http://www.epa.gov/hfstudy/casestudies.html

EPA

Case Study Locations for Hydraulic Fracturing Study

EPA has selected seven case studies located in various formations locations across the country that the agency believes will provide the most useful information about the potential impacts of hydraulic fracturing on drinking water resources under a variety of circumstances. View the criteria according to which these locations were selected. Two prospective case studies, where EPA will monitor key aspects of the hydraulic fracturing process at future hydraulic fracturing sites, are located in

- DeSoto Parish, Louisiana (Haynesville Shale), and
- Washington County, Pennsylvania (Marcellus Shale).

Five retrospective case studies, which will investigate reported drinking water contamination due to hydraulic fracturing operations at existing sites, are located in:

Related Information

- Main page on this study
- Questions and answers about the study
- Quality assurance project plans for the Study Plan
- Main hydraulic fracturing page

Location	Key Issues to be Investigated	Potential Outcomes	Companies Involved
• Bakken Shale: Kildeer and Dunn Counties, North Dakota	• Production well failure during hydraulic fracturing • Suspected drinking water aquifer contamination	• Identify sources of well failure • Determine if drinking water resources are contaminated and to what extent	• Denbury Resources, Inc.
• Barnett Shale: Wise and Denton Counties, Texas	• Possible drinking water well contamination • Spills and runoff leading to suspected drinking water well contamination	• Determine if private water wells are contaminated • Obtain information about the likelihood of transport of contaminants via spills, leaks, and runoff	• Aruba Petroleum, Inc. • Primexx Energy Partners Ltd. • XR-5, LLC • White
• Marcellus Shale: Bradford and Susquehanna Counties, Pennsylvania	• Ground water and drinking water well contamination • Suspected surface water contamination from a spill of fracturing fluids • Methane contamination of multiple drinking water wells	• Determine if drinking water wells are contaminated • Determine source of methane in private wells • Transferable results due to common types of impacts	• Chesapeake Energy Corporation
• Marcellus Shale: Washington County, Pennsylvania	• Changes in drinking water quality, suspected contamination • Stray gas in wells, surface spills	• Determine if drinking water wells are contaminated • Determine if surface spills affect surface and ground water • If contamination exists, determine potential source of contaminants in drinking water	• Range Resources Corporation • Atlas Energy, L.P.
• Raton Basin: Las Animas County, Colorado	• Potential drinking water well contamination (methane and other contaminants) in an area with intense concentration of gas wells in shallow surficial aquifer (coalbed methane)	• Determine source of methane • Identify presence/source of contamination in drinking water wells	• Pioneer Natural Resources Company • Petroglyph Energy, Inc.

Criteria for Case Study Location Selection

The sites were identified, prioritized and selected based on a rigorous set of criteria and represent a wide range of conditions and impacts that may result from hydraulic fracturing activities. These criteria included:

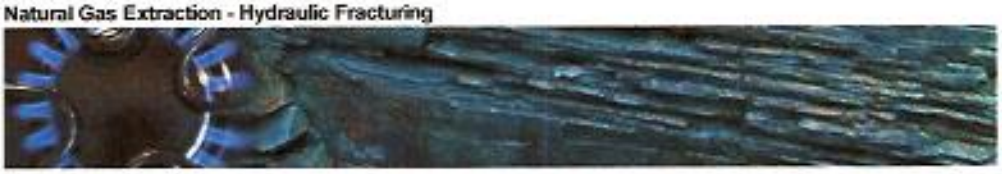
- proximity of population and drinking water supplies,
- evidence of impaired water quality (retrospective only),
- health and environmental concerns (retrospective only), and
- knowledge gaps that could be filled by the case study.

Sites were prioritized based on:

- geographic and geologic diversity,
- population at risk,
- site status (planned, active or completed),
- unique geological or hydrological features,
- characteristics of water resources, and
- land use.

EPA

Natural Gas Extraction - Hydraulic Fracturing



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.

Hydraulic Fracturing Study Plan

- Read the study plan and learn more about the study at epa.gov/hfstudy

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:

- Improving our scientific understanding of hydraulic fracturing
- Providing regulatory clarity and protections against known risks
  - Ensuring that hydraulic fracturing using diesel fuels is properly permitted
  - Ensuring the safe disposal of wastewater and stormwater from hydraulic fracturing activities
    - 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

- **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 will release initial study results in a 2012 report and an additional report at the end of 2014. Learn more about the study at epa.gov/hfstudy.

- **Ground water investigation near Pavillion, Wyoming:** At the request of Pavillion residents, in 2008, EPA began investigating water quality concerns in private drinking water wells. Since that time, in conjunction with the state of Wyoming, the local community, tribes, and the owner of the gas field, Encana, EPA has been working to assess ground water quality and identify potential sources of contamination. Learn more about the groundwater investigation.

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 and gas production from permitting under the UIC Program. This was because of concern about the risks to drinking water from diesel fuels.

- EPA and states share primary responsibility ("primacy") for implementing the UIC program.
- EPA is developing UIC guidance for permitting hydraulic fracturing activities that use diesel fuels.

► Ensuring the safe disposal of wastewater and stormwater 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

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 solicit public comment on a proposed rule for coalbed methane in 2013 and a proposed rule for shale gas in 2014.

- Effluent guidelines (CWA section 304(m)): 2010 effluent guidelines program plan
  - Effluent guidelines home page
  - 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 early 2012.

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. States, tribes, and some local governments have primary responsibility for adopting and implementing programs to ensure proper management of these wastes. EPA is currently evaluating industry practices and state requirements and is considering the need for technical guidance on the design, operation, maintenance, and closure of pits under the Resource Conservation and Recovery Act (RCRA) in order to minimize potential environmental impacts.

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

useful

• 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.

- 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
- 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)
  - July 28, 2011 proposal to reduce emissions of smog-forming volatile organic compounds (VOCs) and air toxics from the oil and natural gas industry.
    - Proposed rule (PDF) (504pp, 1.1 MB)
    - Fact sheet (PDF) (8pp, 419k)
    - Overview presentation (PDF) (15pp, 258k)
    - Regulatory impact analysis (PDF) (204pp, 1.6 MB)
  - Greenhouse Gas Reporting Program

You will need Adobe Reader to view some of the files on this page. See EPA's PDF page to learn more.

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.

N.D. Does not plan for compliance

- 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

Promoting Transparency and Conducting Outreach

Needed in ND

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.
  - 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, 509 K)

  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.

- 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 SGEIS
- 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 involvement strategy for EPA's study of hydraulic fracturing and its potential impact on drinking water resources
  - August 2011 request by EPA requesting participation in EPA's Hydraulic Facturing Study
  - September 2010 request by EPA to provide data on the chemical composition of fluids used in the hydraulic fracturing process
  - 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 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 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.

Natural Gas Drilling Tipline

Report illegal disposal of wastes or other non-emergency suspicious activity related to oil and natural gas development.

- Call 1-877-919-4372 (toll free), or
- Email eyesondrilling@epa.gov

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

Sign up for hydraulic fracturing email alerts

Enter email address sign up

Related Information

Additional EPA information:

- Process of hydraulic fracturing
- Radioactive wastes from oil and gas drilling

Other federal government information:

- 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)
- U.S. Department of Energy Natural Gas Subcommittee of the Secretary of Energy Advisory Board
  - Subcommittee website: shalegas.energy.gov
  - August 11, 2011 press release announcing the subcommittee's recommendations
  - Draft report (PDF) (41 pp, 781 K)
  - Share your ideas and submit comments on the report

WCMS
Last updated on Wednesday, February 15, 2012

http://www.epa.gov/hfstudy/

EPA United States Environmental Protection Agency

EPA's Study of Hydraulic Fracturing and Its Potential Impact on Drinking Water Resources

In its Fiscal Year 2010 budget report, the U.S. House of Representatives Appropriation Conference Committee identified the need for a focused study of hydraulic fracturing. EPA scientists, under this administration and at the direction of Congress, are undertaking a study of hydraulic fracturing to better understand any potential impacts of hydraulic fracturing on drinking water and ground water. EPA consulted with experts in the field through peer review and technical workshops, and engaged stakeholders in a dialogue about the study through facilitated public meetings.

The overall purpose of the study is to understand the relationship between hydraulic fracturing and drinking water resources. The scope of the research includes the full lifespan of water in hydraulic fracturing, from acquisition of the water, through the mixing of chemicals and actual fracturing, to the post-fracturing stage, including the management of flowback and produced water and its ultimate treatment and disposal.

New Information on this Website

You will need Adobe Reader to view some of the files on this page. See EPA's PDF page to learn more.

- **November 2011 Final Study Plan:**
  - Questions and Answers about EPA's Hydraulic Fracturing Study page
  - Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources (PDF) (100 pp, 2.1 MB)
  - Presentation on the Final Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources (PDF) (November 2011) (19 pp, 497 K)
  - Dr. Paul Anastas's statement on the release of Plan (as prepared for delivery) (November 2011) (PDF) (7 pp, 50 K)
  - Press release: EPA Announces Final Study Plan to Assess Hydraulic Fracturing
  - Quality Management and Quality Assurance Project Plans
- Information about the status of Hydraulic Fracturing Study research (November 2011)
- Abstracts summaries of presentations from technical workshops in February and March 2011 on:
  - Chemical and analytical methods
  - Well construction and operations
  - Fate and transport
  - Water resources management

Status of Hydraulic Fracturing Study Research (December 2011)

A first report of results is expected by the end of 2012. A final report will be released in 2014.

EPA is working to complete the study in a timely manner so that the results are available to the public. Research has begun. Importantly, all of these activities explicitly described in the draft study plan and supported by the Science Advisory Board (SAB). As laid out in both the draft study plan and the final study plan, we have:

- conducted an initial literature review;
- requested and received information from industry on chemicals and practices used in hydraulic fracturing;
- discussed initial plans for case studies with landowners and state, local and industry representatives; and
- conducted baseline sampling for retrospective case studies using scientifically sound approaches that have been shared with collaborators.

We have timed our work to enable us to provide more results in the 2012 report.

Additional Information

- EPA response to SAB's comments on the Draft Study Plan (September 2011) (PDF) (2 pp, 370 K)
- Table outlining EPA responses to SAB comments on the Draft Study Plan (PDF) (5 pp, 82 K)
- SAB Review of the Draft Study Plan (August 2011) (PDF) (89 pp, 1.4 MB)
- Memo from EPA to SAB request review of the Draft Study Plan (February 2011) (PDF) (3 pp, 82 K)
- Draft Study Plan (February 2011) (PDF) (140 pp, 3.6MB)
- Press release on submission of the Draft Study Plan to SAB (February 2011)
- Case study locations for the Study
- Criteria for case study location
- Press release on selection of locations for the Study (June 2011)
- Questions and answers about the Study

Background

- Study approach
  - Case studies
- Voluntary information requests
  - August 2011 request

- September 2010 request
- Science Advisory Board
- Stakeholder involvement strategy
  - Sector specific meetings and state and federal partner consultations
  - Public meetings
  - Tribal government consultations
  - Webinars on the draft study plan
  - Technical workshops
- Publications

Study Approach

The overall purpose of the study is to identify potential impacts of hydraulic fracturing on drinking water resources. More specifically, the study is designed to examine the conditions that may be associated with the potential contamination of drinking water resources, and to identify the factors that may lead to human exposure and risks. The scope of the research includes the hydraulic fracturing water use lifecycle, which for this study, consists of water acquisition, chemical mixing, well injection, flowback and produced water (collectively referred to as "hydraulic fracturing wastewater"), and wastewater treatment and waste disposal. The study will:

- include an extensive review of peer-reviewed literature;
- compile and analyze existing data;
- include laboratory research, computer modeling, scenario evaluations, and field investigations, including prospective and retrospective case studies; and
- characterize the toxicity of chemicals used in hydraulic fracturing.

All research activities associated with this study will be conducted in accordance with EPA's Quality Assurance Program for environmental data. EPA will provide periodic updates on the progress of various projects as the research is being conducted. The results of individual research projects will be made available after undergoing a quality assurance review. It is expected that a first report of research results will be released in 2012. Certain portions of the work identified in the draft study plan, however, are long-term projects that are not likely to be completed in 2012. Additional reports of study findings will be published in a second report in 2014.

- EPA's Quality Assurance Program

Case Studies

In June 2011, EPA identified seven case study locations to help the agency assess the potential impacts of hydraulic fracturing on drinking water resources. The sites identified were selected following extensive input from stakeholders, including the public, local and state officials, industry, and environmental organizations. EPA began field work in some of the selected areas in the summer of 2011.

Two sites are prospective case studies where EPA will monitor key aspects of the hydraulic fracturing process at future hydraulic fracturing sites. They are located in DeSoto Parish, Louisiana (Haynesville Shale), and in Washington County, Pennsylvania (Marcellus Shale). The other five case studies are retrospective, where EPA will investigate reported drinking water contamination due to hydraulic fracturing operations at existing sites, are located in:

- Killdeer, Dunn County, North Dakota (Bakken Shale)
- Denton County, Texas (Barnett Shale)
- Bradford and Susquehanna Counties, Pennsylvania (Marcellus Shale)
- Washington County, Pennsylvania (Marcellus Shale)
- Colorado (Raton Basin)

- Key issues to be investigated at each location
- Criteria for case study location selection
- June 23, 2011 press release on selection of locations for Hydraulic Fracturing Study Plan
- Questions and answers about EPA's hydraulic fracturing study

Voluntary Information Requests

August 2011 Voluntary Information Request

On August 11, 2011 EPA sent letters to nine oil and gas companies requesting their voluntary participation in EPA's hydraulic fracturing study. EPA requested data on well construction, design, and well operation practices for 350 oil and gas wells that were hydraulically fractured from 2009-2010. EPA made this request as part of its national study to examine the potential impacts of hydraulic fracturing on drinking water resources. The wells were selected using a stratified random method and reflect the diversity in both geography and size of the oil and gas operator. This account of well performance – together with a literature review, assessment of data and information from states and communities, case studies, laboratory work, and computer modeling – will allow EPA to do a more thorough assessment of the potential impacts of hydraulic fracturing on drinking water resources.

All nine oil and gas companies said that they planned to assist EPA. By sharing information about specific well construction design and operations, these companies will help EPA and the public better understand technologies and practices associated with hydraulic fracturing.

- Letter sent by EPA to the nine oil and gas companies (PDF) (14 pp, 108 K)

- **Companies that received the request:**
  - Clayton Williams Energy
  - ConocoPhillips
  - EOT Production
  - Hogback Exploration

- Laramie Energy II
- MDS Energy
- Noble Energy
- Sand Ridge Operating
- Williams Production

- **How were these wells selected?**
  In response to EPA's September 2010 request to nine hydraulic fracturing service companies, we received a list of approximately 25,000 oil and gas production wells that were hydraulically fractured between 2009 and 2010 and the names of the oil and gas operator for each well.

  To identify the wells for this request, we first sorted the list of operators by those with the most wells to those with the fewest wells. We defined operators to be "large" if their combined number of wells accounted for the top 50% of wells on the list, "medium" if their combined wells accounted for the next 25% of wells on the list, or "small" if their wells were among the last 25% of wells on the list, and removed all operators with 10 wells or less.

  Then, using a map from the U.S. Energy Information Administration showing all shale gas plays, EPA classified four different areas of the nation: East, South, Rocky Mountain (including California) and Other. To choose the nine companies that received the request, EPA randomly selected one "large" operator from each from the geographic areas; for a total of four "large" operators, and then randomly, and without geographic consideration, selected two "medium" and three "small" operators.

  Once the nine companies were identified, we used a computer algorithm that balanced geographic diversity and random selection within an operator's list to select wells until we had a total of 350 wells.

September 2010 Voluntary Information Request

On September 9, 2010, EPA issued voluntary information requests to nine hydraulic fracturing service providers. The data requested, which is integral to the hydraulic fracturing study, included:

- the chemical composition of fluids used in the hydraulic fracturing process;
- data on the impacts of the chemicals on human health and the environment;
- standard operating procedures used at hydraulic fracturing sites; and
- the locations of sites where fracturing has been conducted.

All nine companies to access this crucial information that will help us carry out our Congressionally-mandated study on the potential impacts of hydraulic fracturing on drinking water resources.

Three of the nine hydraulic fracturing service companies also provided non-confidential information related to their hydraulic fracturing services. This information is available at Docket Number EPA-HQ-ORD-2010-0674.

News Releases

- September 2010 news release about the voluntary information request
- November 2010 news release on results of voluntary information request

Communications between EPA and Hydraulic Fracturing Service Providers

- Letter sent by EPA to the nine hydraulic fracturing service providers (PDF) (10pp, 39K)
- Letter sent by EPA to Halliburton, November 9, 2010 (PDF) (2 pp, 51KB)
- Subpoena sent by EPA to Halliburton (PDF) (11 pp, 3.5M)

got an A.E.S. Staffer on his Science Advisory Board?

Peer Review by the Science Advisory Board

EPA asked the EPA Science Advisory Board (SAB) to provide a peer review of the draft study plan, and for the SAB to provide suggestions and comments. The SAB is an independent, external federal advisory committee. The SAB met in April 2010 to provide advice on the proposed approach to be used to frame the hydraulic fracturing study design and on the areas that will be addressed by research relevant to hydraulic fracturing. Their ideas were provided to EPA in a June 2010 Report to the Administrator.

- Scoping materials for initial design of EPA research on potential relationships between hydraulic fracturing and drinking water resources
- June 2010 SAB Report to the EPA Administrator (PDF) (26 pp, 246K)

EPA considered SAB's comments, as well as stakeholder comments, in the development of the Draft Study Plan. Four separate SAB meetings (two teleconferences and two face-to-face meetings) were open to the public and provided additional opportunities for the public to provide information and comments to inform the SAB's review of the study. Initial research results are expected by the end of 2012 with a goal for a report in 2014.

- February 2011 Draft Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources (PDF) ("Draft Study Plan") (140 pp, 3.6MB)
- February 2011 memo from EPA Office of Science Policy to SAB requesting review of the Draft Study Plan (PDF) (3 pp, 82 K)
- August 2011 SAB Review of the Draft Study Plan (PDF) (89 pp, 1.4 MB)
- September 2011 EPA Response to SAB's comments on the Draft Study Plan (PDF) (2 pp, 370 K)
  - Table outlining EPA responses to SAB comments on the Draft Hydraulic Fracturing Study Plan (PDF) (5 pp, 82 K)

News Releases

- February 2011 news release about EPA's submission of the Study Plan to SAB for review
- March 2010 news release announcing the study and request for comments from the SAB

SAB Website Links

- SAB Hydraulic Fracturing Study Plan - Information on SAB's activities to provide advice on the **scientific adequacy and appropriateness of the EPA study**. A Hydraulic Fracturing Study Plan Review Panel was formed in January 2011. The Panel conducted this review in early March 2011.
- SAB Hydraulic Fracturing Research Plan - Information on SAB's activities to provide advice on the **proposed approach and scope of the EPA study**, including April 2010 SAB meeting materials, and the June 2010 Final Report to the Administrator (PDF) (26 pp, 240K)
- August 2011 SAB Review of EPA's Draft Hydraulic Fracturing Study Plan (PDF) (89 pp, 1.4 MB)

Stakeholder Involvement Strategy

EPA understands the importance of outreach to individual citizens, communities, tribes, state and federal partners, industry, trade associations, and environmental organizations.

During summer 2010, EPA engaged stakeholders in a dialogue about the hydraulic fracturing study through facilitated meetings. EPA also consulted with experts in the field through peer review and technical workshops. Meeting materials and summaries from stakeholder events can be found below and are also available at Docket Number EPA-HQ-ORD-2010-0674.

Sector-Specific Meetings and State and Federal Partner Consultations

You will need Adobe Reader to view some of the files on this page. See EPA's PDF page to learn more.

- States - May 27, 2010
  - Presentation (PDF) (34 pp, 2MB)
  - Meeting Summary (PDF) (3 pp, 30K)
- Federal - June 7, 2010
  - Presentation (PDF) (34 pp, 3MB)
  - Meeting Summary (PDF) (4 pp, 32K)
- Industry - June 21, 2010 with re-cast on June 30, 2010
  - Presentation (PDF) (34 pp, 3MB)
  - Meeting Summary (PDF) (7 pp, 39K)
- Environmental Organizations - June 23, 2010
  - Presentation (PDF) (34 pp, 3MB)
  - Consultation (PDF) (5 pp, 43K)

Public Meetings

- Information about the public meetings:
  - Federal Register Notice (75 FR 35023; June 21, 2010) announcing the meetings
  - Agendas for the meetings (PDF) (7 pp, 130K)
  - EPA presentation (PDF) (26 pp, 835K)
  - Meeting handouts:
    - Water Life Cycle in the Hydraulic Fracturing Process Poster (PDF) (1 pg, 150K)
    - Proposed Criteria for Case Study Site Selection Poster (PDF) (1 pg, 282K)
    - Proposed Criteria for Selecting Case Studies for the EPA Hydraulic Fracturing Study (PDF) (4 pp, 128 K)
    - Proposed Study Design for the EPA Hydraulic Fracturing Study (PDF) (4 pp, 168 K)
- July 8, 2010, Fort Worth, Texas
  - Comments (PDF) (26 pp, 156K)
- July 13, 2010, Denver, Colorado
  - Comments (PDF) (12 pp, 105K)
- July 22, 2010, Canonsburg, Pennsylvania
  - Comments (PDF) (36 pp, 178K)
- September 13, 2010, Binghamton, New York
  - Afternoon Comments (PDF) (39 pp, 189K)
  - Evening Comments (PDF) (31 pp, 176K)
- September 15, 2010, Binghamton, New York
  - Afternoon Comments (PDF) (25 pp, 182K)
  - Evening Comments (PDF) (24 pp, 181K)

Tribal Government Consultations

- Summary of August 5 and 30, 2010, Consultation with Tribal Governments (PDF) (4 pp, 40K)
- Summary of August 13, 2010, Consultation with Haudenosaunee Task Force (PDF) (6 pp, 47K)
- August 30, 2010, Tribal Presentation: Potential Relationships Between Hydraulic Fracturing and Drinking Water Resources (PDF) (24 pp, 1MB)

Webinars on the Hydraulic Fracturing Study Plan

- Presentation on the Final Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources (PDF) (November 2011) (78 pp, 497 K)
- Overview of the Draft Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources
  - Stakeholder Webinars held February 15-16, 2011 (PDF) (23 pp, 711K)
  - Public Webinar held March 2, 2011 (PDF) (23 pp, 715K)

Technical Workshops

EPA held four technical workshops in February and March 2011 on these subjects integral to hydraulic fracturing: chemical and analytical methods, well construction and operations, fate and transport, and water resource management. For each workshop, EPA selected between 40-50 technical experts from the oil and natural gas industry, consulting firms, laboratories, state and federal agencies, and environmental organizations to participate in the workshops. The technical workshops were intended to:

1. inform EPA of the current technology and practices being used in hydraulic fracturing,
2. identify research related to the potential impacts of hydraulic fracturing on drinking water resources, and
3. provide an opportunity for EPA scientists to interact with technical experts.

EPA will use the information presented in these abstracts and presentations to inform research that effectively evaluates the relationship between hydraulic fracturing and drinking water.

The links below will take you to pages that include summaries of the presentations and discussion sessions as well as abstracts for each presentation.

- Chemical and Analytical Methods (February 24-25, 2011)
- Well Construction and Operations (March 10-11, 2011)
- Fate and Transport (March 28-29, 2011)
- Water Resource Management (March 29-30, 2011)

For more information on the workshop topics, you can view the Technical Workshops Flyer (PDF) (1 pg, 53K , About PDF)

Publications

- Draft Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources, February 2011 (PDF) (140 pp, 3.6MB)
- Opportunity for Stakeholder Input on EPA's Hydraulic Fracturing Research Study
  - Study Design, July 2010 (PDF) (3 pp, 50K)
  - Criteria for Selecting Case Studies, July 2010 (PDF) (4 pp, 57K)
- Scoping Materials for Initial Design of EPA Research Study on Potential Relationships Between Hydraulic Fracturing and Drinking Water Resources, March 2010 (PDF) (12 pp, 111K)

Related Information

- Main hydraulic fracturing page
- Questions and answers about this study
- Case study locations and selection criteria
- Quality Management and Quality Assurance Project Plans
- Hydraulic Fracturing: Drilling for Answers (EPA *Science Matters* newsletter, June 2010) - why EPA is studying hydraulic fracturing.
- Answering Questions about EPA's Plan to Study Hydraulic Fracturing (EPA *Science Matters* December 2011)-EPA scientist shares information about a recently released research plan.

Drinking water resources:

- Ground water and drinking water home page
- Frequent questions about ground water and drinking water
- Private drinking water wells
- Public drinking water systems

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