United States Environmental Protection Agency

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

PROGRESS REPORT

U.S. Environmental Protection Agency
Office of Research and Development

January 3-4, 2013



Webinar Outline

- Study background
- Progress report
- Stakeholder engagement
  - Technical Roundtables update
  - Next steps
- Questions?

Study Background

In its 2010 Appropriations Committee Conference Report, Congress urged EPA to study the relationship between hydraulic fracturing and drinking water, using:

- Best available science
- Independent sources of information
- Transparent, peer-reviewed process
- Consultation with others

Study Timeline

US Congress urges the EPA to conduct a study

Peer review of draft study plan*
(February – August 2011)

Release final study plan
(November 2011)

Release progress report*

Peer review of
draft report of results

Final report
of results

Planning | **Conduct Research** | **Report of Results**

Technical workshops
(February – March 2011)

Meetings with stakeholders to identify
concerns and study scope
(July – August 2010)

Technical roundtables*
(Summer 2013)

Technical workshops*
(Spring 2013)

Technical roundtables* / information request
(November 2012)

Webinars conducted to provide updates

United States Environmental Protection Agency

Purpose of the Study

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

Purpose of the Progress Report

- Demonstrate progress made on the EPA's *Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources*
  - Project-specific updates that include research approach, status and next steps

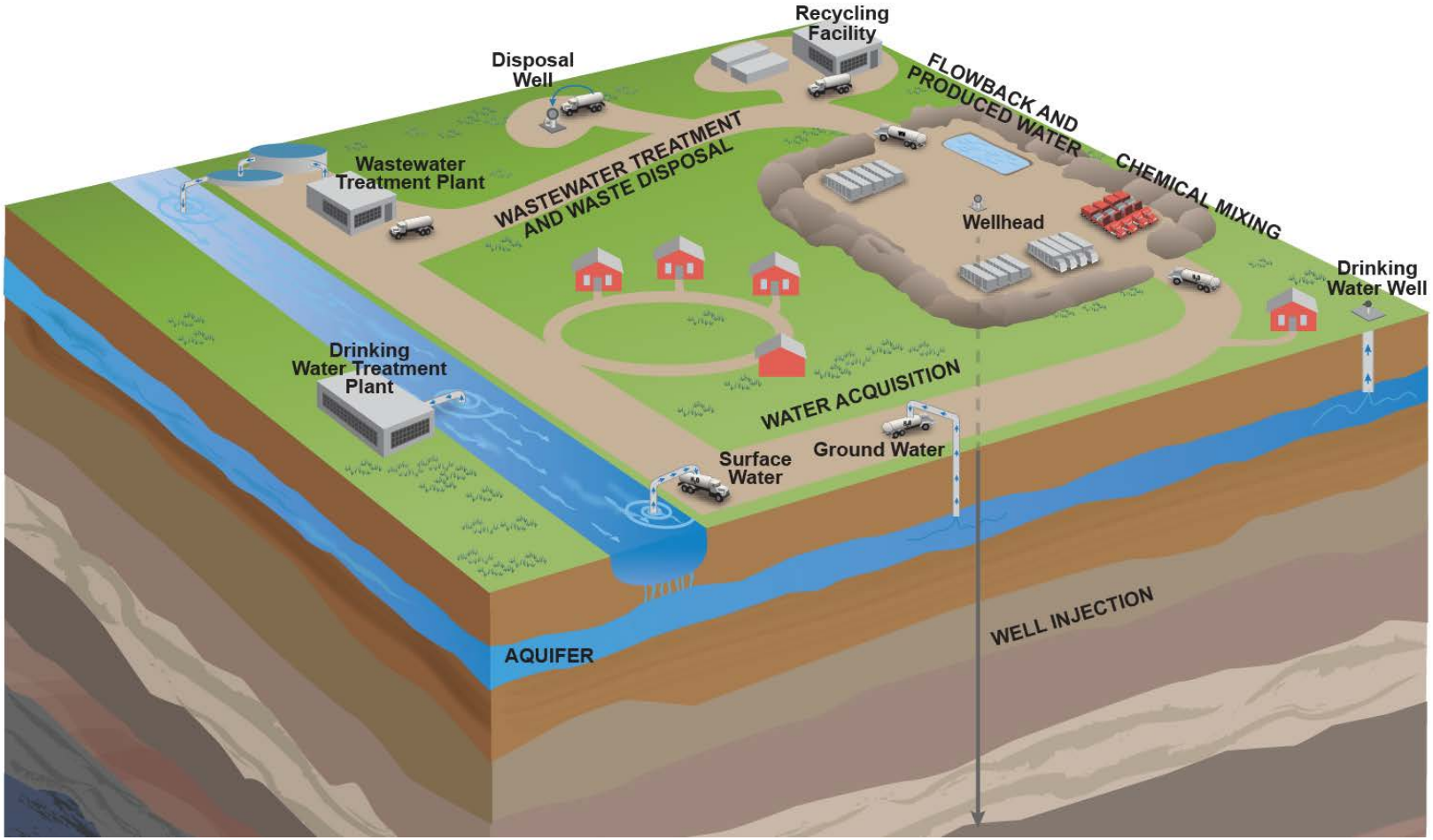
Progress Report

- **Chapter 1:** Introduction
- **Chapter 2:** Overview of the Research Study
- **Chapter 3:** Analysis of Existing Data
- **Chapter 4:** Scenario Evaluations
- **Chapter 5:** Laboratory Studies
- **Chapter 6:** Toxicity Assessment
- **Chapter 7:** Case Studies
- **Chapter 8:** Conducting High Quality Science
- **Chapter 9:** Research Progress Summary and Next Steps

- Appendix A: Chemicals Identified in Hydraulic Fracturing Fluids and Wastewater
- Appendix B: Stakeholder Engagement
- Appendix C: Summary of Quality Assurance Project Plans

Progress report is available at www.epa.gov/hfstudy

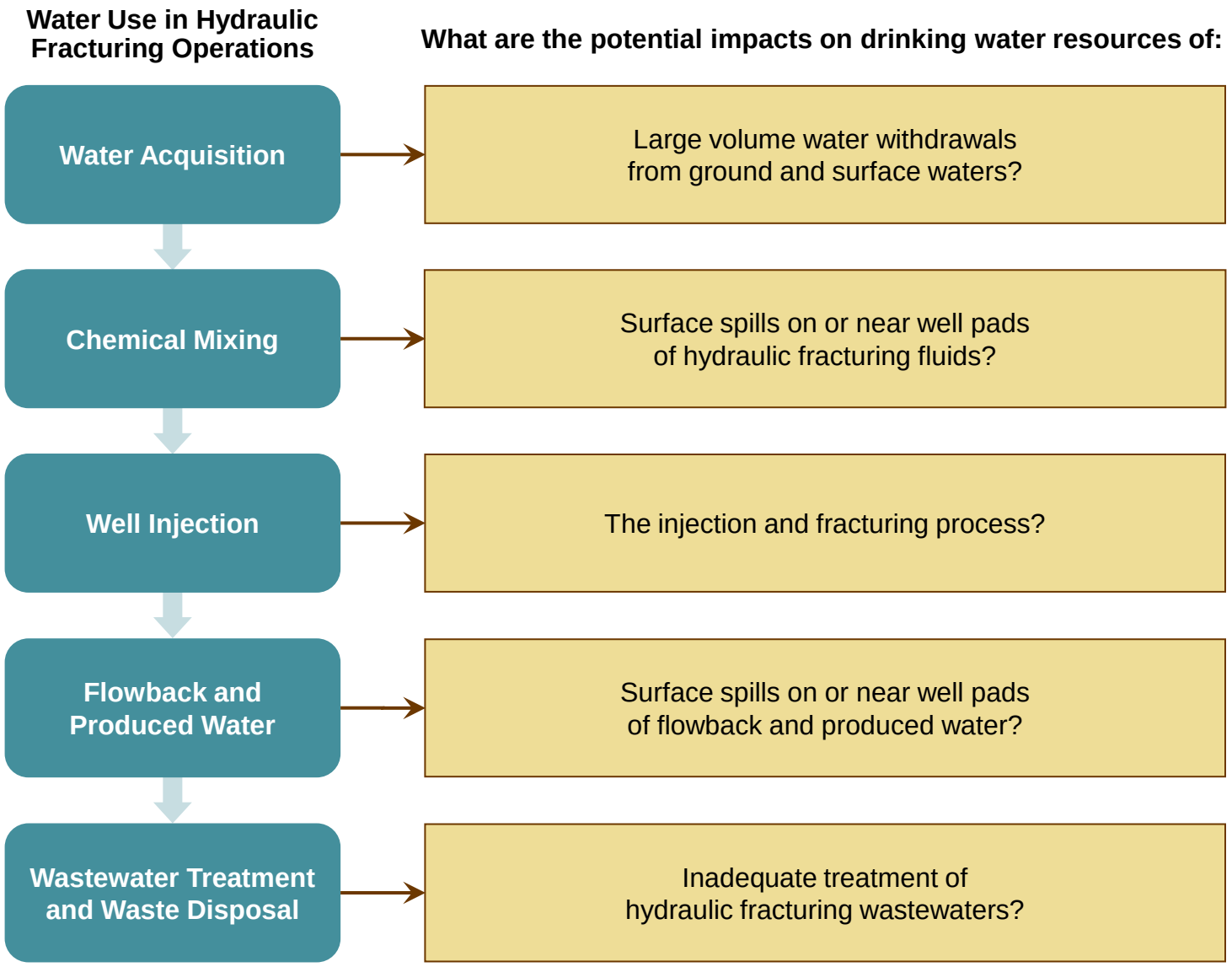
Research Overview



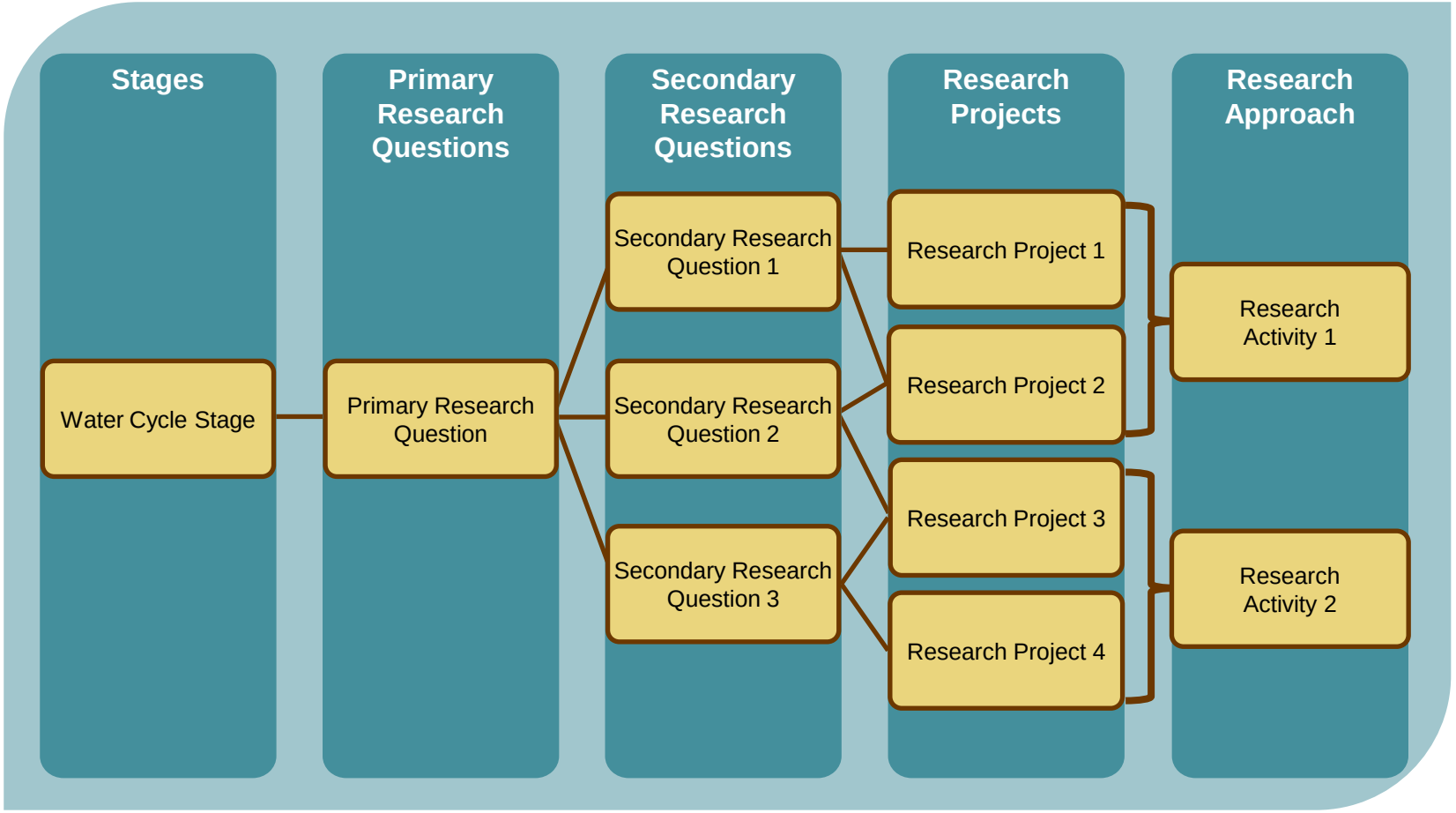
WATER CYCLE STAGES

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

Research Overview



Research Overview



WATER CYCLE STAGES

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

Analysis of Existing Data

Research Project	Description
Literature Review	Review and assessment of existing papers and reports, focusing on peer-reviewed literature
FracFocus Analysis	Analysis of data compiled from FracFocus, the national hydraulic fracturing chemical registry operated by the Ground Water Protection Council and the Interstate Oil and Gas Compact Commission
Spills Database Analysis	Analysis of selected federal and state databases for information on spills of hydraulic fracturing fluid and wastewater
Service Company Analysis	Analysis of information provided by nine hydraulic fracturing service companies in response to a September 2010 information request on hydraulic fracturing operations
Well File Review	Analysis of information provided by nine oil and gas operators in response to an August 2011 information request for 350 well files

RESEARCH PROGRESS

- Data sources have been identified for review and analysis, including:
  - Over 12,000 well records entered into FracFocus
  - State spill databases from Colorado, New Mexico and Pennsylvania
  - National Response Center spill database
  - Information provided by 9 hydraulic fracturing service companies
  - Well files supplied by 9 oil and gas operators
- Literature review is ongoing

Scenario Evaluations

Research Project	Description
Water Availability Modeling	Assessment and modeling of current and future water use scenarios in the Upper Colorado River Basin and the Susquehanna River Basin
Subsurface Migration Modeling	Numerical modeling of subsurface fluid migration scenarios that explore the potential for gases and fluids to move from the fractured zone to drinking water aquifers
Surface Water Modeling	Modeling of concentrations of selected chemicals at public water supplies downstream from wastewater treatment facilities discharging treated hydraulic fracturing wastewater

RESEARCH PROGRESS

- Computer models have been identified, including TOUGH+, HSPF, SWAT
- Scenarios have been constructed:
  - Future water use scenarios, including business-as-usual, full development and “green” technologies
  - Fluid and gas migration due to faulty well construction, nearby wells, existing faults and fractures
  - General surface water discharge scenarios based on data from wastewater treatment facilities in Pennsylvania
- Models are being run
- Sensitivity analyses will be conducted

Laboratory Studies

Research Project	Description
Analytical Method Development	Adapting analytical methods for selected chemicals found in hydraulic fracturing fluids or wastewater
Source Apportionment Studies	Development of a method to identify the potential source(s) of surface water contamination
Wastewater Treatability Studies	Assessment of the efficacy of common wastewater treatment processes on removing selected chemicals found in hydraulic fracturing wastewater
Br-DBP Precursor Studies	Assessment of the ability of chemicals found in hydraulic fracturing wastewater to form brominated disinfection byproducts (Br-DBPs) during drinking water treatment processes

RESEARCH PROGRESS

- Analytical methods are being adapted and tested for several classes of chemicals, including:
  - Glycols, acrylamide, ethoxylated alcohols, radionuclides, inorganic chemicals
- Samples of surface water, raw hydraulic fracturing wastewater and treated effluent have been collected and are undergoing laboratory analyses
- Wastewater treatability experiments are being designed
- Studies assessing the ability of hydraulic fracturing wastewater to create Br-DBPs are underway

Toxicity Assessment

For hydraulic fracturing fluids and wastewater:

1. Identify chemicals in injected fluid and wastewater
   - Sources include: service company data, well files, FracFocus, state and federal reports
   - Identify chemical name, CASRN, chemical structure
2. Compile information on chemical, physical and toxicological properties
   - Chemical and physical properties from LeadScope, EPISuite, QikProp
   - Toxicological properties from federal and state databases (e.g., IRIS, State of California Toxicity Criteria Database)
3. Estimate properties for chemicals with known structures, but unknown properties, using quantitative structure activity relationships

RESEARCH PROGRESS

- Over 1,000 unique chemical substances identified
  - Chemicals are included in Appendix A of the progress report
- Chemical structures are available for roughly 750 chemicals
  - Some properties have been obtained for over 300 chemical structures

Case Studies

Retrospective Case Studies	Investigation of potential drinking water impacts from…
Las Animas and Huerfano Counties, Colorado	Coalbed methane extraction in the Raton Basin
Dunn County, North Dakota	A well blowout during hydraulic fracturing for oil in the Bakken Shale
Bradford County, Pennsylvania	Shale gas development in the Marcellus Shale
Washington County, Pennsylvania	Shale gas development in the Marcellus Shale
Wise County, Texas	Shale gas development in the Barnett Shale

RESEARCH PROGRESS

- Two rounds of samples have been collected and analyzed
- Additional sampling is ongoing
- The EPA continues to work with industry partners to design and initiate prospective case studies

Conducting High Quality Science

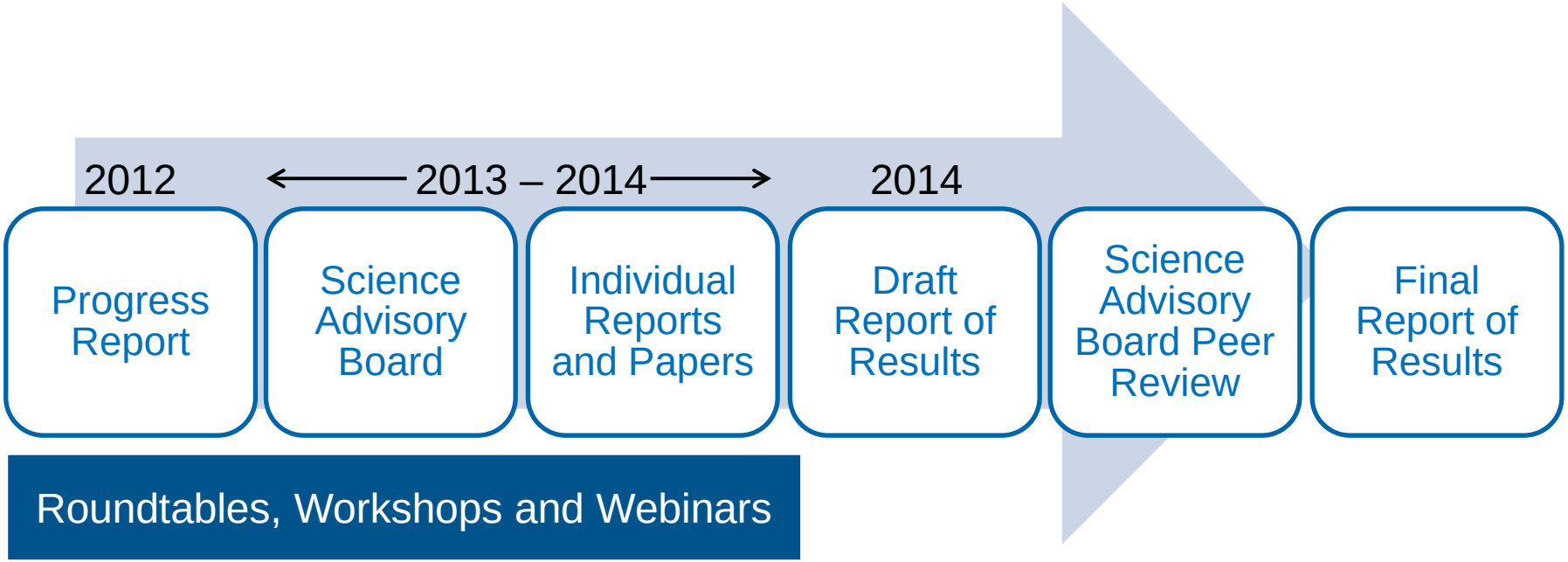
QUALITY ASSURANCE

- Quality Management Plan defines the QA-related policies, procedures, roles and responsibilities for the study
- Quality Assurance Project Plans document the planning, implementation and assessment procedures for individual research projects
  - Available at www.epa.gov/hfstudy

PEER REVIEW

- Products for individual research projects will undergo external peer review through scientific journals, letter reviews or *ad hoc* panels
- Report of results has been classified as a Highly Influential Scientific Assessment
  - Peer review will be conducted by the EPA's Science Advisory Board

Research Progress Summary and Next Steps



Report of results will include a synthesis of available results from the research projects described in the progress report

Technical Stakeholder Engagement for EPA's *Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources*

FEDERAL REEGISTER NOTICE to Request Data from the Public to Inform Ongoing Research
November 9, 2012

Technical Roundtables

November 14

- Water Acquisition
- Chemical Mixing

November 15

- Well Injection
- Flowback & Produced Water

November 16

- Wastewater Treatment & Waste Disposal

Release of 2012 Progress Report

Webinar

Technical Workshops

Discuss specific technical topics identified by Roundtables.

February 25, 2013

Analytical Chemical Methods Workshop

April 2013 (est.)

Well Construction / Operation and Subsurface Modeling

Wastewater Treatment and Modeling

June 2013 (est.)

Water Acquisition

Case Studies

SAB Meeting

Public face-to-face meeting of the SAB ad hoc Hydraulic Fracturing Advisory Panel. EPA will brief the SAB regarding the 2012 progress report.

March 2013

Technical Roundtables

Reconvene in Summer 2013 to provide continuity of stakeholder input.

Present and discuss EPA's scientific research approach and progress.

Report of Results

Peer Review Ongoing

Technical Roundtables

PURPOSE

- EPA presented more detailed information on research underway
  - One roundtable for each stage of the hydraulic fracturing water cycle
- Allow participants to nominate topics for technical workshops
- Seek a broad and balanced range of data and expertise from stakeholders
  - Participants from the oil and gas industry, water industry, non-governmental organizations, local and state agencies, tribes and the academic community

Number of Participants: November 14-16, 2012

Stakeholder Group	Participants	Observers
Oil and gas industry	23	2
Water industry	8	1
Non-governmental organizations	9	5
State/local governments	16	3
Tribes	1	1
Total	57	12

Technical Roundtables

- **Water Acquisition:** water availability and use; modeling; sources of water for hydraulic fracturing operations; potential impacts on water systems; recycling flowback waters
- **Chemical Mixing:** analytical methods; trends in use of chemicals; indicator compounds; lifecycle assessment
- **Well Injection:** well construction/operation; modeling assumptions, parameters and uncertainty
- **Flowback and Produced Water:** spills database analysis; retrospective case studies; information on state databases available in Texas, Wyoming and Alabama; monitoring strategies for indicator compounds
- **Wastewater Treatment and Waste Disposal:** wastewater treatability studies; residuals; validation of optimized methods for DBP studies; regional differences in wastewater practices; radioactive constituents; reused and reinjected wastewater

Materials from the Technical Roundtables are available at http://epa.gov/hfstudy/techwork13.html

Technical Workshops

Technical Workshop Topics and Dates	
Topic	**Date**
Analytical Chemical Methods	February 25, 2013
Well Construction/Operation and Subsurface Modeling	April 2013 (est.)
Wastewater Treatment and Modeling	April 2013 (est.)
Water Acquisition Modeling	June 2013 (est.)
Case Studies	June 2013 (est.)

IDENTIFYING TECHNICAL WORKSHOPS PARTICIPANTS

- Nomination for Technical Workshop on Analytical Chemical Methods closes on January 8, 2013
- Subject matter experts: submit resume and short abstract to participate
- Registration for remaining workshops will open in January

See www.epa.gov/hfstudy for application information

Other Stakeholder Activities

WEBINARS

- After technical workshops and roundtables in Summer 2013

INFORMATION REQUEST

- Federal Register Notice requesting relevant studies and data, particularly peer-reviewed studies (November 9, 2012)
  - Available at https://federalregister.gov/a/2012-27452
  - To submit information:
    - Follow the instructions at http://www.regulations.gov and identify your submission with Docket ID No. EPA-HQ-ORD-2010-0674
    - Or email ord.docket@epa.gov, Attention Docket ID No. EPA-HQ-ORD-2010-0674

WEBSITE

- Study updates are available at www.epa.gov/hfstudy
- Sign up for email updates

EPA United States Environmental Protection Agency

Questions?

See the website for more information: www.epa.gov/hfstudy