Spills and leaks Associated with Shale Gas Development
(Updated April 27th, 2012)

Brief description of spills and leaks that could happen at the surface

Spills and leaks are common concerns associated with any kind of industrial activity. A spill in this case is defined as an unintended release of toxic chemicals, contaminated water, or hazardous materials. Spills and leaks associated with shale gas development can occur during transport of chemicals to and from the well pad; during storage, mixing, injection and recovery of fluids at the well pad; and during storage, processing or transport of waste fluids. They may result from accidents, from inadequate management or training, or from illicit dumping.

With respect to the WRI framework, spills can be considered unplanned surface events. They are certain to occur, but cannot be predicted precisely in time or space. As with all industries the occurrence of spills associated with shale gas development will depend on the pace and scale with which the industry grows. Minimizing impacts associated with spills requires preventative planning, best management practices and targeted regulations set within a system of enforced compliance.

How can spills be managed?

Spills have been and will continue to be an important concern associated with shale gas development. But, all spills are not alike. The following diagram (Figure 1), called an “event tree,” shows how different kinds of spills and management practices can lead to various outcomes.
Figure 1. Basic event tree framework for assessing the risk associated with spills

**Event tree characteristics**

**Containment** refers to whether or not the material spilled poses a threat to water resources. If a spill is properly contained it can be easily cleaned up, and poses little threat, regardless of its potency or volume. **Potency** refers to a chemical’s toxicity to human health and/or aquatic systems. Determination of potency is made by considering both the nature and concentration of a chemical – dilute chemicals generally pose less risk. **Volume** refers to the quantity of material spilled. The distinction between “High” and “Low” volume spills is an order of magnitude distinction – e.g. thousands of gallons as opposed to hundreds.

Spills that are contained pose very low risk. Thus, ensuring spill containment should be the primary focus of regulatory and industry efforts to prevent spill related water impacts. Uncontained, high potency spills are a concern, regardless of volume. Therefore, employing the least potent chemicals is another important strategy to
minimize spill-related water impacts. WRI, in cooperation with the New York Water Environment Association (NYWEA), has released a paper that suggests how regulations issued in NY for shale gas development can focus on containment and other management practices for mitigating some of the negative impacts that will likely result from spills (should development move forward in NY State). Similarly, WRI has submitted comments to the Delaware River Basin Commission with respect to their draft regulations for shale gas development. Those comments also emphasize containment and preventative management practices. Lastly, preventative planning is an important component of minimizing environmental impacts from industrial development. Planning measures include preventing industrial activity from occurring too close to sensitive habitat and infrastructure (these are called “setbacks”). They also include prohibition of industrial activities in some cases, as well as policies that attempt to encourage development in such a way as to fit within regional and local visions of land use, infrastructure, and economic growth.

What do we know about spills associated with shale gas development?

Although we can’t predict with certainty when and where spills might happen in NY, we can learn from other states. In particular, shale gas development in Pennsylvania can be used as an indicator for how development may occur here. The Pennsylvania Department of Environmental Protection (PADEP) posts records of violations handed out to Marcellus shale gas operators. While these records do not always provide detailed information, they are useful for exploring general data that may indicate the frequency of spills, along with their severity, potential potency, volume, etc.
Here, we focus on Bradford County, an area in PA that borders NY, and which has seen significant, new shale gas development in the past couple of years. Figure 2 illustrates data from 2010, and attempts to quantify the number of environmentally relevant events which triggered violations from the PADEP. Spills and leaks accounted for the most frequent environmental violations given – violations for spills were handed out at approximately 8% of all wells drilled in Bradford County. Leaking pits, along with other surface violations associated with the management of chemicals and waste fluids, accounted for most of the other environmental violations recorded. Thus, it is reasonable to anticipate that spills will also be a concern at shale gas development sites here in NY.

**Putting risk in context**

As discussed above, spills are a common concern for many industrial activities. Industrial spills are a hazard that we face all the time, and NY maintains information on industrial spills that are reported across the state. The following table (Table 1) describes spill information taken from Tioga County, NY – a rural area with a minor industrial component that may face significant shale gas development.
Table 1. Spills reported to the NY State Department of Environmental Conservation in Tioga County, NY in 2010; “ni” indicates that no information on volume was reported.

Although it is impossible to directly compare industrial spills in NY with shale gas related spills in PA, a few observations can be made. There are some similarities insofar as both databases document the spills of diesel and other petroleum products, brines and other hazardous fluids. This very limited analysis suggests also that the number of spills reported in Tioga County, NY is comparable to the number of incidents reported in Bradford County, PA resulting from shale gas development. Thus, using this limited data, it is plausible to think that the total number of spills in a rural county of NY with limited current industrial activity will increase significantly. What is not known is the extent to which these data reflect an accurate assessment of all spills that occur. The context of these spills is also not known in all cases, and it is difficult to say whether any single spill truly threatens the environment, or whether the spill was contained and/or managed effectively.
Building a better adaptive management process

Data from PA suggests that spills will regularly occur. In response to this, NY has initiated a number of protective measures. Among them are a new permit for the management and discharge of stormwater at shale gas development sites; prohibitions on the use of waste pits and development in floodplains and primary aquifers; and regulations that require secondary containment of chemicals and waste fluids on well pads; among others. Still, it is unclear how current and proposed regulations will be applied and enforced should shale gas development commence, and whether or not new regulations will be effective once implemented. Preventing spills, and containing spills that do occur, represents a challenge that industry, policy makers and regulators need to continue to address and respond to. Transparent monitoring and reporting systems are necessary to quantify the risk that spills pose, but also to track the effectiveness of management strategies and assure the public that development is progressing responsibly.

Linked references include:


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