

# 1 Problem

<b>What</b>	Problem(s)	Higher levels of methane in water near natural gas wells; Potential explosive water; Chemical exposure?
<b>Where</b>	State, city	East Coast
	Facility, site	Near natural gas wells
	Task being performed	Hydraulic fracturing
<b>Impact to the Goals</b>	<b>Safety</b>	Risk of explosion from water
	<b>Environmental</b>	Private drinking water wells contaminated
	<b>Property, Equip, Mtls</b>	Potential lawsuits
	<b>Compliance</b>	Potential EPA oversight

# 2 Analysis

**Basic Level Cause Map** - Start with simple Why questions.



**Basic Cause-and-Effect**

The study investigated whether or not anecdotal stories about lighting tap water on fire had any scientific basis. It turns out that residents near hydraulic fracturing sites indeed had significantly higher levels of methane in their drinking water. A basic Cause Map shows how fracking can cause safety issues in local communities.

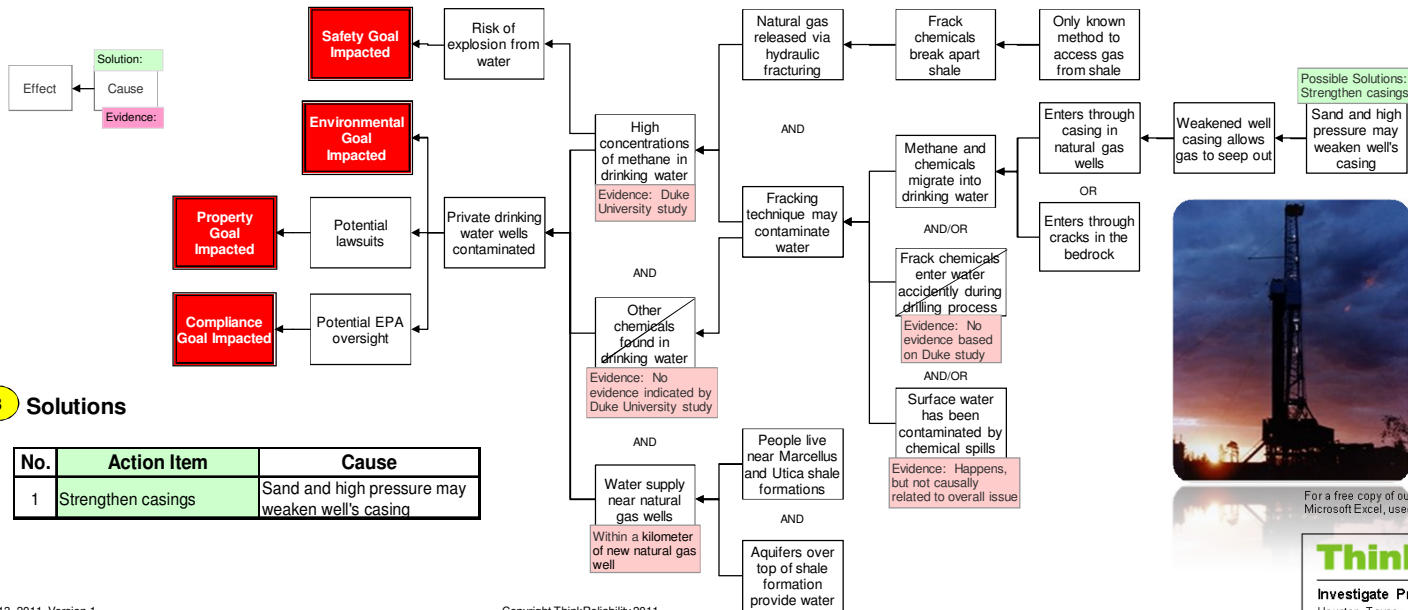
**More Detailed Cause-and-Effect**

A Cause Map lays out the possible reasons needing further investigation. For instance, the frack chemicals might enter the water supply accidentally during the drilling process. Spills could also contaminate surface water, or chemicals could migrate into the water supply.

The study indicates that chemical migration is most likely what's happening. Surface spills, which have happened, are not a major contributor to the wide-spread methane contamination; so that cause can be left in the Cause Map but won't be investigated further for our purposes. Furthermore, the study produced no evidence that the drilling process itself was causing the contamination; so that block can be crossed off the Cause Map.

That leaves one possibility - migration. The chemicals (including methane) could migrate in two different ways - through the well casing or through the bedrock. The study's authors felt it was unlikely that chemicals were migrating thousands of feet through bedrock, so migration from well casings experiencing high pressure flow is more probable. While more evidence is needed, it is possible that the well casings are weakened by the fracking process which pushes sand through the casings at high pressure.

**More Detailed Cause Map** - Add detail as information becomes available.



# 3 Solutions

No.	Action Item	Cause
1	Strengthen casings	Sand and high pressure may weaken well's casing

# EXPLOSIVE WATER

## Cause Map

### Side Effects of Fracking

As with any new technology, there are potential consequences. Lawmakers and regulators have debated the safety of the largely unregulated fracking industry, but with little definitive evidence either way...until now. A study by Duke University has concluded that fracking does indeed lead to methane contamination in drinking water. Methane is the primary component in natural gas and is not lethal to consume. However, high concentrations are explosive.

Cause Mapping is a Root Cause Analysis method that captures basic cause-and-effect relationships supported with evidence.

## CAUSE MAPPING

Problem Solving • Incident Investigation • Root Cause Analysis

- Step 1 Problem** - What's the Problem?
- Step 2 Analysis** - Why did it happen?
- Step 3 Solutions** - What will be done?