

Review of State and Industry Spill Data: Characterization of Hydraulic Fracturing-Related Spills

Background

Advances in hydraulic fracturing and horizontal drilling technologies have led to increased oil and gas exploration and production activity in different regions across the United States. Hydraulic fracturing is a stimulation technique used to produce economically viable quantities of oil, natural gas, and natural gas liquids from underground rock formations. The volumes and chemical compositions of hydraulic fracturing fluids and flowback fluids (i.e., fluids that return to the surface after hydraulic fracturing) managed on oil and gas production well pads have led to concerns about potential impacts from surface spills of these fluids to drinking water resources. To better understand what is known about spills associated with hydraulic fracturing, the EPA has analyzed spill data from states and industry (service companies, oil and gas well operator) sources. For the purposes of the study, hydraulic fracturing-related spills were defined as those occurring on or near the well pad before or during the mixing and injection of hydraulic fracturing fluids or during the post-injection recovery of fluids.

Data on spills that occurred between January 2006 and April 2012 were obtained from nine states with online spill databases or other data sources, nine hydraulic fracturing service companies, and nine oil and gas production well operators. The data sources used in this study contained over 36,000 spill events. Spill records from an estimated 12,000 spill events (33 percent of the total number of spills reviewed) contained insufficient information to determine whether the event was related to hydraulic fracturing. Of the spill events with sufficient information, the EPA identified an estimated 24,000 spill events (66 percent) as not related to hydraulic fracturing and 457 spill events (approximately 1 percent) as related to hydraulic fracturing. The 457 hydraulic fracturing-related spill events occurred in 11 different states over six years (January 2006 and April 2012).

For these 457 hydraulic fracturing-related spill events, the most commonly reported information obtained from state and industry data sources was the type of material spilled (reported in 97 percent of the hydraulic fracturing-related spill events), followed by the volume spilled and then the source and cause of the spill. In approximately 90 percent of the hydraulic fracturing-related spill events, information was available on whether or not the spill reached at least one environmental receptor (surface water, ground water, and/or soil). This study did not determine if or how spilled fluids may have affected surface or ground water quality, nor did it evaluate spill reporting requirements.

Results

This report presents the results of a broad review of state and industry spill data that identified 457 hydraulic fracturing-related spill events. Data from these spills were used to characterize volumes and materials spilled, spill sources and causes, and environmental receptors. There were several key findings that contribute to an understanding of the characteristics of hydraulic fracturing-related spill events that may reach surface or ground water resources. The hydraulic fracturing-related spills were characterized by numerous low volume events (up to 1,000 gallons) and relatively few high volume events (greater than 20,000 gallons). The most common material spilled was flowback and produced water, and the most common cause of spills was human error. There were 300 spill events (66 percent of the 457 spill events identified in this study) in which spilled fluids reached at least one environmental receptor.

Twenty-four of these events reached multiple environmental receptors. Spilled fluids were reported to have reached surface water in 32 hydraulic fracturing-related spill events (7 percent); the median volume per spill for these events was 3,500 gallons, and volumes per spill ranged from 90 gallons (5th percentile) to 45,000 gallons (95th percentile). There was one spill event in which spilled fluids were reported to have reached ground water (0.2 percent). Spilled fluids were reported as not reaching surface or ground water in 186 spill events (41 percent). While the data sources indicated that some spills reached ground or surface water resources, the EPA did not determine if or how spilled fluids may have affected surface or ground water quality. However, available information indicates that responses to hydraulic fracturing-related spills generally include both immediate actions to stop the spill and/or contain spilled fluids and longer term actions to remediate the affected area. These results, as well as other information on the spill characteristics and containment and response activities, provide important insights into the nature of hydraulic fracturing-related spills in several key states with hydraulic fracturing.

The spills characterized in this study were likely a subset of the total number of hydraulic fracturing-related spills that occurred in the United States between January 2006 and April 2012. Although spill data were obtained from nine states that are among the top oil and gas producing states in the country, similar data from other oil and gas producing states were not included. The state data sources used in this study may not have included all spills related to hydraulic fracturing because some spills may not have met the spill reporting requirements that were in place at the time of the spill. Additionally, some reported spills may not have been identified as related to hydraulic fracturing due to insufficient information in the data sources. The quantitative characterization of hydraulic fracturing-related spills presented in this report (e.g., the percentages in the paragraph above) may have been different if more hydraulic fracturing-related spills could have been identified from the data sources used in this study.

Overview of the EPA's Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources

The EPA released a draft assessment of the potential impacts of oil and gas hydraulic fracturing activities on the quality and quantity of drinking water resources in the United States. The draft assessment is based upon extensive review of literature, results from EPA research projects, and technical input from state; industry; non-governmental organizations; the public; and other stakeholders. As part of this effort, the EPA characterized hydraulic fracturing-related spills with respect to volumes and materials spilled, spill sources and causes, and environmental receptors.

For more information, please visit: www.epa.gov/hfstudy

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