# An Environmental Perspective on Risk Management and Water

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There is no denying that the oil and gas industry, as well as the agencies that regulate its activities, have significantly improved many aspects of environmental performance in recent years. Standards and practices have changed, in some cases drastically, leading to risk reductions in a number of areas.

Despite this progress, there is always more to be done to identify and manage risks associated with oil and gas development. As industry continues to evolve through technical advances, so should leading practices and regulations. This is particularly important given that the broader public is increasingly aware of and concerned about potential impacts on the environment and their communities from development, especially where those impacts involve water. Fortunately, improved understanding of risks and newly emerging risk control options make continual improvement possible.

Where should industry and its technical advisers concentrate at this juncture? A number of noteworthy, long-awaited reports on the environmental impacts of oil and gas development have been published over the past year or are awaiting publication. To a significant degree, these reports coalesce into a few major areas of concern, and endeavor to provide guidance on how governments and industry can achieve additional risk reductions to minimize or eliminate potential impacts on water.

## The Reports

***US Environmental Protection Agency (EPA), "Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources," Draft, June 2015***

The EPA report highlights potential vulnerabilities to drinking water and confirmed pollution events. Vulnerabilities include (1) inadequately cased or cemented wells resulting in below-ground migration of gases and liquids, (2) inadequately treated waste water discharged into drinking water resources, and (3) spills of hydraulic fracturing fluids, flowback, and produced water. Given these vulnerabilities and knowledge gaps highlighted by EPA, industry should not take too much comfort in the widely reported conclusion that the EPA found no evidence of widespread, systemic impacts.

***California Council on Science and Technology (CCST), SB4 Commissioned Report for the California Natural Resources Agency, "An Independent Scientific Assessment of Well Stimulation in California," July 2015***

The CCST summary report contains an appendix summarizing the "most concerning risk issues" including (1) the number and toxicity of chemicals in hydraulic fracturing and acid stimulation fluids, (2) hydraulic fracturing in reservoirs with a long history of oil and gas production, (3) spills and leaks, (4) beneficial use of produced water, and (5) disposal of water in percolation pits.

***Ground Water Protection Council (GWPC), "State Oil & Gas Regulations Designed to Protect Water Resources," 2014 Edition***

The GWPC report highlights state regulatory trends and presents related considerations for regulators and policymakers, including ideas regarding well integrity (e.g., comprehensive integrity testing during construction, isolation of flow zones, standards for reconditioned casing), storage in pits and tanks (e.g., design, construction, spill containment, and leak detection), transportation of produced water for disposal (e.g., permitting transporters and recording volumes), produced water recycling and reuse (e.g., chemical characterization and management of side streams, and careful regulation of alternative uses of produced water), and spill response (e.g., cleanup standards relative to characteristics of material spilled).

***Health Effects Institute (HEI), "Strategic Research Agenda on the Poten-***

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***tial Impacts of 21st Century Oil and Gas Development in the Appalachian Region and Beyond," Draft, July 2015***
The HEI's research agenda prioritizes 13 topics of overarching importance. These include research in the field of chemical toxicity and evaluation of the most effective practices for accidental waste release, permitted waste management, and wellbore integrity.

## Risks and Risk Reduction

These reports coalesce into three major areas in which risk management improvements would be beneficial: well integrity, spills and leaks, and treatment and final disposition of produced water. It is not surprising that these concerns center on water impacts because the public has been raising similar issues in recent years, particularly in regions plagued by drought. Making genuine strides in these areas of vulnerability will increase industry resilience in the long term.

**Well integrity.** Regulatory oversight of well construction has come a long way in the past few years. Wyoming, Pennsylvania, and Ohio are notable examples. And in the mere 2 years since Texas adopted sweeping well construction changes in 2013, more than a dozen states have extended well integrity rule improvements to a wide range of issues.

Despite achievements of industry and regulators in improving management of well construction risks over the past years (Texas's 2013 rule package resulted in a 40% decrease in well blowouts last year), a number of well integrity issues deserve more widespread attention.

Risk reduction options with regard to well integrity include: conducting an "area of review" analysis to ensure that nearby wells are not affected by hydraulic fracturing, taking special precautions in unusually shallow fracturing jobs in close proximity to protected water, and carrying out more rigorous efforts to isolate corrosive zones and flow zones that have the potential to compromise cement jobs. American Petroleum Institute's *API RP 100-1*, forthcoming 2015, will offer much on such topics.

**Spills and leaks of produced water.** By some estimates, close to 70% of groundwater impacts from oil and gas development come from spills and leaks at the surface, not containment failure downhole. Spills are not a novel problem. But spill-related issues are evolving along with industry practices. For example, as alternative management options such as recycling become more common, the need to handle large volumes of waste water at the surface for longer periods of time will require advanced spill and leak prevention technologies and improved handling practices.

To reduce the frequency and severity of surface leaks and spills, operators and regulators will need to tighten rules and operational practices for wastewater storage and transportation. Risk reductions will stem from improvements in design, construction, and operation requirements for pits and tanks; advanced siting restrictions; and detailed closure requirements.

Similarly, pipeline design, construction, operation, and siting requirements deserve scrutiny as the need to move untreated or minimally treated water from site to site increases. Finally, requirements for waste haulers should be advanced to improve wastewater tracking and minimize the risk of illegal or accidental dumping.

**Treatment and final disposition of produced water.** By some estimates, the oil and gas industry uses more than 90 billion gal of water to fracture wells each year, and produces more than 800 billion gal of waste water. Even if industry were to completely transition to recycled water for drilling and fracturing operations, hundreds of billions of gallons of water would still need to be disposed of each year. In some areas of the country, there are signs of a trend away from disposal in underground injection wells toward treatment and discharge to surface waters and reuse in sectors such as agriculture.

Although many of these laudable alternatives are pursued in an effort to conserve freshwater resources, it is vital that new practices not create more environmental risks than they solve. EPA reports that more than 1,000 chemicals are used in hydraulic fracturing operations, with hundreds found or expected to be found in produced water. The composition and toxicity of this waste water is not well understood.

In pursuing alternative treatment and disposal options, the character and potential impact of waste water on the receiving media, such as surface water, soil, and crops, should be extensively understood before permitting. Treatment technologies should be proven capable of removing all constituents of concern including inorganics, organics, and radionuclides.

Treated water that is applied or discharged to the surface should be extensively tested and potential long-term impacts of novel uses should be monitored and investigated. Not to be forgotten, the solid or solidified residual waste streams created from these practices should be analyzed and disposed of properly given their potentially toxic character.

## Where To Go From Here?

The Environmental Defense Fund (EDF) is working to better understand new and existing risks and is collaborating with a range of stakeholders to ensure that protective risk management practices are developed and implemented. This includes improvements in rules and policies at the state and federal level, the development of leading industry practices, and scientific initiatives to fill knowledge gaps on emerging issues such as wastewater characterization and treatment.

EDF believes that successful risk management requires a process of continual improvement (both in regulations and in leading practices) that endures indefinitely. To be successful, this process must function at a steady high gear, and achieve efficient results on pace with changing circumstances.

What are the risks? What are the risk options? Where are rules or practices lacking? Efforts to answer these questions may often lead to change that is incremental, but it is meaningful change nonetheless. EDF looks forward to finding additional opportunities to work on these issues with like-minded colleagues. **JPT**