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Inside This Issue…

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How BIG Was this Election for the Energy Sector? In a word, it was ….HUGE!

After months of trailing in the polls and being written off by the national media, Donald Trump notched one of the most surprising and potentially impactful electoral victories in modern American politics. President-elect Trump lost the popular vote, but secured the necessary votes in the Electoral College to win. En route to his victory, he won rural areas by as three-to-one margin, received 50 percent of the union vote, and had stronger support from the African American and Hispanic communities than either John McCain or Mitt Romney in prior elections. For years, analysts will dissect how the pollsters got this so wrong and the exact movements within the country that allowed this election to occur. But for folks in the energy industry, it is enough to say that it happened, and it is a very good thing.

From an energy policy perspective, the Trump election brings an unprecedented opportunity for energy producers. Throughout the election, President-elect Trump repeatedly spoke of alleviating regulatory burdens and unlocking America's energy resources. Efforts to expand energy development in the United States, streamline permitting, and halt intrusive rules and regulations could allow U.S. energy development on both private and federal lands. Additionally, accelerated approvals of energy export projects could provide new and expanded markets for domestic producers even while global commodity prices remain low.

Regulatory relief

From the campaign, it is clear that regulatory relief is coming. The speed of that relief may be uneven within the various departments and agencies as the new administration encounters entrenched bureaucracies. However, the President-elect Trump transition team began an effort a few months ago identifying regulatory actions, executive orders, and modifications to rules that can be made in short order to provide regulatory relief as quickly as possible when the new administration takes office in January.

Prior to the election, the Trump campaign provided few details of the regulations he would target, saying only that he would freeze all regulatory action when he takes office, appoint strong, talented people to the agencies, and conduct a comprehensive review of the most costly and ineffective regulation. Based on other comments on the campaign trail, some regulatory actions President-elect Trump is expected to address include:

- Repeal of the Clean Power Plan;
- Repeal of the Waters of the United States Rule;
- Suspension and repeal of the Environmental Protection Agency (EPA) Methane Rules;
- Approval of the Keystone XL Pipeline;
- Approval of the Dakota Access Pipeline; and,
- Lifting the moratorium on coal leasing on federal lands.

One very important regulatory shift involves climate change. For the last few years, nearly all energy and environmental policy has been viewed through a lens of climate change and the impact of fossil fuels on the planet. The Trump Administration is expected to look at the same issues through a prism of jobs and economic opportunity, allowing a fundamental recalibration in how regulations are evaluated.
Additionally, the election virtually guarantees a conservative make-up of the Supreme Court well into the future. This outcome from the election will prove the key to restraining over-zealous regulators in the future. The make-up of the Supreme Court could in fact be the most impactful outcome of this election.

Regulatory reform

Congressional leaders and President-elect Trump have both expressed support for regulatory reform. Currently, where opportunities exist to use statutes and regulatory processes to stall or reject energy development, anti-development groups take advantage of them. Through executive actions and legislation, we expect to see a refining of these processes to limit future abuses. These efforts will be pursued under the banner of greater efficiency and government reform.

A few examples of where modifications could occur are:

- Legal reforms to address and curtail "sue and settle" activities;
- Federal Energy Regulatory Commission (FERC) reforms to ensure timely review of project applications;
- National Environmental Policy Act (NEPA) reforms to clearly define and limit the number and scope of required reviews;
- EPA reforms to clarify scientific basis of claims during rulemaking procedures;
- Endangered Species Act (ESA) reforms to clarify listing procedures and disincentive excessive listing applications; and,
- Clear guidance on cost benefit analysis used to evaluate proposed rules.

Congress

On the congressional front, House Republicans maintained their majority with few losses, and the leadership team is expected to stay largely unchanged. Speaker Ryan (R-Wisc.) intends to pursue a legislative agenda focused on tax and regulatory reforms. While massive tax reform has not occurred in 30 years, the environment appears favorable. The challenge for Republicans in the House will be to deliver what they promised without overreaching.

Senate Republicans also managed to hold on to the majority. While it still takes 60 votes to do business in the Senate, the make-up of the chamber may allow progress as the midterm election map favors the Republicans. Democrats have to defend 25 seats of the 33 Senate races in 2018. Ten of these are in states won by Trump, and there are a handful of others legitimately in play. On the other side, there is only one Republican running for re-election in a state carried by Hillary Clinton. Energy, infrastructure, and regulatory reform offer opportunities for bipartisan progress in the 115th Congress.

In the states

Extreme environmental organizations and anti-development groups immediately issued statements following the election urging increased opposition and activity in the states, calling the election a "national tragedy." These calls for greater funding and use of civil disobedience focused in states and local communities represent a significant shift of resources and tactics to the states, which is a trend energy producers need to understand and prepare to aggressively address.

Make America great again

The slogan worked, and Donald Trump was sworn in as the new President of the United States. During the rallies leading up to his election, the same song and refrain from the Rolling Stones was played:

"You can't always get what you want
But if you try sometimes, you just might find
You get what you need"

This election creates incredible opportunities for the American energy sector. Now, we just have to make sure we get what we need.

Hydraulic Fracturing Drinking Water Assessment

Wastewater Management and Waste Disposal

Hydraulic fracturing generates large volumes of produced water that require management. In this section we refer to produced water and any other waters generated onsite by the single term “wastewater”. In 2007, approximately one million active oil and gas wells in the United States generated 2.4 billion gal per day (9.1 billion L per day) of wastewater. There is currently no reliable way to estimate what fraction of this total volume can be attributed to hydraulically fractured wells. Wastewater volumes in a region can increase sharply as hydraulic fracturing activity increases.

Wastewater management and disposal could affect drinking water resources through multiple mechanisms, including: inadequate treatment of wastewater prior to discharge to a receiving water, accidental releases during transport or leakage from wastewater storage pits, unpermitted discharges, migration of constituents in wastewaters following land application, inappropriate management of residual materials from treatment, or accumulation of wastewater constituents in sediments near outfalls of centralized water treatment facilities (CWTs) or publicly owned treatment works (POTWs) that have treated hydraulic fracturing wastewater. The scope of this assessment excludes potential impacts to drinking water from the disposal of hydraulic fracturing wastewater in underground injection control (UIC) wells.

Research Questions: Wastewater Management and Waste Disposal

What are the common treatment and disposal methods for hydraulic fracturing wastewater, and where are these methods practiced?

Hydraulic fracturing wastewater is managed using several options, including: disposal in UIC wells (also called disposal wells); through evaporation ponds; treatment at CWTs, followed by reuse or by discharge to either surface waters or POTWs; reuse with minimal or no treatment; and land application or road spreading. Treatment of hydraulic fracturing wastewater by POTWs was used in the past in Pennsylvania. This decreased sharply following a request by the Pennsylvania Department of Environmental Protection (PA DEP) for well operators to stop sending Marcellus Shale wastewater to POTWs (and 15 CWTs) discharging to surface waters.

Wastewater management decisions are generally based on the availability and associated costs (including transportation) of disposal or treatment facilities. A survey of state agencies found that, in 2007, more than 98% of produced water from the oil and gas industry was managed via underground injection. Available information suggests that disposal wells are also the primary management practice for hydraulic fracturing wastewater in most regions in the United States. The Marcellus Shale region is a notable exception, where most wastewater is reused because of the small number of disposal wells in Pennsylvania. Although this assessment does not address potential effects on drinking water resources from the use of disposal wells, any changes in cost of disposal or availability of disposal wells would likely influence wastewater management decisions.

Wastewater from some hydraulic fracturing operations is sent to CWTs, which may discharge treated wastewater to surface waters, POTWs, or back to well operators for reuse in other hydraulic fracturing operations. Available data indicate that the use of CWTs for treating hydraulic fracturing wastewater is greater in the Marcellus Shale region than other parts of the country. Most of the CWTs accepting hydraulic fracturing wastewater in Pennsylvania cannot significantly reduce TDS, and many of these facilities provide treated wastewater to well operators for reuse and do not currently discharge treated wastewater to surface water.

Reuse of wastewater for subsequent hydraulic fracturing operations may require no treatment, minimal treatment, or more extensive treatment. Operators reuse a substantial amount (70-90%) of Marcellus Shale wastewater in Pennsylvania. Lesser amounts of reuse occur in other areas. In certain formations, such as the Bakken Shale in North Dakota, there is currently no indication of appreciable reuse.

In some cases, wastewater is used for land applications such as irrigation or road spreading for deicing or dust suppression. Land application has the potential to introduce wastewater constituents into surface water and ground water due to runoff and migration of brines. Studies of road spreading of conventional oil and gas brine have found elevated levels of metals in soils and chloride in ground water.

How effective are conventional POTWs and commercial treatment systems in removing organic and inorganic contaminants of concern in hydraulic fracturing wastewater?

Publicly owned treatment works using basic treatment processes are not designed to effectively reduce TDS concentrations in highly saline hydraulic fracturing wastewater - although specific constituents or constituents groups can be removed (e.g., metals, oil, and grease by chemical precipitation or other processes). In some cases, wastewater treated at CWTs may be sent to a POTW for additional treatment and discharge. It is blended with POTW influent to prevent detrimental effects on biological processes in the POTW that aid in the treatment of wastewater.

Centralized waste treatment facilities with advanced wastewater treatment options such as reverse osmosis, thermal distillation, or mechanical vapor recompression, reduce TDS concentrations and can treat contaminants currently known to be in hydraulic fracturing wastewater. However, there are limited data on the composition of hydraulic fracturing wastewater, particularly for organic constituents. It is unknown whether advanced treatment systems are effective at removing constituents that are generally not tested for.

What are the potential impacts from surface water disposal of treated hydraulic fracturing wastewater on drinking water treatment facilities?

Potential impacts to drinking water resources may occur if hydraulic fracturing wastewater is inadequately treated and discharges to surface water. Inadequately treated hydraulic fracturing wastewater may increase concentrations of TDS, bromide, chloride, and iodide in receiving waters. In particular, bromide and iodide are precursors of disinfection byproducts (DBPs) that can form in the presence of organic carbon in drinking water treatment plants or wastewater treatment plants. Drinking water treatment plants are required to monitor for certain types of DBPs, because some are toxic and can cause cancer.

Radionuclides can also be found in inadequately treated hydraulic fracturing wastewater from certain shales, such as the Marcellus. A recent study found elevated radium concentrations in the tens to thousands of picocuries per liter and gross alpha and gross beta in the hundreds to thousands of picocuries per liter in effluent samples from some CWTs receiving oil and gas wastewater. Radium, gross alpha, and gross beta were also detected in effluents from POTWs receiving oil and gas wastewater (mainly as effluent from CWTs), though at lower concentrations than from the CWTs.

Continued on page 3.

Hydraulic Fracturing Drinking Water Assessment

Continued from page 2.

Research in Pennsylvania also indicates the accumulation of radium in sediments and soils affected by the outfalls of some treatment plants that have handled oil and gas wastewater, including Marcellus Shale wastewater, and other wastewaters.

Mobilization of radium from sediments and potential impacts on downstream water quality depend upon how strongly the radium has sorbed to sediments. Impacts may also occur if sediment is resuspended (e.g., following storm events). There is no evidence of radionuclide contamination in drinking water intakes due to inadequately treated hydraulic fracturing wastewater.

Hydraulic fracturing wastewaters contain other constituents such as barium, boron, and heavy metals. Barium in particular has been documented in some shale gas produced waters. Little data exist on metal and organic compound concentrations in untreated and treated wastewaters in order to evaluate whether treatment is effective, and whether there are potential downstream effects on drinking water resources when wastewater is treated and discharged.

Conclusions

Through this national-level assessment, we have identified potential mechanisms by which hydraulic fracturing could affect drinking water resources. Above ground mechanisms can affect surface and ground water resources and include water withdrawals at times or in locations of low water availability, spills of hydraulic fracturing fluid and chemicals or produced water, and inadequate treatment and discharge of hydraulic fracturing wastewater. Below ground mechanisms include movement of liquids and gases via the production well into underground drinking water resources and movement of liquids and gases from the fracture zone to these resources via pathways in subsurface rock formations.

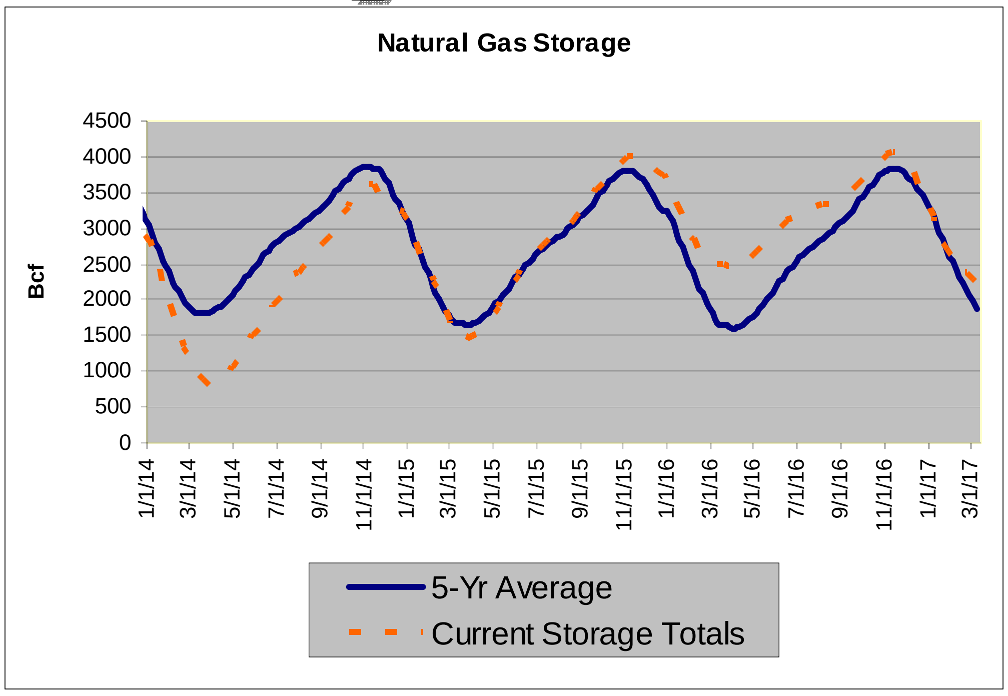
We did not find evidence that these mechanisms have lead to widespread, systemic impacts on drinking water resources in the United States. Of the potential mechanisms identified in this report, we found specific instances where one or more of these mechanisms led to impacts on drinking water resources, including contamination of drinking water wells. The cases occurred during both routine activities and accidents and have resulted in impacts to surface or ground water. Spills of hydraulic fracturing fluid and produced water in certain cases have reached drinking water resources, both surface and ground water. Discharge of treated hydraulic fracturing wastewater has increased contaminant concentrations in receiving surface waters. Below ground movement of fluids, including gas, most likely via the production well, have contaminated drinking water resources. In some cases, hydraulic fracturing fluids have also been directly injected into drinking water resources, as defined in this assessment, to produce oil or gas that co-exists in those formations.

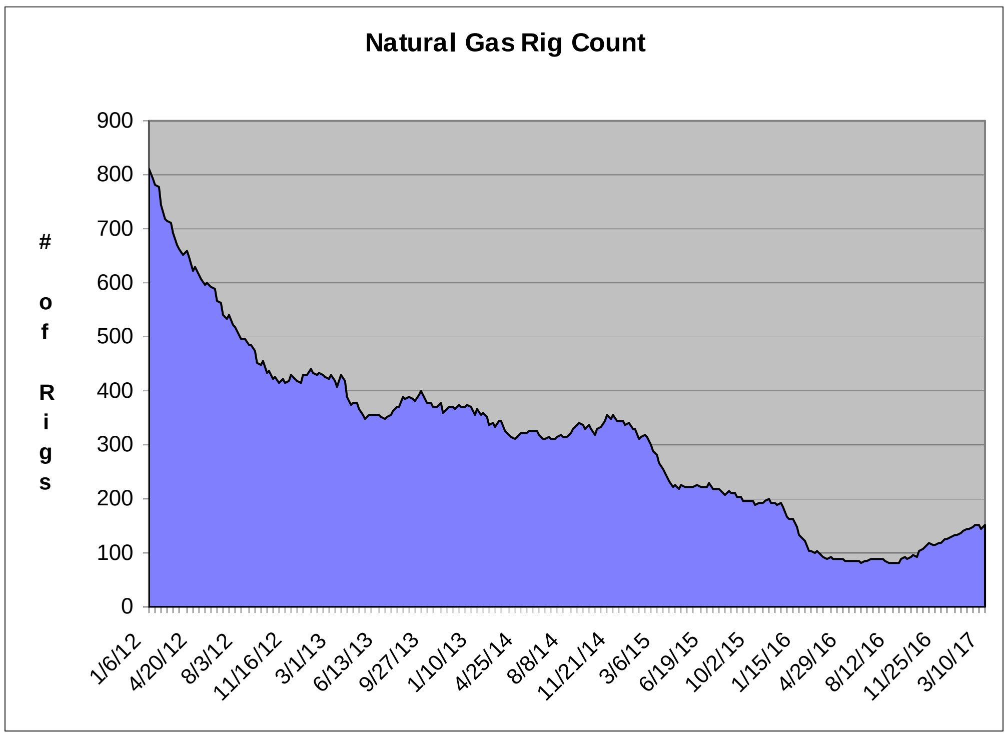
The number of identified cases where drinking water resources were impacted are small relative to the number of hydraulically fractured wells. This could reflect a rarity of effects on drinking water resources, or may be an underestimate as a result of several factors. There is insufficient pre-and post-hydraulic fracturing data on the quality of drinking water resources. This inhibits a determination of the frequency of impacts. Other limiting factors include the presence of other causes of contamination, the short duration of existing studies, and inaccessible information related to hydraulic fracturing activities.

This state-of-the-science assessment contributes to the understanding of the potential impacts of hydraulic fracturing on drinking water resources and the factors that may influence those impacts. The findings in this assessment can be used by federal, state, tribal and local officials; industry; and the public to better understand and address any vulnerabilities of drinking water resources to hydraulic fracturing activities. This assessment can also be used to help facilitate and inform dialogue among interested stakeholders, and support future efforts, including: providing context to site-specific exposure or risk assessments, local and regional public health assessments, and assessments of cumulative impacts of hydraulic fracturing on drinking water resources over time or over defined geographic areas of interest. Finally, and most importantly, this assessment advances the scientific basis for decisions by federal, state, tribal, and local officials, industry, and the public, on how best to protect drinking water resources now and in the future.

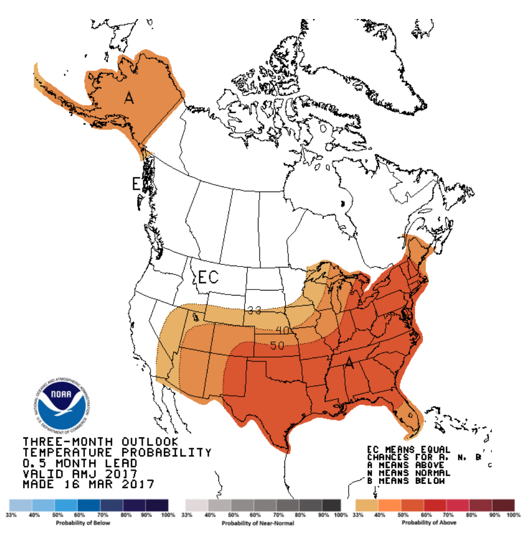
Follow-up article on page 4.

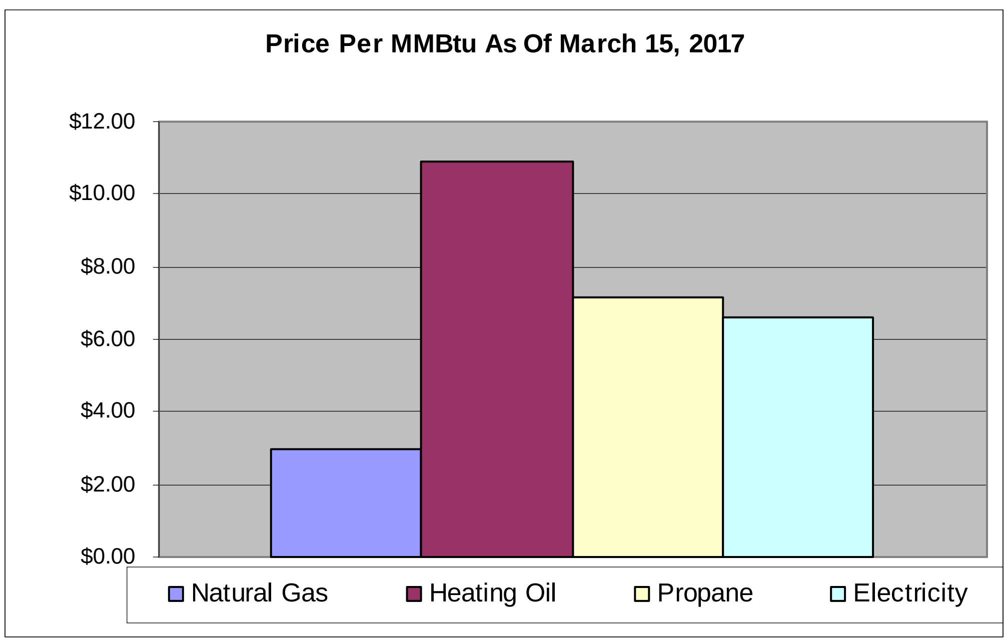
Snapshots





Seasonal Temperature Outlook
April – May – June





UPDATE: Impacts from the Hydraulic Fracturing Water Cycle on Drinking Water Resources in the United States.

Executive Summary

People rely on clean and plentiful water resources to meet their basic needs, including drinking, bathing, and cooking. In the early 2000s, members of the public began to raise concerns about potential impacts on their drinking water from hydraulic fracturing at nearby oil and gas production wells. In response to these concerns, Congress urged the U.S. Environmental Protection Agency (EPA) to study the relationship between hydraulic fracturing for oil and gas and drinking water in the United States.

The goals of the study were to assess the potential for activities in the hydraulic fracturing water cycle to impact the quality or quantity of drinking water resources and to identify factors that affect the frequency or severity of those impacts. To achieve these goals, the EPA conducted independent research, engaged stakeholders through technical workshops and roundtables, and reviewed approximately 1,200 cited sources of data and information. The data and information gathered through these efforts served as the basis for this report, which represents the culmination of the EPA's study of the potential impacts of hydraulic fracturing for oil and gas on drinking water resources.

The hydraulic fracturing water cycle describes the use of water in hydraulic fracturing, from water withdrawals to make hydraulic fracturing fluids, through the mixing and injection of hydraulic fracturing fluids in oil and gas production wells, to the collection and disposal or reuse of produced water. These activities can impact drinking water resources under some circumstances. Impacts can range in frequency and severity, depending on the combination of hydraulic fracturing water cycle activities and local- or regional-scale factors. The following combinations of activities and factors are more likely than others to result in more frequent or more severe impacts:

- Water withdrawals for hydraulic fracturing in times or areas of low water availability, particularly in areas with limited or declining groundwater resources;
- Spills during the management of hydraulic fracturing fluids and chemicals or produced water that result in large volumes or high concentrations of chemicals reaching groundwater resources;
- Injection of hydraulic fracturing fluids into wells with inadequate mechanical integrity, allowing gases or liquids to move to groundwater resources;
- Injection of hydraulic fracturing fluids directly into groundwater resources;
- Discharge of inadequately treated hydraulic fracturing wastewater to surface water resources; and
- Disposal or storage of hydraulic fracturing wastewater in unlined pits, resulting in contamination of groundwater resources.

The above conclusions are based on cases of identified impacts and other data, information, and analyses presented in this report. Cases of impacts were identified for all stages of the hydraulic fracturing water cycle. Identified impacts generally occurred near hydraulically fractured oil and gas production wells and ranged in severity, from temporary changes in water quality to contamination that made private drinking water wells unusable.

The available data and information allowed us to qualitatively describe factors that affect the frequency or severity of impacts at the local level. However, significant data gaps and uncertainties in the available data prevented us from calculating or estimating the national frequency of impacts on drinking water resources from activities in the hydraulic fracturing water cycle. The data gaps and uncertainties described in their report also precluded a full characterization of the severity of impacts.

The scientific information in this report can help inform decisions by federal, state, tribal, and local officials; industry; and communities. In the short-term, attention could be focused on the combinations of activities and factors outlined above. In the longer-term, attention could be focused on reducing the data gaps and uncertainties identified in this report. Through these efforts, current and future drinking water resources can be better protected in areas where hydraulic fracturing is occurring or being considered.

Report Conclusions

This report describes how activities in the hydraulic fracturing water cycle can impact – and have impacted - drinking water resources and the factors that influence the frequency and severity of those impacts. It also describes data gaps and uncertainties that limited our ability to draw additional conclusions about impacts on drinking water resources from activities in the hydraulic fracturing water cycle. Both types of information - what we know and what we do not know - provide stakeholders with scientific information to support future efforts. The uncertainties and data gaps identified throughout this report can be used to identify future efforts to further our understanding of the potential for activities in the hydraulic fracturing water cycle to impact drinking water resources and the factors that affect the frequency and severity of those impacts. Future efforts could include, for example, groundwater and surface water monitoring in areas with hydraulically fractured oil and gas production wells or targeted research programs to better characterize the environmental fate and transport and human health hazards associated with chemicals in the hydraulic fracturing water cycle. Future efforts could identify additional vulnerabilities or other factors that affect the frequency and/or severity of impacts.

In the near term, decision-makers could focus their attention on the combinations of hydraulic fracturing water cycle activities and local- or regional-scale factors that are more likely than others to result in more frequent or more severe impacts. These include:

- Water withdrawals for hydraulic fracturing in times or areas of low water availability, particularly in areas with limited or declining groundwater resources;
- Spills during the management of hydraulic fracturing fluids and chemicals or produced water that result in large volumes or high concentrations of chemicals reaching groundwater resources;
- Injection of hydraulic fracturing fluids into wells with inadequate mechanical integrity, allowing gases or liquids to move to groundwater resources;
- Injection of hydraulic fracturing fluids directly into groundwater resources;
- Discharge of inadequately treated hydraulic fracturing wastewater in unlined pits, resulting in contamination of groundwater resources.

The above combinations of activities and factors highlight, in particular, the vulnerability of groundwater resources to activities in the hydraulic fracturing water cycle. By focusing attention on the situations described above, impacts on drinking water resources from activities in the hydraulic fracturing water cycle could be prevented or reduced.

Overall, hydraulic fracturing for oil and gas is a practice that continues to evolve. Evaluating the potential for activities in the hydraulic fracturing water cycle to impact drinking water resources will need to keep pace with emerging technologies and new scientific studies. This report provides a foundation for these efforts, while helping to reduce current vulnerabilities to drinking water resources.