United States Environmental Protection Agency

Web Conference Summary of December 9, 2013 Technical Roundtable on EPA's Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources



January 28, 2014

EPA United States Environmental Protection Agency

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

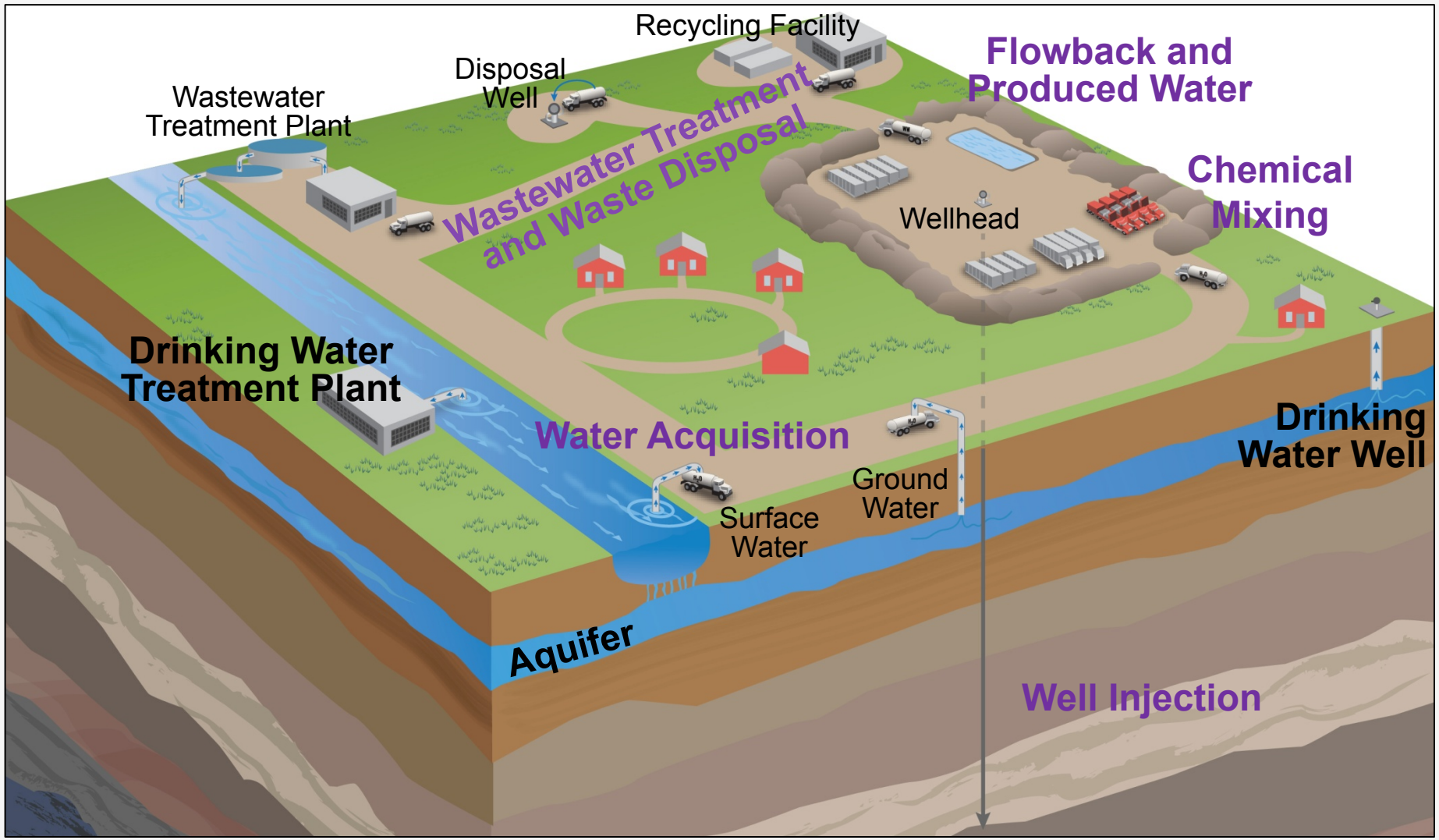
Study Goals:

- Asses whether hydraulic fracturing may impact drinking water resources
- Identify driving factors that may affect the severity and frequency of potential impacts

For more information:
http://www.epa.gov/hfstudy

EPA United States Environmental Protection Agency

Hydraulic Fracturing Water Cycle



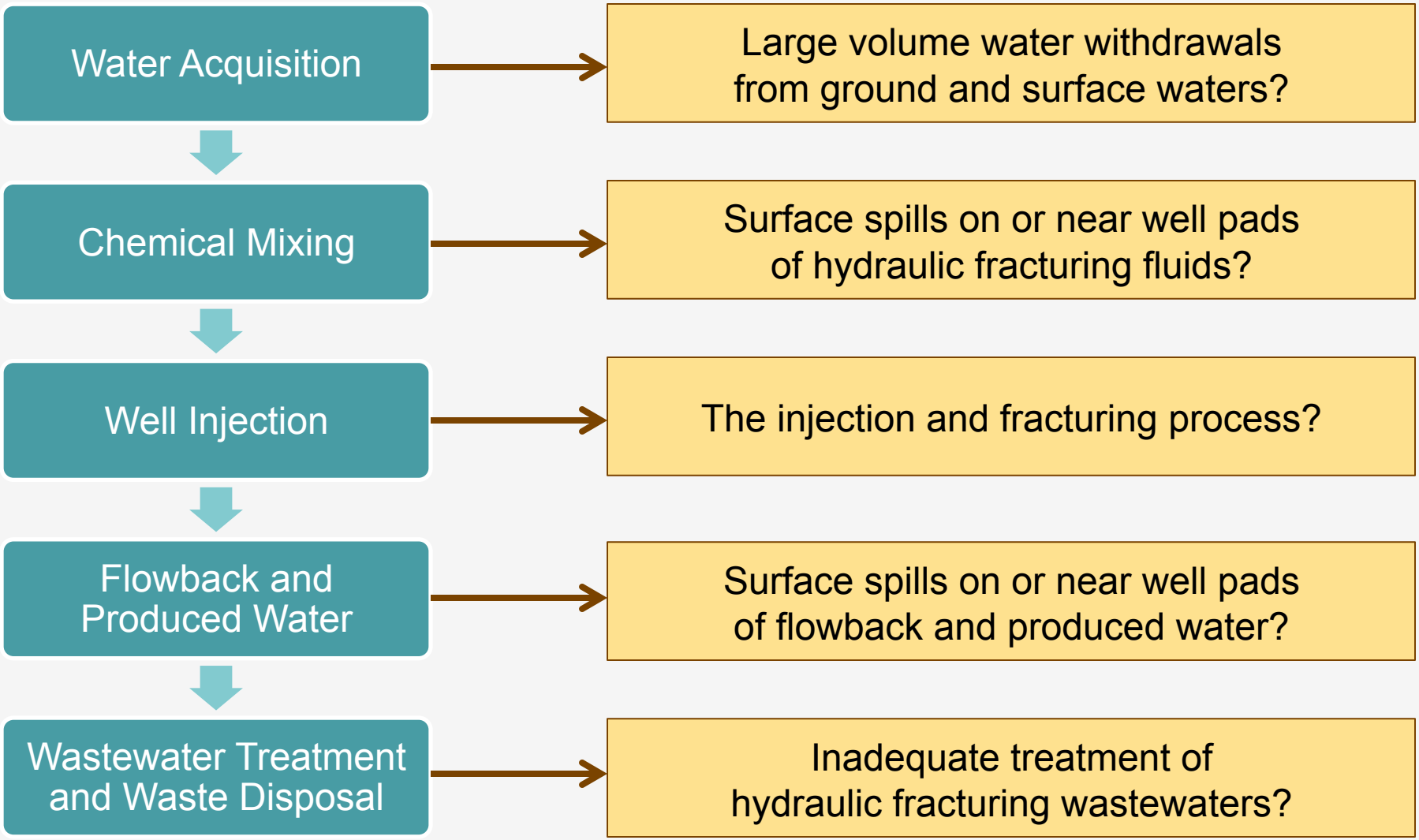
WATER CYCLE STAGES

Water Acquisition → Chemical Mixing → Well Injection →
Flowback and Produced Water → Wastewater Treatment and Waste Disposal

EPA United States Environmental Protection Agency

Primary Research Questions

What are the potential impacts on drinking water resources of:



Technical Meetings

EPA conducted a series of five technical roundtables and a series of in-depth technical workshops to address specific topics related to the study's research questions.

Technical Roundtables

- **Consult with technical representatives from key stakeholder groups**
  - Oil and gas industry, water industry, non-governmental organizations, state/local governments, tribes, academia
- **November 2012**
- **December 9, 2013**

Technical Workshops

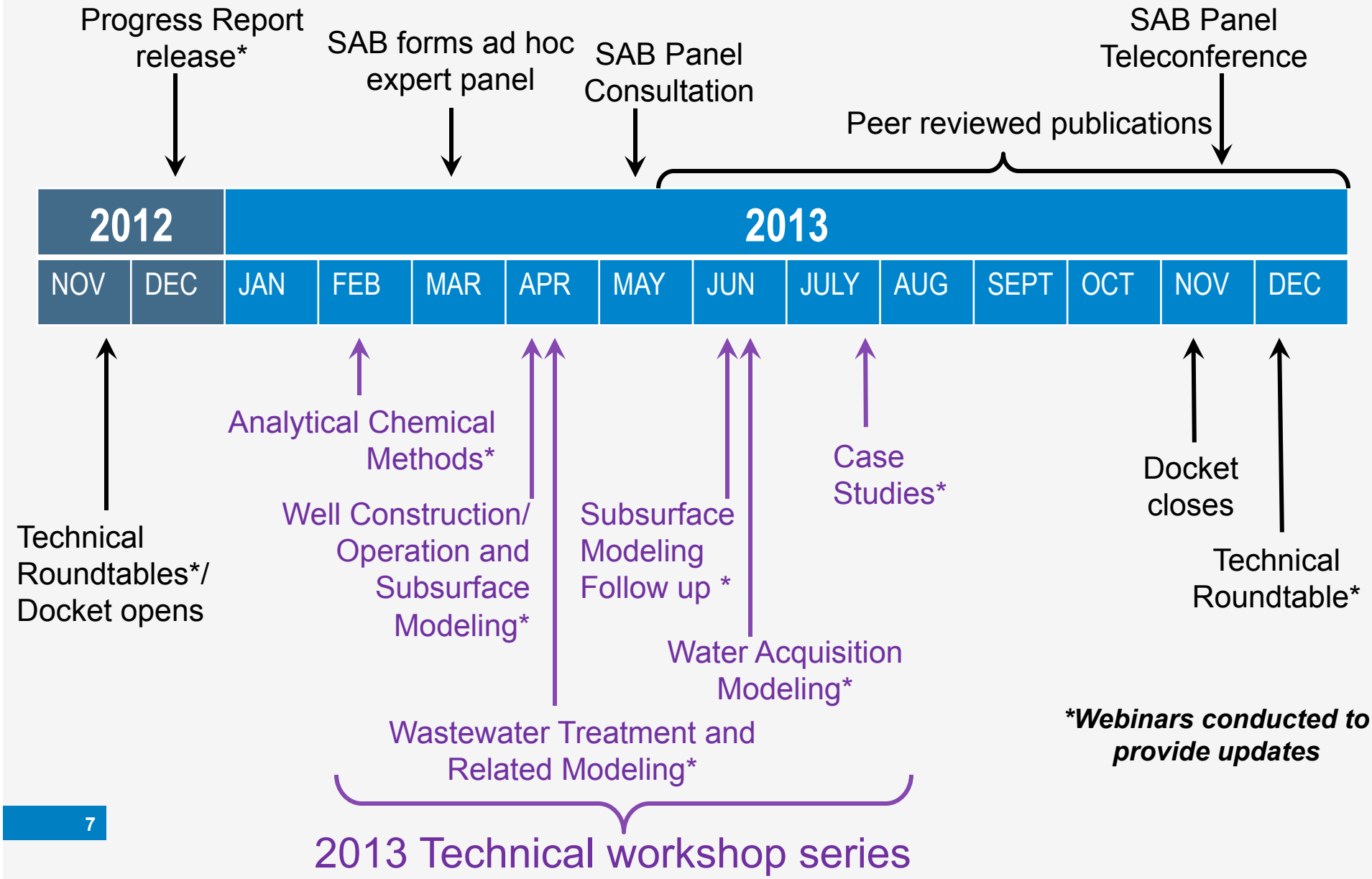
- **Engage with subject-matter experts on specific topics:**
  - Analytical chemistry methods *(Feb. 25)*
  - Well construction/operation and subsurface modeling *(Apr.16-17 / June.3)*
  - Wastewater treatment and related modeling *(Apr.18)*
  - Water acquisition modeling *(June.4)*
  - Case studies *(July.30)*
- **Winter/Spring/Summer 2013**

EPA United States Environmental Protection Agency

Roundtable Agenda

- Study update
- Panel Discussion of the 2013 Technical Workshop Series
- EPA's Hydraulic Fracturing Drinking Water Assessment Report
- Plans for a Federal Multiagency Collaboration on Unconventional Oil and Gas
- Stakeholder engagement

Study Update: A Year in Review



Webinars conducted to provide updates

EPA United States Environmental Protection Agency

Study Update: Research Projects and Products

17 research projects are expected to produce >30 peer reviewed journal papers or EPA reports

- Most will undergo an internal (EPA) and an external (journal or letter) peer review
- To date, 5 papers have been published in scientific journals
  - Subsurface migration modeling (3)
  - Analytical method development (2)

These products will be considered together with scientific literature in the draft assessment report

- Draft assessment report is a Highly Influential Scientific Assessment (HISA)

EPA United States Environmental Protection Agency

Study Update: Peer Reviewed Publications

Analytical method development:

- DeArmond, P. D. and DiGoregorio, A. L. 2013. Characterization of liquid chromatography-tandem mass spectrometry method for the determination of acrylamide in complex environmental samples. Analytical and Bioanalytical Chemistry 405 (12): 4159-66.
- DeArmond, P. D. and DiGoregorio, A. L. 2013. Rapid liquid chromatography-tandem mass spectrometry-based method for the analysis of alcohol ethoxylates and alkylphenol ethoxylates in environmental samples. Journal of Chromatography A 1305:154-63.

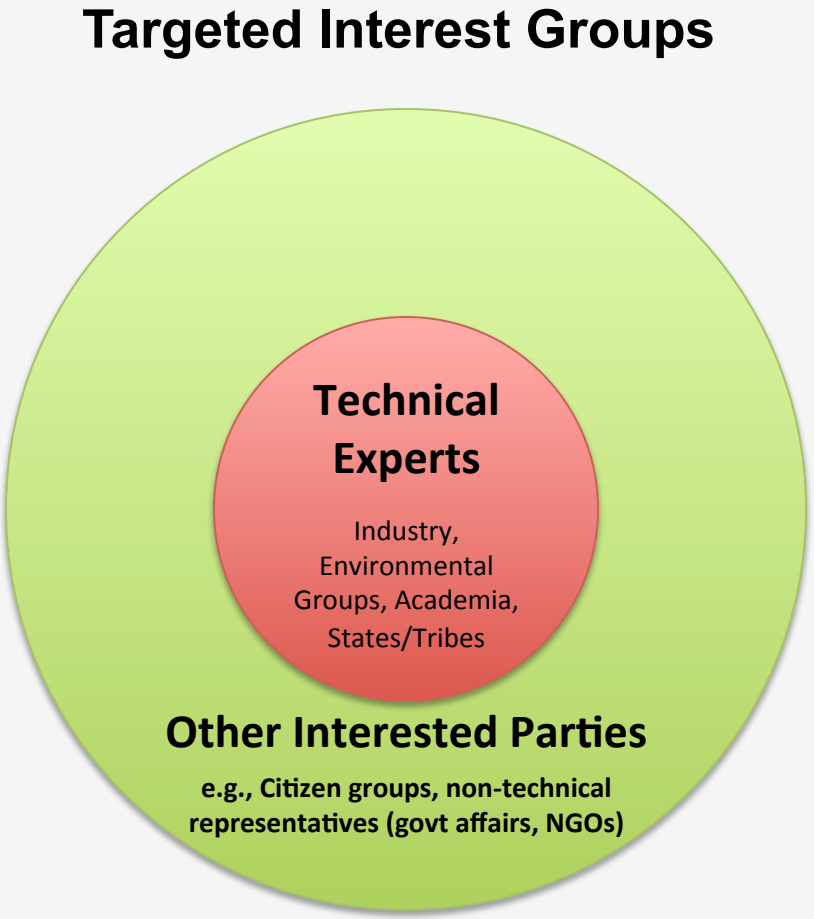
Subsurface migration modeling:

- Rutqvist, J., Rinaldo, A. P., Cappa, F., Moridis, G.J. 2013. Modeling of fault reactivation and induced seismicity during hydraulic fracturing of shale-gas reservoirs. Journal of Petroleum Science and Engineering 107: 31-44.
- Kim, J. and Moridis, G. J. 2013. Development of the T+M coupled flow–geomechanical simulator to describe fracture propagation and coupled flow–thermal–geomechanical processes in tight/shale gas systems. Computers and Geosciences 60: 184-198.
- Moridis, G. J. and Freeman, C. M. 2013. The RealGas and RealGasH2O Options of the TOUGH+ Code for the Simulation Of Coupled Fluid And Heat Flow in Tight/Shale Gas Systems. Computers and Geosciences. (Accepted/ currently in press. Manuscript available online)

Stakeholder Engagement: Purpose

1. Effective, meaningful two-way engagement with technical experts to inform and positively impact EPA's research study.

2. Engage broader stakeholder community to provide status updates on the study, report out on technical roundtables and workshops, and to seek information and data to inform the 2014 draft report.



EPA United States Environmental Protection Agency

Stakeholder Engagement: Key Objectives

- Increase technical engagement with stakeholder community to assure that EPA has ongoing access to a broad range of expertise and data outside the Agency
- Obtain timely and constructive feedback on data and analysis developed in the study
- Assure that EPA is current on changes in industry practices and technologies
- Improve public understanding of the goals and design of the study
- Provide useful information to stakeholders which can be used to reduce environmental and public health impacts of hydraulic fracturing

EPA United States Environmental Protection Agency

Stakeholder Involvement 2010-2013

- 2010 public meetings held in 4 states
- 2011 technical workshops to inform the research
- Webinar consultations with tribal governments and an in-person meeting with the Haudenosaunee Environmental Task Force in 2010
- 2012 Technical Roundtables | 2013 Technical Workshops
  - 213 individual attendees from 138 organizations, representative of 14 states
- Contacts in person and via phone/email to exchange data and information for research projects
- Responses to information requests through Federal Register Notice and Science Advisory Board reviews

EPA United States Environmental Protection Agency

Panel Discussion: 2013 Technical Workshop Series Summary

- Co-chairs of EPA's five 2013 Technical Workshops presented the questions addressed in each workshop as well as observations and suggestions from individual workshop participants.
- An overview of how each of the workshops informed the EPA study was also presented.

EPA United States Environmental Protection Agency

Panel Discussion: Analytical Methods Workshop

Topics covered:

- Baseline Information
- Sampling procedures
- Analytical chemical approaches
- Analyte selection and methods development
- Detection limits
- Advancements in industry practices
- Tracers and indicators
- Quality Assurance/Quality Control (QA/QC)

EPA United States Environmental Protection Agency

Panel Discussion: Well Construction/Operation and Subsurface Modeling

Topics covered:

- Current designs to prevent leaks in well casing and wellbore
- Adequate confinement of fluids
- Identification and documentation of ground water resources
- Testing for issues prior, during, and post hydraulic fracturing
- Testing and monitoring techniques to assure confinement
- Potential scenarios to be investigated
- Model complexity and approaches
- Well performance data

EPA United States Environmental Protection Agency

Panel Discussion: Wastewater Treatment and Related Modeling

Topics covered:

- Advances in wastewater reuse and recycling
- Flowback water treatment and reuse
- Wastewater treatment methods
- Point source discharges of treated wastewater
- Wastewater reuse and disposal priorities
- Aggregate impacts on watersheds

EPA United States Environmental Protection Agency

Panel Discussion: Water Acquisition Modeling

Topics covered:

- Modeling approaches and considerations
- Lifecycle implications
- Key attributes of a scientifically robust approach
- Sources of existing data and limitations

EPA United States Environmental Protection Agency

Panel Discussion: Case Studies

Topics covered:

- What data to collect or use in the assessment
- Statistical approaches
- Occurrence of ground water contamination
- Practical approaches for overcoming challenges

EPA United States Environmental Protection Agency

Panel Discussion: How workshops informed the study

- Analytical Chemical Methods:
  - Established collaborations with other laboratories to participate in analytical methods verification studies

- Well Construction and Operation:
  - In conducting the well file review and literature synthesis, EPA will consider points heard at the workshop as we move forward in our research, generally inclusive of:
    - Properties, behaviors, and effectiveness of cements
    - Annulus pressure and monitoring well condition
    - Characterization of older existing wells prior to hydraulic fracturing
    - Incorporated additional data on deep well injection from a joint Department of Energy and industry study in Colorado

EPA United States Environmental Protection Agency

Panel Discussion: How workshops informed the study

- Subsurface Modeling
  - Improved conceptual models with improved scenario modeling of well construction and geology
- Wastewater Treatment and Related Modeling
  - Added focus on wastewater treatment at commercial and package plants
  - Attendees assisted EPA in obtaining Texas and Wyoming spill data

EPA United States Environmental Protection Agency

Panel Discussion: How workshops informed the study

- Water Acquisition Modeling
  - Incorporated additional ground water models in conjunction with current tools and simulations
  - Addressed water availability and use at multiple spatial scales
  - Increased temporal resolution to address seasonal and low flow impacts
  - Represented different water management strategies based on regulatory constraints, and well operator practices

- Case Studies
  - Acknowledged importance of understanding site-specific geochemistry to understand sources of groundwater contamination
  - Requested underlying water quality data from Battelle's *Characterization Reports for Retrospective Case Study Areas*

EPA United States Environmental Protection Agency

Assessment Report: Sources of Information

- Scientific literature and reports, with an emphasis on peer-reviewed literature
- Government reports and technical papers
- Results from the agency's ongoing research activities
- Information submitted by stakeholders
  - Technical roundtables and workshops
  - EPA docket
  - Comments submitted to the Science Advisory Board

EPA United States Environmental Protection Agency

Assessment Report: Impacts Evaluated & Spatial Scope

- Impacts related to:
  - Normal operations reflecting modern typical practices
  - Potential and actual accidents or unintended events
  - Potential immediate, short-term, and long-term impacts
- National: Evaluating available information for multiple regions
- Evaluating potential impacts at multiple scales:
  - Single well
  - Cluster of wells
  - Watershed
  - Shale plays

EPA United States Environmental Protection Agency

Assessment Report: Intended Use

- Contribute to understanding of potential impacts of hydraulic fracturing on drinking water resources
- Identify pathways of greatest concern
- Inform and promote dialogue among federal, tribal, state, and local government entities, industry, non-governmental organizations (NGOs) and other stakeholders
- Identify knowledge gaps and information needs

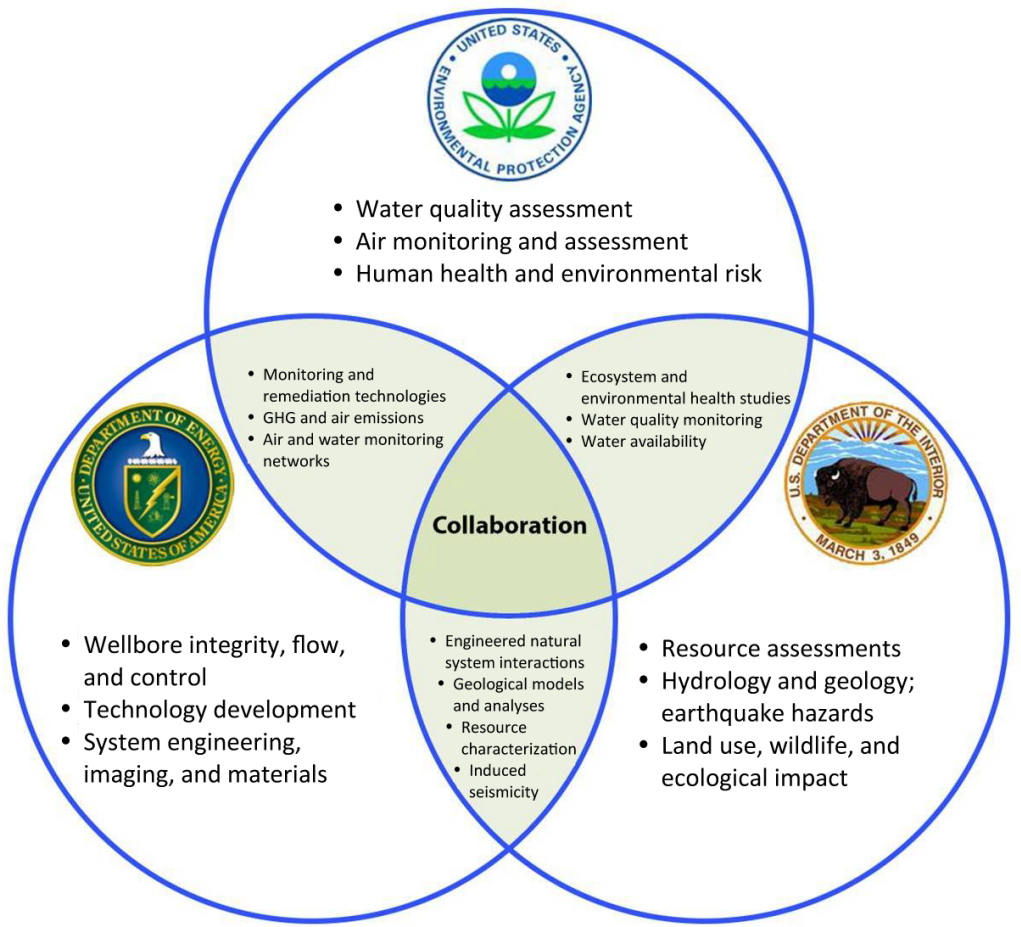
EPA United States Environmental Protection Agency

Assessment Report: Moving Forward

- Internal review prior to release
- Interagency review
- Review by the independent agency Science Advisory Board (SAB), including public review and comment
- Final assessment will reflect agency consideration of both public and SAB comments

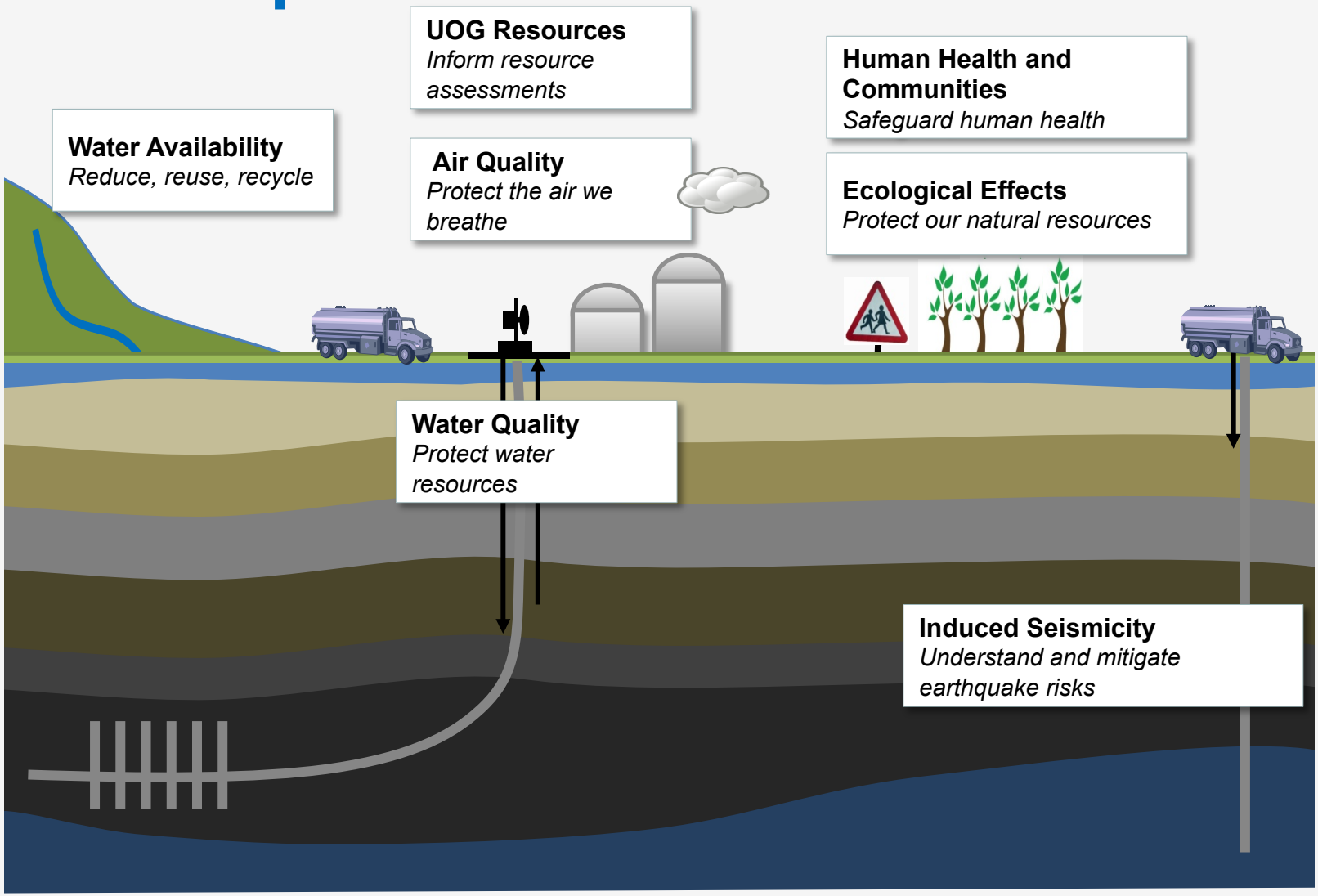
Federal Multiagency Collaboration on Unconventional Oil and Gas

- A multi-year effort by the U.S. Department of Energy (DOE), U.S. Department of Interior (DOI), and EPA, to ensure coordination and collaboration among the agencies and partners in developing timely, policy-relevant science and technology research that informs the design of policy options.
- Builds on the overlapping competencies of the three agencies to enhance collaborative efforts.



EPA United States Environmental Protection Agency

Multiagency: Research Strategy Topics



EPA United States Environmental Protection Agency

Multiagency: Goal and Policy Implications

The multiagency effort is…

- Outlining an approach to identify and address the highest research needs associated with safely and prudently developing Unconventional Oil & Gas (UOG) resources
- Providing the foundation for engaging stakeholders in identifying and prioritizing the challenges and benefits associated with UOG production activities
- Guiding the Agencies in designing and implementing future efforts, including the creation of more-detailed research plans to address priority topics

EPA United States Environmental Protection Agency

Next Steps

EPA will continue to conduct research, analyze information and literature, and engage stakeholders

- Completed research will undergo peer review
- Exchange information with industry, academia, states, NGOs, tribes, and public
  - Published papers to be posted on study website.
- Reconvene roundtable in 2014
- Update SAB panel on publications and research
- Release draft report in late 2014
  - The SAB Panel will peer review the draft report
  - The public will have an opportunity to provide written and oral comments

EPA United States Environmental Protection Agency

Additional Resources

- **EPA Hydraulic Fracturing Study Website**
  - http://www2.epa.gov/hfstudy
- **December 9, 2013 Technical Roundtable Materials**
  - http://www2.epa.gov/hfstudy/2013-technical-roundtable
- **Published Scientific Papers**
  - http://www2.epa.gov/hfstudy/published-scientific-papers