un moratoire dès maintenant
Moratoriums
62% of Canadians support a moratorium on all fracking for natural gas until all federal and provincial environmental reviews are complete

Environics Research Poll – January 2012
<table>
<thead>
<tr>
<th>Region</th>
<th>% Opposed to Fracking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alberta</td>
<td>57</td>
</tr>
<tr>
<td>Atlantic provinces</td>
<td>66</td>
</tr>
<tr>
<td>BC</td>
<td>67</td>
</tr>
<tr>
<td>Manitoba/Saskatchewan</td>
<td>64</td>
</tr>
<tr>
<td>Ontario</td>
<td>65</td>
</tr>
<tr>
<td>Quebec</td>
<td>55</td>
</tr>
</tbody>
</table>
Public perceptions regarding hydraulic fracturing

<table>
<thead>
<tr>
<th>%</th>
<th>Very concerned</th>
<th>Somewhat concerned</th>
<th>Not very concerned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impacts on the environment</td>
<td>40</td>
<td>44</td>
<td>16</td>
</tr>
<tr>
<td>Impacts on water quality</td>
<td>35</td>
<td>40</td>
<td>25</td>
</tr>
<tr>
<td>Lack of disclosure</td>
<td>56</td>
<td>32</td>
<td>12</td>
</tr>
</tbody>
</table>

Source: Energy Institute, Univ. of Texas at Austin, Feb., 2012
It’s Your Drinking Water
Help Stop Fracking
Understanding Fracturing Fluid

The fluid from the hydraulic fracturing process is nearly 99.5% WATER & SAND.

Typical Additives Used in Fracturing Fluid and COMMON HOUSEHOLD ITEMS

- SODIUM CHLORIDE used in table salt
- ETHYLENE GLYCOL used in household cleaners
- BORATE SALTS used in cosmetics
- SODIUM/POTASSIUM CARBONATE used in detergent
- GUAR GUM used in ice cream
- ISOPROPANOL used in deodorant

90% WATER

Source: American Petroleum Institute 2012
CAPP Hydraulic Fracturing Guiding Principles and Operating Practices
CAPP Guiding Principles …

• We will support the development of fracturing fluid additives with the least environmental risks
• We will continue to advance, collaborate on and communicate technologies and best practices that reduce the potential environmental risks of hydraulic fracturing
1. Identify chemical ingredients and characteristics of each additive.

2. Assess potential health and environmental risks of each additive.

3. Define operational practices and controls.

4. Develop and implement risk management plans.
The SYSTEM

What it does …

• Increases awareness and understanding …
• Provides early warning …
• Helps guide decision-making …
• Identifies additives with lowest risk profiles.
Non-judgemental
• **What’s captured ...**
  - Additive-based
  - **Chemical ingredient-driven**
  - Operates at a screening level
  - Emphasis on public health and the environment
  - Focus on HFF additives ... but can be applied to other products

• **What isn’t ...**
  - Compliance with regulations
  - Degradation products
  - Worker hazards
The SYSTEM ...

Identification of chemical ingredients (CAS RN)

Review of ingredients against screening criteria

Classification of additives

Category A
No action required

Category B
Controls/practices required

Category C
Further review required
Endpoints

Bioaccumulation Potential
Acute Toxicity to Wildlife
Carcinogenicity
Mutagenicity
Acute Oral Toxicity
Reproductive Toxicity
Chronic Oral Toxicity
Toxicity to Aquatic Life
Environmental Persistence
Databases …

• Developed/maintained by leading scientific/regulatory authorities
• Current
• Readily accessible
• Easily searchable
Databases
Categories …

A, B, or C
## Categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Basis</th>
<th>Recommended Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>None of the additive’s ingredients “triggers” any of the screening endpoints. No obvious potential for additive to cause significant impacts to public health and/or the environment.</td>
<td>None</td>
</tr>
</tbody>
</table>
### Categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Basis</th>
<th>Recommended Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>One or more of the <strong>environmental</strong> screening endpoints triggered. Additive is potentially capable of causing adverse environmental impacts.</td>
<td>Determine appropriate operational practices and controls to be implemented to reduce identified risks.</td>
</tr>
</tbody>
</table>
### Categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Basis</th>
<th>Recommended Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>One or more of the <strong>public health</strong> screening endpoints triggered. Additive is potentially capable of causing adverse impacts on public health. One or more of the environmental screening endpoints also may be triggered.</td>
<td>Further review to determine measures needed to manage potential risks to public health as well as any potential environmental risks.</td>
</tr>
</tbody>
</table>
Data Availability Index

- Indication of extent of availability of information on an additive’s ingredients in databases searched as part of screening process

- Four (4) levels:
  - High
  - Medium-High
  - Medium-Low
  - Low
SYSTEM User Guide

• Part One: Narrative
• Part Two: Detailed Instructions
Experience to date …

- More than 1,800 products classified … capturing more than 600 chemical ingredients
  - 10% assigned to Category C
  - 45% assigned Category B
  - Remainder assigned to Category A

- Tool has proven to be rapid, flexible, and transparent.

- Interest expressed by CAPP members, U.S. E&P companies, Canadian and U.S. fluid suppliers and regulatory authorities in using/learning more about the SYSTEM.
Next steps

• Continued training of E&P companies and fluid suppliers on use of SYSTEM.
• Harmonization across North America(?)
• Development of OHS screening module.
• SYSTEM maintenance/updates.
• Development of WEB-based user platform(?)
In summary …

- Recent tremendous surge in unconventional oil and gas development has fuelled public concern.
- Early industry response was not especially effective in addressing concerns ... fuelling angst, confusion, outrage and distrust.
- Regulators are responding, with actions ranging from moratoriums to special reviews to tighter rules to stricter oversight.
- Industry now responding with awareness programs, codes-of-practice, and research initiatives.
- SYSTEM represents one initiative aimed at improving awareness of potential human health and environmental risks of HFF additives.
For further information …

Donald B. Davies, Ph.D., DABT
Senior Vice-President, Principal and Chairman
Intrinsik Environmental Sciences Inc.
736 – 8th Avenue SW, Suite 1060
Calgary, AB
T2P 1H4
(T) 403-237-0275 Ext. 233
(F) 403-237-0291
ddavies@intrinsik.com
www. intrinsik.com
Questions?