

## ENVIRONMENTAL AND ENERGY LAW

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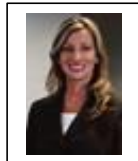
*Walter Boone and Mandie Robinson review and summarize the recent EPA assessment on the effects of fracking on drinking water resources.*

## EPA Study Released: No Evidence that Hydraulic Fracturing has Systemic Impact on Drinking Water

### ABOUT THE AUTHORS



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## INTRODUCTION

Hydraulic fracturing, commonly known as “fracking,” is a drilling technique which involves blasting water, sand, and chemicals into rock formations to free up oil and gas.<sup>1</sup> Aside from blasting water into wells to extract oil and gas, fracking also generates vast amounts of wastewater – most of which is pumped into injection wells deep into the ground. Pursuant to a request from Congress to study the issue, the Environmental Protection Agency (EPA) has now prepared a draft report, released only for the sole purpose of peer review,<sup>2</sup> which addresses the question of whether fracking has any effect on drinking water.<sup>3</sup>

The EPA report ultimately concluded that there was no evidence that fracking operations have led to systemic impacts on drinking water resources. While the EPA found specific instances of actual impact on drinking water resources, the number of identified instances was small compared to the number of hydraulically fractured wells.<sup>4</sup>

## THE INCREASING USE OF FRACKING

In its report, EPA first addressed the process of fracking and how widespread the practice has become since it began in the 1940s. EPA estimated “that from roughly 2011 to 2014, approximately 25,000 to 30,000 new oil and gas wells were hydraulically fractured each year.”<sup>5</sup> Further, EPA found it is difficult to tell how many pre-existing wells there are in which fracking either has, or will be, utilized. As a result, EPA pointed out a trend in which previous fossil fuel production consisting mainly of coal has dropped while “natural gas production has risen to unprecedented levels . . .”<sup>6</sup>

## DRINKING WATER RESOURCES AND PROXIMITY TO FRACKING

In 2011, nearly 24 billion gallons per day were provided to households by local water systems, while private water systems provided 3.6 billion gallons each day.<sup>7</sup> EPA recognized that the availability of surface and ground water supply sources varied geographically with different areas experiencing more drought than others.<sup>8</sup> The study noted that between 2000 and

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<sup>1</sup> See *Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources*, Environmental Protection Agency External Review Draft (June 5, 2015) (available at <http://cfpub.epa.gov/ncea/hfstudy/recordisplay.cfm?deid=244651>).

<sup>2</sup> The EPA assessment contains the disclaimer that “THIS DOCUMENT IS AN EXTERNAL REVIEW DRAFT, for review purposes only. It has not been formally disseminated by EPA. It does not represent and should not be construed to represent any Agency

determination or policy.” Consequently, the EPA report, and the analysis and conclusions within it, are subject to revision or deletion. *Id.* at 1.

<sup>3</sup> See *Id.* (citing H.R. Rep. 111-316, 2009, which requested the EPA conduct this study).

<sup>4</sup> *Id.* at 10-1.

<sup>5</sup> *Id.* at 2-25.

<sup>6</sup> *Id.* at 2-28.

<sup>7</sup> *Id.* at 3-1.

<sup>8</sup> *Id.* at 3-2.

2013, “approximately 9.4 million people lived within one mile of a hydraulically fractured well . . . [and] more than 5.7 million people lived within a half mile of a hydraulically fractured well.”<sup>9</sup> Based on drilling information from 2000-2013, the distance from fracking wells to the nearest public water sources ranged from 0.01 to 41 miles.<sup>10</sup> Overall, “approximately 6,800 [public water sources] had a hydraulically fractured well within a one-mile radius.”<sup>11</sup> Regarding proximity, the report concluded, “[w]hile close proximity of hydraulically fractured wells to drinking water resources does not necessarily indicate that an impact has or will occur, information about the relative location of wells and water supplies is an initial step in understanding where potential impacts might occur.”<sup>12</sup>

## THE HYDRAULIC FRACTURING WATER CYCLE

### 1. Types of Water Used

“Water for hydraulic fracturing typically comes from surface water, ground water, or reused wastewater.”<sup>13</sup> EPA noted that operators preferred fresh water sources, although some will use lower-quality water such as fracking wastewater, brackish water, or small proportions of acid mine drainage.<sup>14</sup> EPA stated the use of non-fresh water reduces the competition for drinking water

resources.<sup>15</sup> But overall, EPA concluded that fracking water “consumption alone does not necessarily result in impacts to drinking water resources. . . .” and found no cases in which fracking alone had “caused a drinking water well or stream to run dry.”<sup>16</sup> EPA concluded, rather, that the impact depended on water availability in a certain area.

### 2. Chemical Mixing

The report also addressed the impact on drinking water from spills of the chemicals mixed together to create hydraulic fracturing fluid. EPA discussed how there are different combinations of chemicals used in different types of fracking activities, and there was the potential for spills at all stages of the process. Of the 151 chemical spills EPA addressed, 54 were from storage units.<sup>17</sup> As far as spills documented to have impacted surface water, the report noted one instance in September of 2009 in which two spills of fracking fluid occurred at the same site in Pennsylvania from busted hoses, releasing 7,350 gallons of fluid which migrated into Stevens Creek.<sup>18</sup> EPA also noted that in July of 2014, over 20,000 gallons of hydrochloric acid spilled from a storage container into a nearby alfalfa field, where it was contained with an emergency berm.<sup>19</sup> Thus, the EPA assessment concluded that chemical spills *have* affected

<sup>9</sup> *Id.* at 3-3 thru 3-4.

<sup>10</sup> *Id.* at 3-6.

<sup>11</sup> *Id.* at 3-7.

<sup>12</sup> *Id.* at 3-11.

<sup>13</sup> *Id.* at 4-47.

<sup>14</sup> *Id.*

<sup>15</sup> *Id.*

<sup>16</sup> *Id.* at 4-48.

<sup>17</sup> *Id.* at 5-31.

<sup>18</sup> *Id.*

<sup>19</sup> *Id.* at 5-33.

the quality of drinking water resources both by reaching surface water and by leaching into ground water.<sup>20</sup>

### 3. Well Injection

EPA noted that properly sited, designed, and constructed wells reduced the potential for impacts to drinking water.<sup>21</sup> However, problems with the well's site or components may lead to adverse effects on drinking water.<sup>22</sup> In other words, EPA's assessment found that injected fluids may migrate through pathways adjacent to wells that were created by the stresses of the fracking operation itself on the components of the wells, such as the cement or casing.<sup>23</sup> EPA's report noted that such well failures and fluid pathways have been documented and tested, and can have an impact on drinking water resources.<sup>24</sup>

Indeed, the report noted that failure to properly conduct a fracking operation in Bainbridge, Ohio, resulted in the movement of gas from the production zone into the local drinking water aquifer.<sup>25</sup> Further, two drinking wells located near a production well in which fracking caused casings at the well to rupture tested positive for brine and tert-butyl alcohol.<sup>26</sup> The report further noted that there were places in the subsurface where oil and gas reservoirs and drinking

water resources co-existed in the same formation, and that fracking in these areas has led to the introduction of fracking fluid into formations that meet the Safe Drinking Water Act's definition of a source of drinking water.<sup>27</sup>

### 4. Flowbacks and Produced Water

At the end of the fracking process, the pressure on a well is reduced and water containing fracking chemicals is allowed to "flow back" from the well to prepare for oil and gas production.<sup>28</sup> As time passes, the salinity of the water flowing back from the operation increases, which is a later stage in which the water is called "produced water."<sup>29</sup> "Flowback" and "produced water" are stored and accumulated at the surface for eventual reuse or disposal.<sup>30</sup> Leaks of such water may occur which could affect drinking water resources.<sup>31</sup> EPA recognized that such leaks may occur on the well pad, due to human error or equipment failure, during piping to other locations, or even if trucks hauling such water are involved in accidents.<sup>32</sup>

According to the report, surface spills of flowback and produced water "have caused impacts to drinking water resources, . . ."<sup>33</sup> EPA outlined several spills from broken pipelines that have caused fish kills and

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<sup>20</sup> *Id.* at 5-42.

<sup>21</sup> *Id.*

<sup>22</sup> *Id.*

<sup>23</sup> *Id.*

<sup>24</sup> *Id.* at 6-51.

<sup>25</sup> *Id.* at 6-52.

<sup>26</sup> *Id.*

<sup>27</sup> *Id.* at 6-53.

<sup>28</sup> *Id.* at 7-1.

<sup>29</sup> *Id.*

<sup>30</sup> *Id.*

<sup>31</sup> *Id.*

<sup>32</sup> *Id.*

<sup>33</sup> *Id.* at 7-30.

resulted in chemicals in small creeks to large rivers.<sup>34</sup> Likewise, there have been cases of well blowouts and leaks from pits and impoundments which have affected drinking water resources.<sup>35</sup> The report stated that out of 457 spills related to fracking, 225 were of flowback and produced water.<sup>36</sup>

#### 5. Wastewater Treatment and Waste Disposal<sup>37</sup>

During hydraulic fracturing, modern wells can produce up to 420,000 gallons of flowback water, necessitating a wastewater management strategy prior to fracking activities.<sup>38</sup> Such wastewater can be injected underground, treated for use in future fracking activities, used for irrigation, or dealt with in other manners.<sup>39</sup> The chemical make-up of wastewater, such as total dissolved solids and inorganics, must be considered when planning for wastewater management.<sup>40</sup>

Regardless of its chemical properties or how the wastewater is disposed, the EPA report found that such wastewater may impact drinking water systems in numerous ways. The report stated:

Each of these wastewater management strategies may potentially lead to an impact

on drinking water resources during some phase of their execution. Such impacts may include accidental releases during transport (see Chapter 7), discharges of treated wastewaters from CWTs [Centralized Waste Treatment facilities] or POTWs [Publically Owned Treatment Works] where treatment for certain constituents has been inadequate, migration of constituents in wastewaters that have been applied to land, leakage from on-site storage pits (see Chapter 7), inappropriate management of residuals (e.g., leaching from landfills or land application), or accumulation of constituents in sediments near outfalls of CWTs or POTWs that have treated hydraulic fracturing wastewater.<sup>41</sup>

EPA explained how disposal of certain wastewater is allowed. For instance, in the arid western portion of the continental United States, oil and gas extraction facilities are allowed direct discharge to surface waters if the wastewater meets the standards set forth in 40 C.F.R. 435.51(c) for use in agricultural or wildlife propagation.<sup>42</sup> Yet, there were still documented cases of unpermitted discharges of fracking wastewater, such as a discharge in Pennsylvania into a storm drain leading into a tributary of the Mahoning River which contained benzene and toluene.<sup>43</sup>

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<sup>34</sup> *Id.* at 7-31.

<sup>35</sup> *Id.* at 7-31 and 7-32.

<sup>36</sup> *Id.* at 7-33.

<sup>37</sup> The EPA includes flowback and produced water within its definition of wastewater. *See id.* at 8-1.

<sup>38</sup> *Id.* The report goes on to note that the most recent national study was from 2007, and found at that time that the one million active wells in the

nation produced 2.4 billion gallons of wastewater per day. *See id.* at 8-4.

<sup>39</sup> *Id.*

<sup>40</sup> *Id.* at 8-10.

<sup>41</sup> *Id.* at 8-13.

<sup>42</sup> *Id.* at 8-19.

<sup>43</sup> *Id.* at 8-20.

EPA acknowledged that the majority of wastewater is disposed of via injection wells. For instance, the report recognized that “[a] 2009 study notes that the oil and gas industry in the United States generated about 882 billion gal . . . of produced water in 2007” [and] “[m]ore than 98% of this volume was managed via some form of underground injection, . . .”<sup>44</sup> However, the report pointed out that a good national estimate of the amount of fracking wastewater injected was difficult to develop due to a lack of collected data.<sup>45</sup>

Interestingly, the report did not address whether there are documented or potential impacts on drinking water resources associated with the injection of wastewater into wells.<sup>46</sup> Instead, the report simply pointed out that if underground injection should become limited in any way, such as the ability to accept large volumes of wastewater being “limited by recent state actions concerning seismic activity associated with injection,” then operators will be forced to adjust their wastewater management programs to favor other options such as treatment or reuse. In that case, “[a]ny new wastewater management decisions would then have to be evaluated in terms of potential impacts on drinking water resources.”<sup>47</sup>

In summary, with respect to the extent wastewater impacts drinking water

resources, the report concluded the answer is based on numerous variables:

Whether drinking water resources are affected by hydraulic fracturing wastewater depends at least in part upon the characteristics of the wastewater, the form of discharge or other management practice, and the processes used if the wastewater is treated. Other site-specific factors (e.g., size of receiving water and volume of wastewater) determine the magnitude and nature of potential effects, but a thorough exploration of local factors is beyond the scope of this assessment.<sup>48</sup>

#### **IDENTIFICATION AND EVALUATION OF CHEMICALS FOUND THROUGHOUT THE HYDRAULIC FRACTURING WATER CYCLE**

Aside from identifying the potential opportunities for impacts to drinking water from the fracking water cycle, the EPA report also contained a section addressing the make-up of such wastewater. The report found that although data on this issue is incomplete, the U.S. House of Representatives’ Committee on Energy and Commerce Minority Staff released a report in 2011 noting that there were more than 650 products used in fracking operations which contain 29 chemicals that are known or possible human carcinogens or are currently regulated under the Safe Drinking Water Act.<sup>49</sup> The EPA report identified additional studies which address the toxicity

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<sup>44</sup> *Id.* (citations omitted).

<sup>45</sup> *Id.*

<sup>46</sup> *Id.*

<sup>47</sup> *Id.* at 8-21.

<sup>48</sup> *Id.* at 8-58.

<sup>49</sup> *Id.*

of chemicals, but concluded that there was a lack of data discussing effects of chronic exposure to such chemicals.<sup>50</sup> The report found that, “[o]verall, available information indicates that there may be hundreds of chemicals associated with the hydraulic fracturing water cycle for which toxicological data is limited or unavailable.”<sup>51</sup>

After addressing the issues regarding the effects and toxicity of each of the chemicals, the report concluded:

[o]verall, contamination of drinking water resources depends on site-, chemical-, and fluid-specific factors . . . , and the exact mixture and concentrations of chemicals at a site will depend upon the geology and the company’s preferences. Therefore, potential hazard and risk considerations are best made on a site-specific, well-specific basis.<sup>52</sup>

## MAJOR FINDINGS

The EPA report noted there are multiple phases of the fracking process in which fracking fluids or wastewater may be released and impact drinking water resources. However, the report concluded:

[w]e did not find evidence that these mechanisms have led 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 mechanisms led to impacts on drinking water resources, including contamination of drinking water wells. The number of identified cases, however, was small compared to the number of hydraulically fractured wells.<sup>53</sup>

EPA then qualified this conclusion, pointing to the lack of sufficient pre- and post-fracturing data.<sup>54</sup>

Further, the report concluded that physical separation of the production zone and water resources can help protect drinking water. EPA noted that most (although not all) fracturing operations target deep formations a mile or greater below drinking water resources. They found fractures created during fracking operations are unlikely to extend upward from these deep formations into the shallow drinking water aquifers.<sup>55</sup> However, the report noted that some fracking operations were conducted in close proximity to drinking water, and there are even some formations in which fracking is occurring which actually contain drinking water resources. EPA concluded that fracking in these formations results in fracking fluids being introduced into those formations which may currently – or in the

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<sup>50</sup> *Id.*

<sup>51</sup> *Id.* at 9-2 thru 9-2.

<sup>52</sup> *Id.* at 9-37

<sup>53</sup> *Id.* at 10-1.

<sup>54</sup> *Id.*

<sup>55</sup> *Id.* at 10-2.

future – serve as a source of drinking water.<sup>56</sup>

For companies actively operating fracking activities, EPA suggested that companies can combat claims that their activities have affected surrounding drinking water resources by taking pre-drilling samples around proposed sites.<sup>57</sup> For instance, the report noted that more than 40% of private wells in Pennsylvania already fail to meet the federal drinking water standards due to levels of iron, manganese, sodium chloride, etc.<sup>58</sup> Thus, pre-drilling testing may be used to show that some levels of certain chemicals were present before drilling was begun in a particular area.

The report concluded by discussing the many uncertainties which exist due to the limitations in monitoring data and chemical information.<sup>59</sup> Thus, EPA advocated better monitoring of hydraulic fracturing data in the future, and that its report (once the final report has been released), will 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.”<sup>60</sup>

## CONCLUSION

The EPA report found that, although there are certain exceptions, there have been few specific instances in which fracking activities

have resulted in some impact to drinking water resources. The report found numerous situations in which fracking activities *could* impact such resources, but that such instances would stem mainly from accidental spills such as those occurring during transportation, during chemical mixing operations, or due to human error or equipment failures. Naturally, such unavoidable accidents will occur within any industry. Thus, although the report suggests better data collection should occur regarding the types of chemicals present in fracking fluid and wastewater, the EPA study adds great weight to the conclusion that physical distance between fracking operations and drinking water resources (whether above or below the ground) should help prevent most cases in which any accidental spills, or hydraulic fracturing itself, would affect any drinking water resources.

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<sup>56</sup> *Id.* at 10-10.

<sup>57</sup> *Id.* at 7-35.

<sup>58</sup> *Id.*

<sup>59</sup> *Id.* at 10-17.

<sup>60</sup> *Id.* at 10-20.

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