Practices for Mitigating Surface Impacts Associated with Hydraulic Fracturing

API GUIDANCE DOCUMENT HF3
FIRST EDITION, JANUARY 2011

energy API
AMERICAN PETROLEUM INSTITUTE

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Upstream Segment

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Executive Summary

Hydraulic fracturing has played an important role in the development of America's oil and gas resources for nearly 60 years. In the U.S., an estimated 35,000 wells are hydraulically fractured annually and it is estimated that well over one million wells have been hydraulically fractured since the first well in the late 1940s. As production from conventional oil and gas fields continues to mature, the need for hydraulic fracturing becomes even more important to the economic recovery of non-conventional resources.

This guidance document identifies and describes best practices currently used in the oil and natural gas industry to minimize potential surface environmental impacts associated with hydraulic fracturing operations. It complements two other API documents: API Guidance Document HF1, *Hydraulic Fracturing Operations—Well Construction and Integrity Guidelines*, First Edition, October 2009, which focuses on groundwater protection related to drilling and hydraulic fracturing operations [1] while specifically highlighting recommended practices for well construction and the integrity of hydraulically fractured wells, and API Guidance Document HF2, *Water Management Associated with Hydraulic Fracturing,* First Edition, June 2010 [2].

A fourth related guidance document, API 51R, *Environmental Protection for Onshore Oil and Gas Production Operations and Leases,* First Edition, July 2009 [3], addresses the design and construction of access roads and well locations prior to drilling, as well as site abandonment, reclamation and restoration operations, including produced water handling.

While hydraulic fracturing does not introduce new or unique environmental risks to exploration and production (E&P) operations, concerns have been raised due to the potential scale of operations where this technology is applied, especially with regard to emerging developments in shale gas in the United States. Many of the best practices for E&P operations are the same as those applicable to hydraulic fracturing operations.

Moreover, where shale gas development intersects with urban settings, regulators and the industry have developed special practices to alleviate potential nuisances and sensitive environmental resources impacts, along with interference with existing commercial activity. Operators need to be vigilant and proactive in mitigating potential environmental impacts from E&P operations, including hydraulic fracturing operations. The following provides highlights from this guidance document:

1) Operators must comply with all federal, state and local requirements. Approvals may be necessary for many activities including:

   — surface water use;

   — wastewater management;

   — injection activities;

   — site construction;

   — storm water discharges;

   — air emissions; and

   — protection of sensitive areas.

2) Two principal reasons for recent concerns regarding hydraulic fracturing, especially as applied in the development of shale gas, are: the increase in well permitting in a number of regions in the U.S. and the new development activity in areas that have not experienced concentrated oil and gas development in the past. Consequently, operators should be cognizant of the increase in public scrutiny of fracturing operations, be

proactive in communicating to, and working with, communities and local regulatory authorities, and minimize, whenever possible, the impacts of their operations. For example, the use of multi-well pads when feasible, which can consolidate water storage, minimize overall footprint, reduce truck traffic and allow for centralized management of fluids.

3) Like all oil and gas E&P operations, before hydraulic fracturing operations are initiated, approvals from one or more government agencies are required. Operators must obtain all necessary permits before commencing operations, and ensure that operations comply with the requirements of local, state and federal regulatory authorities. Proactive engagement with surface owners and/or surface users to inform the owners about the operations prior to project initiation is also recommended. Upon initial development, planning and resource extraction of a new basin, operators should review the available information and, if necessary, assess the baseline characteristics.

4) To alleviate concerns associated with fracture fluid management, hydraulic fracturing operations should be planned and designed in a manner that manages materials and protects the environment. All components of fracture fluids, including water, additives and proppants, should be managed properly on site before, during and after the fracturing process. Both the operator and on-site contractors should require that all responsible personnel involved in the fracturing job and in pre- and post-fracture activities be trained in the transportation and handling of fluids, chemicals and other materials associated with the process. Personnel should be trained on the equipment to be used and the procedures to be implemented to prevent leaks and spills during fracturing operations.

5) State authorities must retain the ability to assess potential incident response needs and plan accordingly, with appropriate confidentiality protections. To balance the protection of trade secrets with the public's need to know, proprietary formulations should be disclosed upon request by designated state agency representatives and health professionals in the event of an emergency, or when designated state agency representatives and health professionals demonstrate a need to know such information.

6) Using hydraulic fracturing fluids in an environmentally safe way means that the base fluid and any additives are sourced, transported, prepared, pumped into the formation, returned from the formation, reused/recycled, and/or finally disposed of in a way that is fully compliant with all federal, state, and local regulations.

7) Surface impoundments, including those used for storing fracture fluids, must be constructed in accordance with existing regulations. Depending on the fluids being placed in the impoundment, the duration of the storage and the soil conditions, impoundment design and construction should be impervious to prevent infiltration of fluids into the subsurface. All surface impoundments must be properly closed in accordance with all local, state and/or federal regulations. Materials removed from impoundments should be reclaimed, recycled or disposed.

8) Fracture fluids should be managed according to federal and state regulations. Fracturing operations should be conducted in a manner that minimizes the potential for any unplanned release and movement beyond the site boundaries. Spill prevention, response and cleanup procedures should be in place prior to initiating activities that have a potential for a spill. The best way to avoid adverse effects of spills is to prevent their occurrence.

9) Hydraulic fracturing is a highly technical process performed by trained personnel. Equipment should be maintained, inspected and tested to assure proper operating integrity and reliability. Facilities and equipment should be kept clean, maintained and operated in a safe and environmentally sound manner. All leaks should be immediately contained and repairs initiated upon discovery—as safety permits. Any spill or leak should be addressed promptly and reported to the site manager for proper identification, management, cleanup and appropriate regulatory actions. It may be necessary to fence operations to prevent access to the facility by the general public, livestock or wildlife.

10) Public concerns relating to fracturing operations may be heightened by the location chosen for the well and the techniques used in constructing the access road and the overall site. To the extent practicable,

consideration for siting a well location might include visual impact of the operational layout; preservation of salient natural features such as natural terrain, trees, groves, waterways and other similar resources; and minimizing cut and fill operations.

11) Truck traffic creates additional concern in populated areas of development. Opportunities to reduce truck traffic might include use of flowlines to transport fluids. Where feasible, producers are increasingly turning to temporary surface flowlines to transport fresh water to impoundments and to wellsites. However, in many situations, the transport of fluids associated with hydraulic fracturing by surface pipeline may not be practical, cost effective or even feasible. Multi-well pads allow centralized water storage and management of flowback water, reducing truck transport. In some cases, it can also enhance the option of pipeline transport of water. Often, operators are able to construct storage ponds and drill source wells in cooperation with private property owners to provide close access to a water source and add improvements to the property that benefit the landowner.

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1 Scope

The purpose of this guidance document is to identify and describe practices currently used in the oil and natural gas industry to minimize surface environmental impacts—potential impacts on surface water, soils, wildlife, other surface ecosystems and nearby communities—associated with hydraulic fracturing operations. While this document focuses primarily on issues associated with operations in deep shale gas developments, it also describes the important distinctions related to hydraulic fracturing in other applications.

2 Terms and Definitions

For the purposes of this document, the following definitions apply.

2.1
aquifer
A subsurface formation that is sufficiently permeable to conduct groundwater and to yield economically significant quantities of water to wells and springs.

2.2
basin
A closed geologic structure in which the beds dip toward a central location; the youngest rocks are at the center of a basin and are partly or completely ringed by progressively older rocks.

2.3
casing
Steel piping positioned in a wellbore and cemented in place to prevent the soil or rock from caving in. It also serves to isolate formations and water zones from production fluids, such as water, gas and oil, from the surrounding geologic formations.

2.4
completion
Following drilling, the activities and methods to prepare a well for production, including the installation of equipment to produce a well.

2.5
downhole
Located in a wellbore.

2.6
flowback
The fracture and produced fluids that return to surface after a hydraulic fracture is completed.

2.7
formation (geologic)
A rock body distinguishable from other rock bodies and useful for mapping or description. Formations may be combined into groups or subdivided into members.

2.8
fracturing fluids
A mixture of water, proppant (often sand) and additives used to hydraulically induce cracks in the target formation.