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U.S. Environmental Protection Agency
1200 Pennsylvania Ave. NW.
Washington, DC 20460

**Comments:**

**Re the EPA's Draft Assessment on the Impacts of Hydraulic Fracturing for Oil and Natural Gas on Drinking Water Resources**

We the undersigned organizations thank you for taking into account these comments on the final draft assessment of the potential extent of impacts of hydraulic fracturing, or fracking, on drinking water resources. It is deeply troubling that the findings in the final draft assessment were misrepresented within the EPA's news release, and thereby in subsequent news media coverage. To a significant degree, this has short-circuited the comment process.

Throughout its assessment, the EPA is clear that "data limitations and uncertainties" prevented researchers from making definitive conclusions about the impacts on drinking water resources from drilling and hydraulic fracturing, or fracking, for oil and natural gas. For the EPA's press release, however, the major finding of the assessment was made to sound conclusive.

Briefly, while the assessment stated *"we did not find evidence"* of *"widespread, systemic impacts to drinking water resources,"* the EPA's news release changed this statement to say: *"Assessment shows hydraulic fracturing activities have not led to widespread, systemic impacts to drinking water resources"* — a subtle but significant difference in the communication of the assessment's topline finding.

The Data Quality Act forces very measured statements about fracking-related impacts on drinking water resources in the assessment, but the press release was not held under such scrutiny, as is practice. This may have made the subtle but consequential change to the assessment findings possible. The effect is that the final draft assessment was used to promote a political position not supported by the document itself. This furthers the oil and gas industry's goal of continued widespread drilling and fracking across the country.

Close reading of the actual EPA assessment shows that, at almost every turn, the technical efforts of EPA to evaluate the impacts were thwarted. At times, the agency was thwarted by circumstances out of its control, but in many other ways the shortcomings of the assessment are of the agency's own making. Of particular interest is the question of whether the EPA was able to exercise sufficient authority, much less apply enough resources, to conduct a study of fracking as conclusive sounding as the topline of the press release was made to sound.

In both its news release and in its assessment, the EPA employs the phrase "widespread, systemic" as a threshold for gauging concern. It is important to note that this threshold is only defined implicitly as being above and beyond existing levels of damage. At the same time, these levels of damage are in question.

For example, consider that the EPA found evidence of over 36,000 spills during a period of six years and four months, from January 2006 to April 2012. This amounts to about 15 spills every day somewhere in the United States. Basic information about the volume and nature of fluids released is commonly lacking, but the EPA opted to define “widespread, systemic” impacts as being above and beyond 15 spills every day across the country.

Currently, there is nothing in the methodology or findings of the assessment that justify EPA’s use and definition of “widespread, systemic” impacts as a threshold for action.

We implore the EPA to gather, such as in the form of a table all identified impacts and to then quantify the levels of expected and potential damage for each one. This is necessary to define explicitly, and quantitatively, what is meant by “widespread, systemic” impacts. The EPA’s use of this phrase suggests that a multi-dimensional threshold for action is not crossed by the potential impacts revealed in the study; that is, the EPA finds that current levels of damage are close enough to zero for each impact, despite persistent uncertainties.

Now, in its final assessment, the EPA should develop a graphic to illustrate this muti-dimensional neighborhood about the origin, such as by using a “star plot.” This would help resolve the distinction, which is otherwise being made only implicitly, between impacts that would be considered “widespread, systemic” and the impacts now being deemed collateral.

Below are more detailed comments, with analysis focused on how the conclusiveness of assessment was misrepresented.

Sincerely,

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- Carol Parenzan, Middle Susquehanna RIVERKEEPER
- Mark Frondorf, Shenandoah Riverkeeper
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- Kaye Fissinger, Our Health, Our Future, Our Longmont
- Adrienne Cronebaugh, Kootenai Environmental Alliance
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- Sahru Keiser, Breast Cancer Action
- Karen Feridun, Berks Gas Truth
- David Braun, Rootskeeper
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## The EPA's press release

### The assessment findings were misrepresented

The subtitle of the EPA's press release — presented as the topline finding by the Obama Administration — reads as follows (emphasis added):

> *"Assessment **shows** hydraulic fracturing activities have not led to **widespread, systemic** impacts to drinking water resources and identifies important vulnerabilities to drinking water resources."*[1]

Media reports ran with this framing of the assessment as definitive and conclusive. Americans were led to believe that fracking is safe and that "any vulnerabilities" can be guarded against.[2]

In the actual text of the assessment, the statement of the major findings differs significantly from what is presented in the press release. The actual assessment states (again, emphasis added):

> *"From our assessment, we conclude there are above and below ground mechanisms by which hydraulic fracturing activities have the potential to impact drinking water resources. ... **We did not find** evidence that these mechanisms have led to **widespread, systemic** impacts on drinking water resources in the United States. ... This finding could reflect a rarity of effects on drinking water resources, but may also be due to other limiting factors."*[3]

That is, for the EPA's press release, the major finding of the assessment was changed from "we did not find evidence" to the "Assessment shows" there is no evidence of "widespread, systemic impacts."

### What EPA identifies as vulnerabilities amount to collateral damage

There is nothing in the methodology or findings of the assessment that justify EPA's use and definition of "widespread, systemic" impacts as a threshold for action.

The EPA press release states that the assessment "identifies important vulnerabilities" to water resources, but these vulnerabilities are not hypothetical. Rather, the evidence of these vulnerabilities is the direct experience of communities affected by ordinary releases of contaminants into the environment. These releases have resulted directly and indirectly from widespread drilling and fracking at the level of 25,000 to 30,000 new wells each year.

For example, consider that the EPA found evidence of over 36,000 spills during a period of six years and four months, from January 2006 to April 2012. This amounts to about 15 spills every day somewhere in the United States. Basic information about the volume and nature of fluids released is commonly lacking, but the EPA opted to define "widespread, systemic" impacts as being above and beyond 15 spills every day across the country.

In both its press release and the actual assessment, the EPA uses and implicitly defines the phrase "widespread, systemic impacts" in a way that excludes the level of impacts found in the assessment. The EPA must explicitly define this phrase in the final assessment, relative to each impact.

### EPA press releases are exempt from the Data Quality Act

One consequence of the scientific process is that warnings of harm to public health and the environment are conservative. In the assessment, this explains the carefully worded caveats, qualifiers, and expressions of uncertainty throughout the assessment.

The careful wording adheres to rules put in place under the Data Quality Act (DQA), also known as the Information Quality Act.[4] The DQA was intended to ensure the "quality, objectivity, utility, and integrity" of information from federal studies, such as the assessment.

In the cost-benefit framework of OMB regulatory review process, an effect of the act, intended or unintended, is that it presents an opening to insert doubt into documentation harm to public health and the environment.[5] This occurs at the same time as industrial control over data, as well as access to sites.

Contrary to the actual draft assessment, the EPA's press release was not subject to IQA standards. The EPA OIG states:

> *"A review of the Information Quality Act and subsequent guidelines issued by both the Office of Management and Budget and the EPA indicates that press releases are exempt. The Information Quality Act does not apply to communications such as press releases."*[6]

According to EPA's own guidelines regarding DQA compliance:

> *"EPA has created a category for information of an "ephemeral" nature, including press releases, speeches, and the like. The intent was that the Guidelines should not cover communications that merely serve as announcements, or for other reasons are intended to be fleeting or of limited duration."*[7]

For proponents of maximizing oil and gas extraction — in particular, via fracking — this exemption makes the DQA that much more workable. Coupled with industry control over data, including access to sites, the DQA explains the lack of conclusiveness throughout the assessment, as well as how a subtle yet very consequential change in wording was allowed to mislead public perception about that conclusiveness.

The EPA OIG should consider this matter.

### Related communication of EPA findings

It is instructive to examine the EPA's past use of "widespread" impacts as a threshold for action, and to then look at the EPA's past communication with the public about individual cases of impacts that stem from drilling and fracking activities.

#### *EPA's past use of "widespread" as a threshold for regulatory action*

A search of agency news releases revealed multiple uses of the word "widespread" to describe impacts on water resources.[8]

*Locally "widespread" contamination*

In past press releases, the EPA has used "widespread" to characterize very damaging pollution events, typically causing local contamination.

- Most recently, the EPA designated new Superfund sites in New Jersey where

> *"Paint manufacturing and related activities at the sites resulted in widespread contamination of soil, sediment and groundwater with high levels of various contaminants including lead, arsenic and volatile organic compounds."* [9]

- In 2011, the EPA designated an area of Nassau County a superfund site, stating that:

> "Ground water throughout the site is contaminated with harmful volatile organic compounds."[10]

  The agency referred to this water contamination as "widespread."[11]

- The EPA found "widespread contamination" of the Gowanus Canal in Brooklyn, New York, referring specifically to the "widespread presence of numerous contaminants every core sample of the canal bed.[12]

  Specifically, numerous contaminants were "pervasive in native sediments underneath the canal between the head of the canal and the Gowanus Expressway, and in the overlying soft sediment in the middle reach of the canal." [13]

*Nationally "widespread" contamination*

In one instance, the EPA used "widespread" on a larger geographic scale. Mercury and PCB contamination in U.S. lakes and rivers was deemed "widespread" on the basis that:

> *"… mercury concentrations in game fish exceeding EPA's recommended levels at 49 percent of lakes and reservoirs nationwide, and polychlorinated biphenyls (PCBs) in game fish at levels of potential concern at 17 percent of lakes and reservoirs."*[14]

*"Widespread" is the wrong measure*

With hydraulic fracturing's impacts on drinking water resources, the damage is done, and risk is created, through events that occur over time with generally low-probability. This is a major reason why the EPA does not find widespread impacts "relative to the number of hydraulically fractured wells."[15] But when operators are drilling and fracking more than 25,000 new wells each year in the United States, damage is accumulating with the "reasonably foreseeable accidents and releases," as California's regulatory agency has phrased it. [16]

However, overall, the EPA's past use of "widespread" has typically been in reference to localized contamination events. In each the contamination was deemed widespread based on uniformly damning testing results. When used at a national level, "widespread" corresponded to more than "17 percent of lakes and reservoirs."[17]

<u>It is necessary for the EPA to reconcile its use of the phrase as a threshold for action, and make explicit that somewhere on the order of 17 percent is not the intended meaning of "widespread" in the final draft assessment.</u>

***EPA's press release on its Dimock, Pennsylvania inquiry***

Dimock, Pennsylvania is the site of a contentious case of ground water contamination, and the EPA has failed to fully investigate what happened.

The state's environmental agency had similarly failed to full investigate,[18] after finding initially that "eighteen (18) drinking water supplies that serve nineteen (19) homes within the Dimock/Carter Road Area have been affected from the drilling activities at the Dimock/ Carter Road Gas Wells."[19]

In announcing a close to its own investigation in 2012, the EPA stated in its press release:

> *"Based on the outcome of that sampling, EPA has determined that there are not levels of contaminants present that would require additional action by the Agency."* [20]

The closing of the investigation was treated as a victory by industry, but EPA's decision hinged on its conclusion that treatment systems resolved the problem.

The EPA stated:

> *"Overall during the sampling in Dimock, EPA found hazardous substances, specifically arsenic, barium or manganese, all of which are also naturally occurring substances, in well water at five homes at levels that could present a health concern. In all cases the residents have now or will have their own treatment systems that can reduce concentrations of those hazardous substances to acceptable levels at the tap. EPA has provided the residents with all of their sampling results and has no further plans to conduct additional drinking water sampling in Dimock."* [21]

The EPA's draft assessment includes a retrospective case study on contamination in Northeastern Pennsylvania, near Dimock. Rather than incorporate the Dimock wells into the case study, the EPA's separate investigation into contamination at Dimock, although cut short, was used as justification by the EPA to exclude the Dimock wells in the case study.[22]

*Northeast Pennsylvania retrospective case study*

The Northeast Pennsylvania retrospective case study factsheet states that *"*up to nine*"* cases of contamination in the region were explained by fracking-related activities.[23] This leaves it ambiguous whether even one case is actually confirmed.

The summary of the actual full text of this case study states things slightly more strongly:

> *"Evidence did indicate one or more homeowner wells have been impacted by stray gas associated with nearby hydraulic fracturing activities. Stray gas (in the form of methane and ethane) entering homeowner wells can account for observed changes to well water appearance and quality (e.g., effervescing, increased turbidity, discoloration) reported by some homeowners."* [24]

Finally, the more detailed text on this case study determines that five water wells indicate the presence of hydrocarbon gases from depth (emphasis added):

> *"The scenarios presented in this report pertaining to the presence of gas in various homeowner wells sampled in the study indicate that, in some cases, the gas present in homeowner wells is almost*

> *certainly naturally occurring background (pre-existing) gas (e.g., NEPAGW04, NEPAGW08, and NEPAGW17). However, in other cases, such as at NEPAGW01, NEPAGW02, NEPAGW06, NEPAGW13, NEPAGW18, NEPAGW20, NEPAGW23, NEPAGW37, and NEPAGW38, gas other than background gas appears to have entered the homeowner well. At several of these locations (e.g., NEPAGW01, NEPAGW02, and NEPAGW23), the gas clearly appears to be originating from shallower depths (Upper Devonian formations), based on the much greater isotopic fractionation of the gas relative to Marcellus Shale gas, the high methane-to-ethane ratios, and the absence of isotope reversal.* ***However, for the cluster of homeowner wells NEPAGW13, NEPAGW18, NEPAGW20, NEPAGW37, and NEPAGW38, the gas appears to be originating from deeper formations—likely the Middle Devonian and possibly the Marcellus Shale itself****—also based on observed isotopic signatures, methane-to-ethane ratios, and isotope reversal differences. Linking gas in homeowner wells to a specific formation such as the Marcellus Shale is challenging given the range of isotopic signatures and isotope reversal differences that can be characteristic of a given formation, and the significant overlap that apparently occurs with respect to isotopic signatures and isotope reversal magnitudes amongst the different formations."*[25]

For the contaminated wells in Dimock, no such analysis was conducted by the EPA. The EPA should carry out an analysis of the events and mechanisms that led to the contamination that occurred in Dimock.

### *The EPA on contamination in Pavillion, Wyoming*

The EPA also failed to finalize its investigation into aquifer contamination in Pavillion, Wyoming as well. After rounds of testing, the EPA had identified the presence of groundwater contamination, from both surface spills and from deep injections. After multiple comment period extensions, the EPA ended its investigation at the final draft stage, before peer-review.[26]

The EPA coordinated with the state of Wyoming on this decision, citing limited agency resources, as well as the working relationship, generally, between federal and state regulators moving forward on the issue of fracking.[27] For years the state has told residents it did not have the resources to conduct such an investigation, and the soon-to-be/just released study was afforded in an agreement with Encana, the company involved.[28]

There is next to no mention of Pavillion, Wyoming or water quality problems due to drilling and fracking activities targeting the Wind River Formation. The final assessment should include a summary of the current understanding of the events and mechanisms that led to the contamination that occurred in Pavillion.

### *The EPA on contamination in Parker County, Texas*

The EPA's decision to stop its investigation of contamination in Parker County, Texas provides another example of EPA's inability, or unwillingness, to exercise investigative authority over fracking.

On the decision, an EPA official stated that:

> *"Resolving the lawsuits with Range allows EPA to shift the Agency's focus in this particular case away from litigation and towards a joint effort on the science and safety of energy extraction."*[29]

It was determined that the EPA withdrew its emergency order against Range Resources in exchange, in part, for the company's agreement to participate in the assessment.[30] This has not come to pass.

Regarding other terms of the voluntary and mutual agreement between the EPA and Range Resources, the EPA OIG has determined that:

> *"According the EPA, the sampling that Range Resources has completed indicates no widespread methane contamination above action levels in the wells that were sampled in Parker County (only one well of 20 showed methane above that level, and a subsequent sample at this well was below that level)."*

The EPA OIG has also cautioned that Range Resources is providing testing, and that the *"EPA lacks quality assurance information."*[31]

Further, the ultimate agreement between the EPA and Range Resources is limited with respect to what testing is being done. The EPA OIG found that at the EPA:

> *"… managers accepted this partial solution because Range Resources would not voluntarily conduct these [additional testing] elements of the order, and they judged that the EPA could not spare the resources to continue enforcement through the courts."*[32]

This illustrates how some of the limitations and uncertainties that cloud the assessment are of the agency's own-making. Most remarkably, the EPA failed to reach an agreement with Range Resources for conducting one of its promised — but not yet delivered — prospective study of groundwater before and after fracturing operations on a single well.

The EPA's actions and public statements on the three above cases — and in Parker County in particulary — demonstrate that the agency is disinclined to pursue investigations beyond industry's own voluntarily agreed-to terms. Such terms generally influence access to sites and methods of acquiring data necessary to examine impacts on drinking water resources, and this calls into question the EPA's efforts to assess such impacts.

## The actual EPA assessment

### Drilling and fracking in the United States is widespread and intensive

#### *The scale of drilling and fracking*

According to the assessment, between 2011 and 2014, about 25,000 to 30,000 oil and gas wells were fracked each year.[33] This level of activity makes clear the meaning of widespread and intensive drilling and fracking.

More than 40,000 new oil and gas wells were drilled and fracked in 2008. The decline in the number of wells in recent years is due not just to generally low demand but also to drilling more lengthy wells, allowing the same access to targeted rock formations without additional well sites. Generally the longer the well, the more fracturing stages conducted and thus the more water used.

Such widespread and intensive drilling and fracking activity must be maintained, if not accelerated, just to maintain current production rates. This makes the expansion of drilling and fracking activities to new areas, and its intensification in already targeted communities, a necessity for the oil and gas industry.

The EPA, acknowledging this policy direction, simply states that:

> *"… hydraulic fracturing is expected to continue to expand and drive an increase in domestic oil and gas production in coming decades. As a result, hydraulic fracturing will likely increase in existing locations, while also potentially expanding to new areas."* [34]

Maximizing production over time essentially means maximizing the cumulative amount of surface area exposed by all of the fractures induced. That is, the aim is to fracture as extensively as possible, so that no point in the targeted rock formation is left too far from a man-made fracture. Only oil and gas exposed by a fracture is released, and the rest remains tightly held, unable to flow.[35]

Across an actively targeted play, this translates to well densities on the order of ten wells per square mile dotting the landscapes and perforating the aquifers that lie beneath.

### *Proximity of fracking plays to communities and drinking water resources*

The EPA looked at the abundance of water resources in the United States, relative to each state's water use, and assessed the proximity of drilling and fracking to U.S. water resources.

The EPA examined available data on about 270,000 of the total number of fracked wells from 2000 to 2013, and determined that about 80,000 (or 30%) of these wells were completed in metropolitan areas (with declines in that category since 2008, due partly to declines in activity targeting the Barnett shale in the Dallas-Ft. Worth area).[36]

According to the assessment,

> *"…approximately 740,000 people obtained drinking water from private supplies in counties with more than 400 fractured wells. These counties were located in Colorado, Kentucky, Michigan, Montana, New Mexico, New York, Oklahoma, Pennsylvania, Texas, and Wyoming."* [37]

Additional findings of the study detail the distribution of hydraulic fracturing operations across the United States, relative to drinking water resources:

- *"… a sizeable number of hydraulically fractured wells (21,900) [about 8 percent] were located within 1 mile of at least one [public water system] source."* [38]
- *"An estimated 6,800 public water system [PWS] sources were located within 1 mile of a hydraulically fractured oil and gas well between 2000 and 2013. These PWS sources supplied water to 3,924 public water systems and served more than 8.6 million people year-round in 2013."* [39]
  - *"Most of these PWS sources were located in Colorado, Louisiana, Michigan, North Dakota, Ohio, Oklahoma, Pennsylvania, Texas, and Wyoming."* [40]
- *"Approximately 9.4 million people lived within 1 mile of at least one hydraulically fractured oil and gas well between 2000 and 2013."* [41]
- *"Approximately 3.6 million people obtain drinking water from private systems in counties with at least one hydraulically fractured well and in which at least 30% of the population (i.e., double the national average) is reliant on private water systems."* [42]

These findings illustrate that many millions of Americans are exposed to risks from baseline levels of oil and gas industry impacts, from the ordinary accidents and releases that accompany drilling and fracking.

### *Limits in scope*

While uncertainties and data limitations make it difficult to quantify the actual, real-life impacts the EPA identifies, the assessment is also limited in scope. The EPA assessment's scope did not include a number of areas of impact on drinking water resources that go hand-in-hand with widespread drilling, including open pit mining for silica sand, pipeline construction, and pipeline accidents.

The EPA clarifies that:

> *"This assessment focuses on the potential impacts from activities in the hydraulic fracturing water cycle on drinking water resources. It does not address all concerns that have been raised about hydraulic fracturing nor about oil and gas exploration and production more generally. Activities that are not considered include acquisition and transport of constituents of hydraulic fracturing fluids besides water (e.g., sand mining and chemical production); site selection and well pad development; other infrastructure development (e.g., roads, pipelines, compressor stations); site reclamation; and well closure. … Additionally, this report does not discuss the potential impacts of hydraulic fracturing on other water uses (e.g., agriculture or industry), other aspects of the environment (e.g., seismicity, air quality or ecosystems), worker health or safety, or communities."* [43]

Therefore earthquakes stemming from disposal of fracking wastewater are not considered.[44]

The scope also excludes impacts on drinking water resources due to climate change, with next to no mention of the issue.

On the increasingly apparent challenges of providing clean drinking water in the face of climate change impacts, the EPA merely states:

> *"The future availability of drinking water resources that are considered fresh in the United States will be affected by changes in climate and water use."*[45]

The EPA is neglecting an opportunity to emphasize the challenges that public drinking water systems already face due to climate change. These challenges are only complicated by new demand for water for fracking and by baseline levels of spills, accidents and releases.

The failure to make the linkage between widespread drilling and fracking, on one hand, and climate change on the other hand, serves the interests of the oil and gas industry. It likewise serves the interests of large banks — including those "too-big-to-fail" — that are banking billions on continued drilling and fracking, for another decade or more.

## Vulnerabilities are manifest as collateral damage on land, water and communities

The narrow scope of the assessment limits what it means to "not find evidence of widespread, systemic impacts on drinking water resources." [46] But this statement has deeper problems.

### *The threshold of "widespread, systemic" is arbitrary and unsupported*

The EPA's use and definition of "widespread, systemic impacts" as a threshold for action serves to discount the level of impacts on drinking water resources observed as a consequence of drilling and fracking 25,000 or so new oil and gas wells each year in the United States.

A close reading of the assessment suggests the use of the "widespread, systemic impacts" threshold to dismiss baseline levels of damage is misleading and unsupported. Inherent uncertainties, as well as industry's control of data and access to sites, made it impossible for the EPA to quantify the frequency and extent of the harms.

To this point, the lead caveat in the summary of the assessment's findings is:

*"As part of this effort, we identified data limitations and uncertainties associated with current information on hydraulic fracturing and its potential to affect drinking water resources. In particular, data limitations preclude a determination of the frequency of impacts with any certainty."*[47]

***Examples of baseline, expected damage from the assessment.***

Based on excerpts of the assessment in the next section, on the order of 15 spills a day occurred, on average, from 2006 to 2012. Such contamination events add up to yield baseline levels of damage due to fracking, but the EPA does not deem such frequent and expected daily spills as evidence of "widespread, systemic" impacts.

More rare events — such as different types of cementing problem that lead to a loss of well integrity and the potential for leaks — likewise amount to a baseline level of damage.

As an illustration, with 25,000 new wells per year, assuming a conservative one-in-a-thousand chance of cementing problems occurring in the first year after a new oil or gas well is constructed would still translate to 25 problematic wells after just one year. Ultimately, however, the EPA cannot say what fraction of those problematic wells might lead to impacts on drinking water resources, or how many of the 25,000 wells built that year will develops problems as they age and degrade.

The EPA states that whatever the actual number problematic wells, it is not evidence of "widespread, systemic impacts," explaining that:

*"The number of identified cases, however, was small compared to the number of hydraulically fractured wells."* [48]

Of course, as opposed to spills, unintended releases of fluids below the ground are less easily detected, and the impacts from such releases are more difficult and expensive to understand and monitor, being beneath the surface.[49] The EPA has neglected to categorize and examine such events.

A recent peer-reviewed paper, published after the draft assessment was finalized, also challenges the EPA's notion of what constitutes "widespread, systemic impacts." The study of groundwater above the Barnett shale reported (emphasis added):

*"At least one of the BTEX (benzene, toluene, ethylbenzene and xylene) class of compounds was detected in 381 of 550 collected samples, and 10 wells had detectable amounts of all four BTEX compounds. ... This area houses underground injection wells for drilling waste disposal across north-central Texas and Oklahoma, thus it is exposed to the largest volume of produced waters in the region through either trucked or injected water, which must be disposed of with great care. ... Of the four BTEX compounds, toluene was the only constituent to have a significant relationship with respect to well depth (r = -0.20, p = 0.003). **This observation is consistent with that of methanol and well depth, suggesting that the source of these two constituents originated from the surface**."*[50]

That is, the authors suggest that injections for the purpose of disposal, as opposed to injections for the purpose of fracturing, may be to blame. The potential impact on drinking water resources from wastewater injection wells, however, was not included in the scope of the EPA's assessment.[51]

The authors of the recent study find:

> *"No research has been reported on organics leaching from underground injection wells, but salt contamination has been identified in association with injection wells and plugged oil and gas wells in southeast Texas. Compared to equivalent studies, the abundance of BTEX compounds in the Barnett shale region is consistent with the characterization of produced water."* [52]

The authors conclude that:

> *"The detection of numerous volatile organic compounds in aquifers above the Barnett shale does not necessarily implicate unconventional UOG extraction as the source of contamination; however, it does provide an impetus for further monitoring and analysis of groundwater quality in this region.* [53]

Given that the Barnett shale is the oldest, and most played out, of the shale plays, the EPA should weight in on whether the same may begin to happen in other parts of the country.

### Mechanisms of drinking water resources impacts

The nearly 1000-page assessment is littered with caveats specific to each of the mechanisms EPA identifies as "having the potential to impact drinking water resources."

Broadly, there are wastes and chemicals released at the surface at well sites, there are injections and releases below the surface, and there are pathways of contamination associated with the treatment and disposal of wastes.

#### *Contamination from spills and releases above ground*

*Uncertain levels of baseline damage*

The EPA examined over 36,000 records of spills that occurred between January 2006 and April 2012.[54] On average, that amounts to over 15 spills recorded each day at oil and gas industry sites within the United States.[55]

In addition to spills and releases of oil, this includes spills of fracking chemicals at sites during mixing and before injection, and spills of wastewaters produced after hydraulic fracturing injections. The initial waste fluids flowing to the surface are higher in fracking chemicals, followed by flows of wastewater more dominated by ancient brines as production begins.

*Equipment failure*

Equipment failure is identified as a primary cause of spills. The EPA reports:

> *"Colorado found that equipment failure was the dominant spill cause, accounting for over 60% of spills between 2010 and 2013, followed by human error accounting for 20%-25% of spills."* [56]

The EPA warns:

> *"As with all components of hydraulic fracturing operations, repeated and prolonged stress from highly pressurized, abrasive fluids may lead to equipment damage. The presence of minute holes or cracks in the frac head may result in leaks when pressurized fluids are pumped. In addition, surface blowouts or uncontrolled fluid releases may occur at the frac head because of valve failure or failure of other components of the assembly."*[57]

Importantly, despite this warning, the EPA makes no attempt to predict potential increases in equipment failures as existing equipment ages and continues to be used in the coming decade.

*A lower bound on spills that coincided with fracturing operations*

Of the 36,000 recorded spills, the EPA found that 12,000 had insufficient information to determine whether or not the spills were directly related to hydraulic fracturing operations.[58]

Based on the 24,000 records of spills with sufficient information, the EPA determined that 457 spills occurred "on or near the well pad before or during the injection of hydraulic fracturing fluid or during the post-injection recovery of fluids."[59] This excludes:

> "… *transportation-related spills, drilling mud spills, and spills associated with disposal through underground injection control wells."* [60]

The EPA determined that of the 457 spills roughly coincident with fracturing operations, "151 spills were of chemicals, additives, or fracturing fluids."[61] The EPA found that about 9 percent of these entered rivers and/or streams and 64 percent contaminated soil.

*Many factors thwarted assessment of impacts on shallow groundwater from spills*

Impacts on groundwater may remain a threat from these documented spills, as well from the likely many undocumented spills. Specifically, the EPA states:

> *"None of the spills reportedly reached ground water (U.S. EPA, 2015n), but it could take several years for spilled fluids to infiltrate soil and leach into ground water."* [62]

Many additional factors thwart assessment of potential impacts on drinking water resources from surface spills. Being in mixtures affects chemical reactions and transport, as do local conditions such as ground permeability, rainfall events, the shallowness of groundwater, and the proximity to rivers or streams.[63]

Referencing one paper out of few on such effects, the EPA states:

> *"Their analysis also suggested that after a spill, a large fraction would enter the air and leave the soil; however, some constituents would be left behind in the water, soil, and biota compartments, which could effectively act as long-term contamination sources."*[64]

Overall, the EPA finds that:

> *"There is a lack of baseline surface water and ground water quality data. This lack of data limits our ability to assess the relative change to water quality from a spill or attribute the presence of a contaminant to a specific source."* [65]

And the EPA concludes that:

> *"The lack of information regarding the composition of chemical additives and fracturing fluids, containment and mitigation measures in use, and the fate and transport of spilled fluids greatly limits our ability to assess potential impacts to drinking water resources."*[66]

*Wastes brought to the surface and spilled are largely left in the environment*

During fracking operations, fracking fluids mix and undergo chemical reactions with ancient brines, which contain varied levels of various salts, metals and hydrocarbons. Overall the chemical composition of the wastewater generated by fracking — in terms of concentrations of salts, metals, hydrocarbons, injected fracking chemicals, and any reaction byproducts — varies with geology and, for each well, changes over time. Respectively, the terms "flowback" and "produced water" refer to hydraulic fracturing-related wastewaters before and after wells are brought into production. As would be expected, less of fracking chemicals are detected in the resulting wastewater as time goes by during production of oil and gas.

The EPA assesses that:

> *"Although varying within and between formations, shale and tight gas produced water typically contains high levels of TDS (salinity) and associated ionic constituents (bromide, calcium, chloride, iron, potassium, manganese, and sodium). Produced water may contain toxic materials, including barium, cadmium, chromium, lead, mercury, nitrate, selenium, and [benzene, toluene, ethylbenzene, and xylenes]."* [67]

Generally, the EPA finds that:

> *"The amount of fracturing fluid returned to the surface varies, and typically averages 10 % to 25%."*[68]

While the EPA states that:

> *"Flowback and produced water spills are known to have occurred across the country"*[69]

the agency also cautions that:

> *"spills of flowback and produced water present many uncertainties that, in combination, limit our ability to predict impacts on drinking water resources."*[70]

For example, the EPA's assessment of impacts from 457 spills identified as related to hydraulic fracturing focused on 225 spills of flowback and produced water, and on these spills, the EPA states the following:

> *"Of the volume of spilled flowback and produced water, 16% was recovered for on-site use or disposal, 76% was reported as unrecovered, and 8% was unknown. The potential impact of the unknown and unrecovered volume on drinking water resources is unknown."* [71]

That is, the EPA is only able to state, with certainty, that its

> *"analysis demonstrates that spills of chemicals, additives and fracturing fluids do occur at well sites and reach both soil and surface water receptors."*[72]

As for the frequency of releases, the EPA states:

> *"Estimates of spill frequencies at hydraulic fracturing sites in Colorado and Pennsylvania, including spills of produced water, ranged from approximately 0.4 to 12.2 spills per 100 wells."*[73]

The EPA continues:

> *"If the estimates are representative, the number of spills nationally could range from approximately 100 to 3,700 spills annually, assuming 25,000 to 30,000 new wells are fractured per year."* [74]

Given the more narrow scope of its assessment,[75] the EPA should note that its estimate is generally consistent with an analysis that found "at least 7,662 spills, blowouts, leaks and other mishaps in 2013 in 15 top states for onshore oil and gas activity."[76]

*Limitations preclude an assessment of the impacts from surface spills*

Overall, regarding the impacts from spills of flowback and produced waters, the EPA concludes that:

> *"Conclusive determination of impacts to water resources depends on commitment of resources to the implementation of sampling, analysis and evaluation strategies."*[77]

The implication is that a much larger effort is needed to determine, with any certainty, what the frequency and extent of impacts to drinking water resources are from spills and releases at the surface.

This is in stark contrast with the certainty of the topline of the EPA's press release.

### ***Contamination from injections and releases below ground***

Another impact that the EPA confirms is a reality for some communities is water well contamination from below ground, in the aftermath of hydraulic fracturing.

Chapter 6 of the assessment focuses on the potential for contamination of drinking water resources from below from injected fracking fluids as well as from released mixes of hydrocarbons and ancient brines full of salts and metals, sometimes including radioactive material.

*Questions remain open*

Compared to spills, the assessment of impacts from subsurface injections and releases is hindered heavily by inherent limitations to what can be observed.

Overall, the EPA again warns that limitations and uncertainties cloud the assessment, stating:

> *"The limited amount of information hinders our ability to evaluate whether—or how frequently — drinking water impacts are occurring (or the potential for these impacts to occur) or to tie possible impacts to specific well construction, operation, or maintenance practices. This also significantly limits our ability to evaluate the aggregate potential for hydraulic fracturing operations to affect drinking water resources or to identify the potential cause of drinking water contamination or suspected contamination in areas where hydraulic fracturing occurs."*[78]

The EPA adds that:

> *"Impacts to drinking water resources from subsurface liquid and gas movement may occur if casing or cement are inadequately designed or constructed, or fail. There are several examples of these occurrences in hydraulically fractured wells that have or may have resulted in impacts to drinking water resources. ... These cases illustrate how construction issues, sustained casing pressure, and the presence of natural faults and fractures can work together to create pathways for fluids to migrate toward drinking water resources."*[79]

These statements also provide stark contrast to the conclusiveness of the EPA's press release.

*Bringing released gas to the surface so it won't contaminate aquifers is no solution*

On the specific question of contamination of underground sources of drinking water due to the migration of shale gas, the EPA assesses:

> *"In most cases, the methane in the [water] wells likely originated from intermediate formations between the production zone and the surface; however, in some cases, the methane appears to have originated from deeper layers such as those where the Marcellus Shale is found."*[80]

The EPA's only apparent solution to this concern is more active production of natural gas, essentially bringing gas to the surface that might otherwise leak. Specifically, the EPA states:

> *" … gas production from the reservoir appears likely to mitigate gas migration, both by reducing the amount of available gas and depressurizing the induced fractures (which counters the buoyancy of any gas that my escape from the production zone into the connecting fracture)."*[81]

Maximizing production of shale gas is remade as a solution to contamination concerns with this statement.

*Artificially over-pressured wells present additional risks*

In recent years, a relatively large number of new oil and gas wells have been "shut-in" after fracturing, before being brought into production. The EPA states that:

> *"The potential for gas migration during shut-in periods following hydraulic fracturing and prior to production may be more significant, especially when out-of-zone fractures are formed. Without the producing gas well, the gas may rise via buoyancy, with any downward-flowing water from the aquifer displacing the upward-flowing gas."*[82]

Moridis et al. (DOE Lawrence Livermore National Lab, see below) intend for such scenarios to be a topic of future modeling.

*Methane contamination as possible harbinger of more problems to come*

As for contamination due to the migration of fracturing fluids or mobilized brines, the EPA found:

> *"Evidence shows that the quality of drinking water resource may have been affected by hydraulic fracturing fluids escaping the wellbore and surrounding formation in certain areas, although conclusive evidence is currently limited."*[83]

Among the uncertainties acknowledged in the assessment is that expanded drilling and fracking increases the connectivity of contamination pathways:

> *"Based on the information presented in this chapter, the increased deployment of hydraulic fracturing associated with oil and gas production activities, including techniques such as horizontal drilling and multi-well pads, may increase the likelihood that these pathways could develop. This, in turn, could lead to increased opportunities for impacts on drinking water resources."*[84]

The EPA also states that such contamination may take years to become apparent:

*"Given the surge in the number of modern high-pressure hydraulic fracturing operations dating from the early 2000s, evidence of any fracturing-related fluid migration affecting a drinking water resource (as well as the information necessary to connect specific well operation practices to a drinking water impact) could take years to discover."*[85]

The fact that oil and gas wells age and degrade over time adds to concern about a long-term legacy of risk to underground sources of drinking water. The EPA states that:

*"Moreover, aging and use of the well can contribute to casing degradation, which can be accelerated by exposure to corrosive chemicals, such as hydrogen sulfide, carbonic acid, and brines."*[86]

<u>These statements provide more stark contrast to the conclusiveness of the EPA's press release.</u>

*Unintended well-to-well communication*

Another mechanism of contamination follows when fractures intersect with adjacent wells. The EPA assesses that:

*"Liquid and gas movement from the production zone to underground drinking water resources may also occur via other production wells or injection wells near hydraulic fracturing operations. Fractures created during hydraulic fracturing can intersect nearby wells or their fracture networks, resulting in the flow of fluids into those wells. These well communications, or "frac hits," are more likely to occur if wells are close to each other or on the same well pad. In the Woodford Shale in Oklahoma, the likelihood of well communication was less than 10% between wells more than 4,000 ft (1,219 m) apart, but rose to nearly 50% between wells less than 1,000 ft (305 m) apart (Ajani and Kelkar, 2012). If an offset well is not able to withstand the stresses applied during the hydraulic fracturing of a neighboring well, well components may fail, which could result in a release of fluids at the surface from the offset well. The EPA identified incidents in which surface spills of hydraulic fracturing-related fluids were attributed to well communication events.*[87]

Also, some fracking is done "where oil and gas resources and drinking water resources co-exist in the same formation," which means injecting "fracturing fluids into formations that may currently serve, or in the future could serve, as a source of drinking water for public or private use."[88]

In addition to such fracking operations, the EPA adds (emphasis added):

*"There are other cases in which production wells associated with hydraulic fracturing are alleged to have caused drinking water contamination. Data limitations in most of those cases (including the unavailability of information in litigation settlements resulting in sealed documents)* ***make it impossible*** *to definitively assess whether or not hydraulic fracturing was a cause of the contamination in these cases."*[89]

<u>This impossibility is what explains the most detailed language used in the Northeast Pennsylvania retrospective study, which went not further than simply indicating that methane contamination from depth at five wells was likely.</u>

***Contamination due to waste treatment and disposal problems***

Liquids and solid waste treatment and disposal problems generate a third and final category of "important vulnerabilities" that the EPA identifies in its assessment, and again these vulnerabilities have translated to actual impacts on drinking water resources and communities. These wastes include drill cuttings, drilling muds, and drilling and fracking wastewaters, residuals from treatment, and any sludge and scale that accumulate in industry equipment.

### *Questions remain open*

Again, overall, the EPA warns that data limitations and uncertainties cloud the assessment impacts from the disposal of such wastes, stating:

> *"A full understanding of the practices being used for management of hydraulic fracturing wastewaters is limited by a lack of available data in a number of areas. … data vary from state to state … data are also generally difficult to locate for production volumes, chemical composition, masses, and management and disposal strategies for residuals."*[90]

The EPA's incapacity to conduct site-specific investigations — due in part to the enormous complexity and thus expense of such undertakings — meant the assessment could only generalize about the risk:

> *"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."*[91]

Another limitation comes from the inherent difficulty of preventing unlawful releases.
On this, the EPA states:

> *"… unauthorized discharges represent both documented and potential impacts on drinking water resources. However, data do not exist to evaluate whether such episodes are uncommon or whether they happen on a more frequent basis and remain largely undetected."*[92]

### *Radioactive material*

The presence of radioactive material in wastes from hydraulic fracturing-related activities is a particular concern. In presenting research used in the assessment, the U.S. Geological Survey explains:

> *"Radium dispersed to soils, sludges, and sediments from the brines can undergo long-term low-level leaching into water bodies, but release can be accelerated with sudden changes in soil or water chemistry. The disposition of Ra-enriched waste fluids and solids in relation to drinking water supplies has yet to be quantified, but the health risk of radium ingestion, from any source, is associated with increased human cancer risk (U.S. Environmental Protection Agency, 1999). The health risk is proportional to the exposure as radium is readily stored in bone from where it emits radioactivity into bone and surrounding tissue. The Maximum Contaminant Level (MCL) in drinking water for combined radium isotopes 226Ra and 228Ra and the alpha particles emitted during radium decay is not to exceed 5 and 15 (pCi/L), respectively (U.S. Environmental Protection Agency, 2000). The establishment of an MCL is based on the Maximum Contaminant Level Goal (MCLG), whereby EPA considers the risk to sensitive subpopulations (infants, children, the elderly, and those with compromised immune systems) of experiencing a variety of adverse health effects."*

### *Leaching from landfills*

The EPA summarizes a study that estimated the potential for leaching from landfills receiving large amounts of drilling and fracking solid wastes, stating:

> *"The extent of leaching varied by constituent and by fluid type; the data illustrate the possibility of leaching of these constituents from landfills."*[93]

North Carolina's Department of Environment and Natural Resources, under previous administration, warned that layers of cuttings could result in plugging of the landfill and to eventual spills of landfill leachate, which is enriched with diverse contaminants, including radioactive material.[94]

The EPA assesses that

> *"... solid wastes from hydraulic fracturing in the Marcellus accounted for 5% of the weight of waste deposited in landfills in the area, with some area landfills reaching as high as 60% landfill mass coming from hydraulic fracturing activities."*[95]

Ultimately, the EPA is only able to conclude that:

> *"Solid residual wastes [i.e., byproducts from waste treatment] have the potential to impact the quality of drinking water resources if contaminants leach to groundwater or surface water. In a recent study by PA DEP, radium was detected in leachate from 34 of 51 landfills, with radium-226 concentrations ranging from 54 to 416 pCi/L, and radium-228 ranging from 2.5 to 1,100 pCi/L (PA DEP, 2015b)."*[96]

<u>The presence and ultimate fate of radioactive material brought to the surface due to fracking-related activities remains under-evaluted, again providing stark contrast to the conclusiveness of the EPA's press release.</u>

*Land spreading*

Drilling and fracking wastes have been disposed of by simply spreading it out over large areas of land, with obvious impacts on watersheds. Interestingly, as far as the significance of the impacts, the EPA passes on a lesson learned about the complexity of biogeochemistry, and how previously unseen, uncertain mechanisms can lead to significant differences in the scale of a contamination event.

The EPA states:

> *"In managing solid wastes from oil and gas production, a study on land application of oilfield scales and sludges suggested that radium in samples became more mobile after incubation with soil under moist conditions, due to microbial processes and interactions with the soil and water (Matthews et al., 2006). Overall, potential effects from land application on drinking water resources are not well understood."*[97]

<u>Clearly there should be no land-spreading.</u>

*More expensive treatment, with more concentrated radioactive waste*

Aside from underground injection disposal, treatment and removal of radioactive material in oil and gas industry wastes faces its own set of problems. According to the EPA,

> *"Data on radionuclide removes achieved in active treatment plants are scarce. The literature does provide some data from the Marcellus Shale region on use of distillation and chemical precipitation (co-precipitation of radium with barium sulfate). The nine-month pilot-scale study conducted by Bruff*

*and Jikich (2011) showed that distillation treatment could achieve high removal efficiencies for radionuclides (see Table 8-6), and Warner et al. (2013b) reported that a CWT achieved over 99% removal of radium via co-precipitation of radium with barium sulfate. However, in both studies, radionuclides were detected in effluent samples, and the CWT was discharging to a surface water body during this time (Warner et al., 2013b; Bruff and Jikich, 2011); see Section 8.6.2."*[98]

*Impacts on treatment facilities and public water systems*

Treatment of fracking wastewater at publicly owned treatment works (POTWs) results in additional problems, including the formation of scale deposits on equipment at POTWs. The EPA states:

*"Radionuclide accumulation in CWTs or POTWs may continue to affect the plant even after discontinuing treatment of high radionuclide wastewater. ... Monitoring would be needed in order to ascertain the potential for accumulation and release of radionuclides from systems that have treated or continue to treat hydraulic fracturing wastewaters with elevated TENORM concentrations.*[99]

Also, effluent from fracking wastewater treatment at POTWs can also generate disinfection byproducts that can be a problem for public water systems downstream. The EPA states:

*"Hydraulic fracturing wastewater discharged from treatment facilities without advanced TDS removal processes has been shown to cause elevated TDS, bromide, and chloride levels in receiving waters in Pennsylvania. ... Bromide in particular is of concern due to the formation of disinfection by-products (DBPs) during disinfection. Some types of DBPs are regulated under SDWA's Stage 1 and Stage 2 DBP Rules, but a subset of DBPs, including a number of chlorinated, brominated, nitrogenous, and iodinated DBPs, are not regulated. ... Modeling suggests that very small percentages of hydraulic fracturing wastewater in a river used as a source for drinking water treatment plants may cause a notable increase in DBP formation.*[100]

Oil and gas industry wastewater disposal remains an unsolved problem, given complications from available treatment and management options above ground. And of course injections below ground are causing earthquakes.[101]

## Limitations of the EPA's Own Making

### EPA neglected to conduct any prospective studies

Because after-the-fact studies of contamination are difficult, the EPA had planned prospective studies, which would include baseline data on water quality and elaborate monitoring over time, from drilling and fracking the well to production. But the agency was not able to come to terms with any companies over site access or plans for monitoring and oversight.

Importantly, to see precisely why and how contaminants are leaking from some fracked wells, the EPA would likely needed to have monitored hundreds of individual wells as closely as technologically possible. Nonetheless, oil and gas companies would not accept the spotlight and close regulatory scrutiny on their fracking operations even once.

This is despite the EPA having withdrawn its emergency order against Range Resources, regarding a case of contamination in Parker County, Texas, in exchange in part for the company's agreement to participate in the assessment.[102]

On its failure to conduct a single prospective study for the assessment, the EPA states:

> *"We have been unable to find a suitable location that meets both the scientific criteria of a rigorous prospective study and the business needs of potential partners. For a location to be suitable, it is necessary to gather a minimum of one year of characterization data for ground water and surface water prior to and following unconventional exploration activities in the study area, and for there to be no other hydraulic fracturing activities on adjacent properties during the entire study period, which could last several years. Since we have been unable to identify suitable locations within the timeframe of the study, results from prospective case studies will not be available in time to inform the development of the study's draft assessment report."*[103]

This adds to the agency's failure to carry out investigations, after the fact, of contamination in Dimock, Pennsylvania, Pavillion, Wyoming and Parker County, Texas.

### EPA's authority over hydraulic fracturing activities

The EPA declined to compel companies to cooperate with the assessment, and the Obama Administration has failed to ensure that the EPA gather adequate data relevant to answering questions about impacts.

To some extent, necessary data is aside from what industry considers relevant to its primary scientific focus, maximizing unconventional oil and gas production, and therefore was not acquired.
But the EPA's failure to acquire adequate data also derives from the fact that oil and gas corporations — inheriting a legacy of decades of federal policy that promotes production— enjoy exemptions from key statutes in the major environmental laws. These exemptions continue to be maintained by Congress.

According to the "Halliburton loophole" in the Energy Policy Act of 2005, an injection of fluid for the purpose of fracturing does not fall under jurisdiction of EPA UIC under SDWA (unless the fluid includes "diesel"). Injections of brine and flowback and other fluids from oil and gas industry are not exempted, when the purpose of the injection is disposal, or when injecting the fluids is done to increase production from an adjacent well, through so-called water flooding. Again, impacts on drinking water resources from disposal operations, and from water-flooding (and cyclic-steam injection) sites, are not included in the scope of the assessment.

Fracking is also exempt under the Resource Conservation and Recovery Act (RCRA) subtitle C from being considered hazardous waste, but fracking-related solid wastes are still covered under subtitle D. Section 7003 allows the EPA to address situations where the handling, storage, treatment, transportation, or disposal of any solid or hazardous waste may present such an endangerment. In these situations, the EPA can initiate judicial action or issue an administrative order to any person who has contributed or is contributing to such handling, storage, treatment, transportation, or disposal to require the person to refrain from those activities or to take any necessary action.

The EPA should issue a RCRA section 7003 corrective action on solid wastes from hydraulic fracturing-related activities, and force industry to cooperate fully in investigations.

## Limitations beyond the EPA's control

### Computational complexity

A key aspect of the assessment was based on research led by George Moridis of Lawerence Berkeley National Laboratory, under contract with the EPA.

Moridis et al. have begun to simulate simplistic versions of different contamination scenarios on the scale of a single well, and sampled a selection of parameters that stem from assumptions about pathways and flow.

Moridis et al. have also identified areas of important future research, working toward questions that can be posed using more realistic numerical models of contamination scenarios.

For example, simplistic single-well simulations of over-pressured shale formations — meaning there is a force that would presumably push up subsurface fluids, such as gas and formation liquids — is yet to be conducted. Simulations thus far are simplistic, and do not approach being able to approximate flows, over long periods of time, on the spatial scale of widespread drilling and fracking in a region.

However, the final assessment should include an outlook on the extent to which sampling important parameters in such simulations will become computationally intractable, as the dimensionality of parameter spaces utilized increases, and more sample points per dimension are needed.

## Hazards from chemicals released at oil and gas sites remain largely unstudied

### *Incomplete disclosure*

In Chapters 5, the EPA looked at the chemicals mixed into water to create fracking fluids, using information from the largely voluntary chemical disclosure site FracFocus, and examined available data about spills of these chemicals at or near well sites.

Fracking fluid chemical trade secret protections limited the EPA's assessment of these chemicals. According to EPA:

> *"As part of the EPA's analysis, more than 39,000 FracFocus 1.0 disclosures over the period January 1, 2013 to March 1, 2013 were analyzed and more than 70% of disclosures contained at least one chemical designated as [confidential business information]. Of the disclosures containing CBI chemicals, there was an average of five CBI chemicals per disclosure."* [104]

Also, about half of the reports on fracking chemicals are from Texas and 90 percent are from Texas, Oklahoma, North Dakota, and Pennsylvania. As such, the EPA states:

> *"The EPA's analysis may or may not be nationally representative."* [105]

This is potentially most true in Florida and California, where oil source rock formations are distinctly different than other shale plays.

### *Basic knowledge concerning hazards is lacking*

Basic knowledge about the potential mobility, transformation and toxicity of the chemicals identified is lacking. The EPA states:

> *"Of the 1,076 hydraulic fracturing fluid chemicals identified by the EPA, 623 did not have estimated physicochemical properties reported in the EPI SuiteTM database. Knowing the chemical properties of a spilled fluid is essential to predicting how and where it will travel in the environment. Although we can make some generalizations about the physicochemical properties of these chemicals and how spilled chemicals may move in the environment."*

That is, there is next to no information about the environmental consequences of past and future releases of fracking chemicals into environment for over half of the chemicals identified.

Additionally, just over ten percent of the chemicals identified by EPA have been assigned values for estimating the health impacts form chronic exposure, indicating vast unknowns with respect to the chemical hazards involved.

The EPA states (emphasis added):

> *"A reference value (RfV) is an estimate of an exposure for a given duration to the human population (including susceptible subgroups) that is likely to be without an appreciable risk of adverse health effects over a lifetime. RfV is a generic term not specific to a given route of exposure. In the context of this chapter, the term RfV refers to reference values for noncancer effects occurring via the oral route of exposure and for chronic durations, except where noted."*

> *"An oral slope factor (OSF) is an upper-bound, approximating a 95% confidence limit, on the increased cancer risk from a lifetime oral exposure to an agent. This estimate, usually expressed in units of proportion (of a population) affected per mg/kg day, is generally reserved for use in the low dose region of the dose response relationship, that is, for exposures corresponding to risks less than 1 in 100."*[106]

> *¨Of the 1,173 chemicals identified by the EPA, only 147 (13%) have federal, or state, or international chronic oral RfVs and/or OSFs from sources listed in Table 9-1. Therefore,* ***chronic RfVs and/or OSFs from the selected sources are lacking for 87% of chemicals that the EPA has identified as associated with hydraulic fracturing****."*[107]

The EPA assessment then notes:

> *"… approximately 35% of FracFocus ingredient records were not able to be assigned standardized chemical names. These ingredient records were excluded from the EPA's analysis."*[108]

Ultimately, regarding the chemical hazards related to hydraulic fracturing, the EPA assessment concludes (emphasis added):

> *"There are several notable uncertainties in the chemical and toxicological data that limit a comprehensive assessment of the potential health impacts of hydraulic fracturing on drinking water resources. For the purposes of this chapter, the lack of RfVs and OSFs from the sources meeting stringent selection criteria is the most significant data gap. For instance, of the 32 chemicals (excluding water, quartz, and sodium chloride) that are used in ≥10% of wells nationwide according to FracFocus, federal chronic RfVs were only available for 7 chemicals. Without these reliable and peer reviewed data,* ***comprehensive hazard evaluation and hazard identification of chemicals is difficult, and the ability to consider the potential cumulative effects of exposure to chemical mixtures in hydraulic fracturing fluid, flowback, or produced water is limited. Consequently, potential impacts on drinking water resources and human health may not be assessed adequately****."*[109]

The EPA finally states that:

> *"Additionally, chemical analysis of flowback and produced water may be challenging, because high levels of dissolved solids in flowback and wastewater can interfere with chemical detection. As a*

*result, it is likely that there are chemicals of concern in flowback and produced water that have not been detected or reported."*[110]

## The EPA is failing to protect

By clouding the findings of the study, and leaving major questions open ended, oil and gas corporations have succeeded in projecting their vision for the future of U.S. energy policy: decades more drilling and fracking to extract as much unconventional oil and gas as possible. Wall Street has billions on the line, and more planned. By whitewashing the findings of the assessment, the Obama Administration has cemented its alliance with these interests, and a vision of energy security that embraces extreme oil and gas production. .

The EPA simply states that:

> *"… hydraulic fracturing is expected to continue to expand and drive an increase in domestic oil and gas production in coming decades. As a result, hydraulic fracturing will likely increase in existing locations, while also potentially expanding to new areas."*[111]

The problem —with respect to not just our drinking water resources —is that building sustainable energy systems in a way that creates rather than destroys wealth in communities, meets energy needs affordably, and addresses climate change will require keeping as much unconventional oil and gas as possible underground.

The ultimate outcome of the assessment is illustrated by the EPA's call for continued study of the different areas of impacts:

> *"We hope the identification of limitations and uncertainties will promote greater attention to these areas through pre- and post-hydraulic fracturing monitoring programs and by researchers."*[112]

The consequence is day-to-day collateral damage is mounting, at the same time climate change from climate pollution brings increasingly widespread, system impacts to drinking water resources. Thus, to the extent that it permits maximizing oil and gas extraction, the EPA's assessment of fracking's impacts on drinking water resources fails to protect. The final assessment ought to acknowledge this truth.

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[1] U.S. Environmental Protection Agency (EPA). [Press release]. "EPA Releases Draft Assessment on the Potential Impacts to Drinking Water Resources from Hydraulic Fracturing Activities." June 4, 2015.
[2] Robbins, Denis. "What media left out of EPA fracking stories: `Insufficient' data, lack of `any certainty.'" *MediaMatters.* June 5, 2015.
[3] U.S. EPA. "EPA's Full Draft Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources." June 4, 2015 at ES-23.
[4] Data Quality Act. Public Law 106-554 Section 515.
[5] Kogan, Lawrence A. "Revitalizing the Information Quality Act as a procedural cure for unsound regulatory science: A greenhouse gas rulemaking case study." Washington Legal Foundation. Critical Legal Issues Working Paper Series. No. 191. February 2015 at ix.
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