EPA United States Environmental Protection Agency

Natural Gas Extraction - Hydraulic Fracturing

EPA Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources

EPA is conducting a study to better understand any potential impacts of hydraulic fracturing on drinking water and ground water. The scope of the research includes the full lifespan of water in hydraulic fracturing. You can learn more about the study at epa.gov/hfstudy.

Natural gas plays a key role in our nation's clean energy future. The U.S. has vast reserves of natural gas that are commercially viable as a result of advances in horizontal drilling and hydraulic fracturing technologies enabling greater access to gas in shale formations. Responsible development of America's shale gas resources offers important economic, energy security, and environmental benefits.

EPA is working with states and other key stakeholders to help ensure that natural gas extraction does not come at the expense of public health and the environment. The Agency's focus and obligations under the law are to provide oversight, guidance and, where appropriate, rulemaking that achieve the best possible protections for the air, water and land where Americans live, work and play. The Agency is investing in improving our scientific understanding of hydraulic fracturing, providing regulatory clarity with respect to existing laws, and using existing authorities where appropriate to enhance health and environmental safeguards.

On this page:

Underground injection control (UIC) of waste disposal fluids from oil and gas wells (Class II wells)
Wastewater discharges to treatment facilities
Stormwater discharges from oil and gas operations or transmission facilities
Use of disposal ponds and impoundments
Recycling of wastewater
Addressing air quality impacts associated with hydraulic fracturing activities
Assuring compliance
Promoting transparency and conducting outreach

Improving our Scientific Understanding of Hydraulic Fracturing

April 2012 Memorandum of Agreement among the U.S. Departments of Energy and Interior and U.S. EPA about Collaboration on Unconventional Oil and Gas Research (PDF)

EPA's study of hydraulic fracturing and its potential impact on drinking water resources: EPA is undertaking a national study to understand the potential impacts of hydraulic fracturing on drinking water resources. The study will include a review of published literature, analysis of existing data, scenario evaluation and modeling, laboratory studies, and case studies. EPA expects to release a progress report in 2012 and final draft report for peer review and comment in 2014. Learn more about the study at epa.gov/hfstudy.

Providing Regulatory Clarity and Protections against Known Risks

Although the national study should enhance our scientific knowledge, some concerns associated with overall natural gas and shale gas extraction, including hydraulic fracturing, are already well known. These operations can result in a number of potential impacts to the environment, including:

Stress on surface water and ground water supplies from the withdrawal of large volumes of water used in drilling and hydraulic fracturing;
Contamination of underground sources of drinking water and surface waters resulting from spills, faulty well construction, or by other means;
Adverse impacts from discharges into surface waters or from disposal into underground injection wells; and
Air pollution resulting from the release of volatile organic compounds, hazardous air pollutants, and greenhouse gases.

Because natural gas development is increasing rapidly in many regions, prudent steps to reduce these impacts are essential now even as further research to understand potential risks continues. EPA is:

Ensuring that hydraulic fracturing using diesel fuels is properly permitted

A core element of the Safe Drinking Water Act's (SDWA) Underground Injection Control (UIC) program is setting requirements for proper well siting, construction, and operation to minimize risks to underground sources of drinking water. The Energy Policy Act of 2005 excluded hydraulic fracturing, except when diesel fuels are used, for oil, gas or geothermal production from regulation under the UIC program. This statutory language caused regulators and the regulated community alike to raise questions about the applicability of permitting practices.

EPA has developed revised UIC Class II permitting guidance specific to oil and gas hydraulic fracturing activities using diesel fuels. Although developed specifically for hydraulic fracturing where diesel fuels are used, many of the guidance's recommended practices are consistent with best practices for hydraulic fracturing in general, including those found in state regulations and model guidelines for hydraulic fracturing developed by industry and stakeholders. Thus, states and tribes responsible for issuing permits and/or updating regulations for hydraulic fracturing will find the recommendations useful in improving the protection of underground sources of drinking water and public health wherever hydraulic fracturing occurs.

EPA is issuing the guidance alongside an interpretive memorandum, which clarifies that Class II UIC requirements apply to hydraulic fracturing activities using diesel fuels, and defines the statutory term "diesel fuel" by reference to five chemical abstract services registry numbers. The guidance outlines for EPA permit writers, where EPA is the permitting authority, (i) existing Class II requirements for diesel fuels used for hydraulic fracturing wells, and (ii) technical recommendations for permitting those wells consistently with these requirements.

Read the guidance, interpretive memo and *Federal Register* notice.
EPA and states share primary responsibility ("primacy") for implementing the UIC program.
Learn about the primacy status of each state.

Ensuring the safe disposal of wastewater, stormwater, and other wastes from hydraulic fracturing activities

As the number of shale gas wells in the U.S. increases, so too does the volume of shale gas wastewater that requires disposal. Wastewater associated with shale gas extraction can contain high levels of total dissolved solids (TDS), fracturing fluid additives, metals, and naturally occurring radioactive materials. In partnership with states, EPA is examining the different disposal methods employed by industry to ensure that there are regulatory and permitting frameworks in place to provide safe and legal options for disposal of flowback and produced water. These options include:

Underground injection of waste disposal fluids from oil and gas wells (Class II wells)

In many regions of the U.S., underground injection is the most common method of disposing of fluids or other substances from shale gas extraction operations. Disposal of flowback and produced water via underground injection is regulated under the Safe Drinking Water Act's Underground Injection Control (UIC) program.

Class II oil and gas-related injection wells
UIC regulations
May 2012 draft permitting guidance for oil and gas hydraulic fracturing activities using diesel fuels | Press release

Related study: 2004 EPA study evaluating the impacts to underground sources of drinking water by hydraulic fracturing of coalbed methane reservoirs

Wastewater discharges to treatment facilities

The Clean Water Act (CWA) effluent guidelines program sets national standards for industrial wastewater discharges based on best available technologies that are economically achievable. Effluent guidelines for oil and gas extraction prohibit the on-site direct discharge of wastewater from shale gas extraction into waters of the U.S. While some of the wastewater from shale gas extraction is reused or re-injected, a significant amount still requires disposal. However, no comprehensive set of national standards exists at this time for the disposal of wastewater discharged from natural gas extraction activities. As a result, some shale gas wastewater is transported to treatment plants (publicly owned treatment works (POTWs) or private centralized waste treatment facilities (CWTs)), many of which are not properly equipped to treat this type of wastewater.

In October 2011, as part of the CWA section 304(m) planning process, we announced a schedule to develop standards for wastewater discharges produced by natural gas extraction from underground coalbed and shale formations. To ensure that these wastewaters receive proper treatment and can be properly handled by treatment plants, we will gather data; consult with stakeholders, including ongoing consultation with industry; and examine a variety of options including separate rulemakings for coalbed methane extraction and shale gas extraction, or a combined rulemaking.

Effluent guidelines (CWA section 304(m)): 2010 effluent guidelines program plan
Discharge standards for wastewater from unconventional oil and gas extraction
October 2011 news release
Fact sheet about the final plan

EPA and states share responsibility for implementing treatment and disposal of wastewater from shale gas extraction under the National Pollutant Discharge Elimination System (NPDES) View a state-by-state map of NPDES program authority (PDF) (1 pp, 663 K)

Related study: 2009 coalbed methane extraction sector survey for effluent guidelines program

EPA is also updating **chloride water quality criteria** for the protection of aquatic life under CWA section 304(a)(1). EPA's recommended Water Quality Criteria are used by states when considering updates to applicable state water quality standards. Such standards provide a basis for establishing acceptable discharge limits. Because flowback and produced water from fracturing operations have very high levels of total dissolved solids (TDS), and chlorides are the major component of the TDS, updating the water quality criteria for chloride will provide an updated scientific basis on which to issue discharge permits. A draft criteria document is expected in summer 2014.

In March 2011, EPA issued a set of questions and answers that provide state and federal permitting authorities in the **Marcellus Shale region** with guidance on permitting treatment and disposal of wastewater from shale gas extraction.

Memo from EPA Office of Wastewater Management to EPA Regions with answers to frequently asked questions about wastewater issues resulting from shale gas extraction.

EPA plans to supplement these frequently asked questions with additional guidance directed to permitting authorities, pretreatment control authorities and POTWs. This guidance will provide assistance on how to permit POTWs and CWTs by clarifying existing CWA authorities and obligations.

Stormwater discharges from oil and gas operations or transmission facilities

Under the CWA, oil and gas exploration, production, processing, or treatment operations or transmission facilities, including associated construction activities, are not required to obtain National Pollutant Discharge Elimination System (NPDES) permit coverage for stormwater discharges unless there is a reportable quantity spill or the discharge causes or contributes to a water quality violation.

Regulation of stormwater discharges from oil and gas exploration, production, processing or treatment operations or transmission facilities under NPDES

Use of surface impoundments (pits or ponds) for storage or disposal

In some cases, operators use surface storage tanks and pits to temporarily store hydraulic fracturing fluids for re-use or until arrangements are made for disposal. In addition, other wastes are generated during the well drilling, stimulation, and production stages. States, tribes, and some local governments have primary responsibility for adopting and implementing programs to ensure proper management of these wastes.

> Regulation of crude oil and natural gas waste under the Resource Conservation and Recovery Act (RCRA)

Recycling of wastewater

Some drilling operators elect to re-use a portion of the wastewater to replace and/or supplement fresh water in formulating fracturing fluid for a future well or re-fracturing the same well. Re-use of shale gas wastewater is, in part, dependent on the levels of pollutants in the wastewater and the proximity of other fracturing sites that might re-use the wastewater. This practice has the potential to reduce discharges to treatment facilities or surface waters, minimize underground injection of wastewater and conserve water resources.

Addressing air quality impacts associated with hydraulic fracturing activities

There have been well-documented air quality impacts in areas with active natural gas development, with increases in emissions of methane, volatile organic compounds (VOCs) and hazardous air pollutants (HAPs). EPA, the Department of the Interior, other federal agencies and states are working to better characterize and reduce these air emissions and their associated impacts. Through the Natural Gas STAR program, EPA and partner companies have identified technologies and practices that can cost-effectively reduce methane emissions from the oil and natural gas sector in the U.S. and abroad. Through the Clean Construction USA program, EPA is promoting newer, more efficient technology and cleaner fuels to innovate the ways in which hydraulic fracturing equipment and vehicles reduce emissions. EPA also administers Clean Air Act regulations for oil and natural gas production, including regulations on reporting greenhouse gas emissions.

October 2012: Notification Requirement for Well Completions
April 2012: EPA Issues Oil and Natural Gas Air Pollution Standards
- News release
- Fact sheet (PDF)
- More information

June 2011 USDA/EPA/Department of Interior memorandum of understanding (MOU) setting forth expectations and agreements for addressing air quality analyses and mitigation measures through the NEPA process related to federal oil and gas planning, leasing, or field development decisions:
Press release | MOU (PDF) | Questions and answers about the MOU (PDF)
Natural Gas STAR Program
- Natural Gas STAR Recommended Technologies and Practices
- Global Methane Initiative Exit

Clean Construction USA program
Oil and natural gas air pollution standards (Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews)
Greenhouse Gas Reporting Program

Assuring Compliance

EPA targets enforcement to ensure compliance with laws and regulations, with an emphasis on correcting violations with significant potential harm to human health and the environment. In addition to self-directed investigations, EPA receives thousands of leads and incident reports relating to oil and gas activities that could impact air or water quality. EPA works with state and local governments to respond to incidents, encourage diligent accident prevention, and provide effective and prompt response when emergencies occur. EPA's offices around the nation ("Regions" or "Regional offices") provide guidance and grants to state regulators, perform inspections, conduct enforcement actions, and issue permits and information request letters, in order to ensure that existing laws are effectively implemented.

National Enforcement Initiatives: Assuring energy extraction sector compliance with environmental laws
October 2000 Compliance Assistance Sector Notebook: Profile of the Oil and Gas Extraction Industry (PDF) (165 pp,1.5 MB)

Promoting Transparency and Conducting Outreach

Within the federal government, EPA has played a lead role in conducting stakeholder outreach to individual citizens, communities, tribes, state and federal partners, industry, trade associations and environmental organizations that have a strong interest in the Agency's work and policies related to hydraulic fracturing and shale gas extraction. EPA is committed to full transparency and providing opportunities for stakeholder input on all agency actions.

Petition by 120 environmental and public health organizations requesting that EPA issue Toxic Substances Control Act (TSCA) Section 4 and 8 rules requiring toxicity testing and reporting of health and safety studies on oil and gas exploration and production chemicals. While EPA has not granted the entire petition, consistent with the priorities identified in the President's Blueprint for a Secure Energy Future (PDF) and with the Secretary of Energy Advisory Board recommendations on steps to support the safe development of natural gas resources , EPA will launch a stakeholder and public engagement process to seek input on the design and scope of developing reporting requirements.

- Read the petition (August 4, 2011) (PDF) (30 pp, 10.6 M)
- November 2, 2011 EPA notification to petitioners (PDF) (2 pp, 548 K)
- November 23, 2011 EPA notification to petitioners (PDF) (2 pp, 939 K)
- July 11, 2013 EPA response outlining reasons for denying in part the petitioners' requests

December 2009 letter from EPA Region 2 to New York State Dept. of Environmental Conservation (NYSDEC) (PDF) commenting on the NYSDEC's September 2009 Supplemental Generic Environmental Impact Statement (SGEIS) as part of NYSDEC's process of reviewing permit applications for hydraulic fracturing operations, including in the Marcellus Shale.

- September 2011 NYSDEC Revised Draft SGEI Exit

EPA Region 3 Online FOIA Reading Room - Key Documents about Mid-Atlantic Oil and Gas Extraction (Region 3 is located in Philadelphia and covering the Marcellus and Utica Shales in Pennsylvania, West Virginia, Virginia and western Maryland)

EPA's Hydraulic Fracturing Study:

- Stakeholder outreach and peer review
- November 2011 Study Plan (PDF)
- Quality assurance project plans

Stakeholder involvement on draft UIC guidance for permitting oil and gas hydraulic fracturing activities using diesel fuels

Testimony:

Testimony of Regina McCarthy, Assistant Administrator, Office of Air and Radiation, before the Committee of Environment and Public Works, U.S. Senate, June 19, 2012 (PDF) (9 pp, 92 K) -- Discussion of Oil and Gas New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants

Testimony of Nancy K. Stoner, Acting Assistant Administrator, Office of Water, before the Subcommittee on Technology, Information Policy, Intergovernmental Relations and Procurement Reform, Committee on Oversight and Government Reform, U.S. House of Representatives, May 31, 2012 (PDF) (8 pp, 37 K) -- Discussion of hydraulic fracturing and the Safe Drinking Water Act's Underground Injection Control Program

Testimony of Cynthia Dougherty, Director, Office of Groundwater and Drinking Water, before the Subcommittee on Water and Power, Committee on Energy and Natural Resources, U.S. Senate, October 20, 2011 (PDF) (5 pp, 28 K) -- Discussion of EPA's role in ensuring that public health and water quality are protected during natural gas extraction and production activities.

Testimony of Dr. Paul Anastas, former Assistant Administrator for Research and Development, before the Committee on Science, Space and Technology, U.S. House of Representatives, May 11, 2011 (PDF) (4 pp, 22x K) -- Discussion of potential impacts of hydraulic fracturing on drinking water resources.

Testimony of Bob Perciasepe, Deputy Administrator, before the Subcommittee on Water and Wildlife, Committee on Environment and Public Works, U.S. Senate, April 12, 2011 (PDF) (7 pp, 35 K) -- Discussion of EPA's role in ensuring that public health and the environment are protected during natural gas extraction and production.

Report Environmental Violations

Report **illegal disposal of wastes or other non-emergency suspicious activity** related to oil and natural gas development through **epa.gov/tips.**

You can provide tips anonymously if you do not want to identify yourself.

Emergency events and spills or releases should be reported through the **National Response Center:**

- **1-800-424-8802 or**
- **through the NRC online reporting form.**

Related Information

Additional EPA information:

- Process of hydraulic fracturing
- Radioactive wastes from oil and gas drilling
- Activities in Pavillion, WY

Other federal government information:

- Multi-Agency (EPA, DOE and USGS) Collaboration on Unconventional Oil and Gas Research (unconventional.energy.gov)
- U.S. Department of Energy Natural Gas Subcommittee of the Secretary of Energy Advisory Board
  - Subcommittee website shalegas.energy.gov
  - Final report (PDF) (23 pp, 3.5 MB)
- What is shale gas? (U.S. Energy Information Administration)
- Review of emerging resources: U.S. shale gas and shale oil plays (U.S. Energy Information Administration)
- Report "Oil and Gas: Information on Shale Resources, Development, and Environmental and Public Health" (GAO)

Last updated on February 11, 2014