

FRACKING BEYOND THE LAW

Despite Industry Denials, Investigation Reveals
Continued Use of Diesel Fuels in Hydraulic Fracturing



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THE ENVIRONMENTAL INTEGRITY PROJECT

The Environmental Integrity Project (EIP) is a nonpartisan, nonprofit organization established in March of 2002 by former EPA enforcement attorneys to advocate for effective enforcement of environmental laws. EIP has three goals: 1) to provide objective analyses of how the failure to enforce or implement environmental laws increases pollution and affects public health; 2) to hold federal and state agencies, as well as individual corporations, accountable for failing to enforce or comply with environmental laws; and 3) to help local communities obtain the protection of environmental laws. Visit our website at <http://www.environmentalintegrity.org>.

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Photo on page 2 from the Monroe County (Ohio) Emergency Management Agency.

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Executive Summary

The United States Environmental Protection Agency (EPA) reconfirmed in recent guidance that drilling operators are prohibited from injecting diesel fuels to hydraulically fracture oil and gas wells unless authorized by a Safe Drinking Water Act permit. An Environmental Integrity Project (EIP) investigation into the industry's compliance with this mandate identified 351 unpermitted wells fracked with diesel fuels between 2010 and July 2014 by 33 different companies across 12 states, with Texas, Colorado, and North Dakota indicating the highest volumes injected. EIP's identification and analysis of these wells was based on data submitted by the industry to the fracking chemical disclosure registry, FracFocus, and EPA public records.



Fracking with diesel fuel can pose a risk to drinking water and human health because diesel contains benzene, toluene, and other chemicals that have been linked to cancer and other health problems. This 2014 photograph shows gas wells next to a residential neighborhood in southwest Pennsylvania.

In 2005, Congress stripped EPA of its authority under the Safe Drinking Water Act to regulate injection of fracking fluids, except diesel fuels, as part as what is known as the “Halliburton Loophole.” Congress left intact EPA’s authority to regulate diesel fuels because they contain high levels of benzene, ethylbenzene, toluene or xylene (known as BTEX), chemicals that are highly mobile in groundwater and that are known to cause cancer or other significant health effects. In the past decade, and as recently as February 2014, the industry repeatedly has asserted that the use of diesel fuels in fracking no longer occurs.

Yet EIP identified these 351 wells and found no evidence that any of the wells’ operators applied for or received a Safe Drinking Water Act permit.¹ A June 2014 report by the U.S. Government Accountability Office addressed the continued use of diesel in the fracking process, and specifically noted that none of the state programs reviewed for the report had issued Safe Drinking Water Act permits. Moreover, EIP identified numerous fracking fluids with high diesel content for sale online, including over a dozen products offered by Halliburton (advertised as additives, friction reducers, emulsifiers, solvents, etc.) Operators are clearly buying these products without obtaining permits to use them. In addition, EIP’s review of diesel products available online found no indication that Halliburton or any other supplier is informing customers that injection of diesel products is prohibited unless authorized by a Safe Drinking Water Act permit.

Permit programs are essential to EPA and the states' environmental missions, and in this case, the purpose of Safe Drinking Water Act permits is to protect human health by ensuring, for this generation and those that follow, that fracking activities do not contaminate or threaten existing or potential sources of drinking water. These threats to health and water are not just theoretical. Pennsylvania released public information in July 2014 indicating that fracking "damaged" public water supplies 209 times since the end of 2007. A multi-day fire and up to 30 explosions from a fracking-related mishap on a well site owned by Statoil occurred on June 28, 2014, in Clarington, Ohio. Halliburton was fracking the well and was on site at the



A fire and explosions at this well in Clarington, Ohio, in June 2014 involved 16 different fracking products, including diesel fuel. The accident polluted miles of a nearby stream and caused a significant fish kill.

time of the accident, which involved at least 16 different fracking products (including 9,000 gallons of diesel). In addition to potential impact to drinking water supplies, approximately 70,000 fish were killed (as far as three and a half miles downstream) as a result of the uncontained chemicals and well flowback.

The true number of wells fracked with diesel is likely much larger than the 351 wells identified in this report. There are a number of reasons for this, including: 1) well operators can assert trade secret claims, which are not subject to verification, and

thereby avoid disclosing diesel use; 2) there are numerous flaws in the way users can search and access FracFocus data, resulting in the under-identification of wells fracked with any particular mixture or chemical, including diesel; 3) FracFocus allows well operators to amend or replace disclosures, at any point in time, without leaving a record of the change; and 4) companies like Halliburton continue to produce fracking fluids that contain diesel fuels, which means operators are purchasing and using them to frack wells—regardless of whether they are disclosed.

Through its investigation, EIP learned that some well operators have replaced—and continue to replace—their original FracFocus disclosures (that reported the injection of diesel fuel) with new disclosures that no longer indicate injection of diesel fuel. This is curious given that many of the disclosures EIP first identified were changed *after* EPA issued its draft guidance on the use of diesel in hydraulic fracturing in May 2012 and then others were replaced *after* the guidance became final in February 2014.² In short, whether through trade secret claims, changing disclosures, or outright failure to reveal the use of products that contain diesel, the industry is under-reporting both the frequency and amount of diesel fuels used.

Unfortunately, diesel fuels are not the only fracking fluids that pose significant threat to human health, which is why the Halliburton Loophole is both wrong and potentially dangerous. A quick search on FracFocus reveals the injection of countless different products and mixtures that contain BTEX chemicals (some at concentrations significantly higher than what are present in diesel fuels) as well as

other dangerous chemicals, such as acrylamide, a known carcinogen. Despite the risks posed, EPA lacks authority to regulate the injection of these chemicals—at least when oil and gas operators are doing the injection.

When Congress manipulates environmental statutes for the benefit of polluters and ignores best available science, double standards like the Halliburton Loophole are born. Congress should fix its mistake and restore EPA's authority to require safe practices at oil and gas injection wells, though today's political climate renders the possibility remote. But until that happens, diesel fuels are unique in that they presently are the only category of fracking fluids subject to permitting under the Safe Drinking Water Act. For this reason, EIP urges the following:

- EPA and the states must exercise their authority over diesel fuels by investigating the compliance status of these 351 wells and by taking all necessary steps to ensure that these and any other wells are properly permitted.
- Operators should voluntarily agree to disclose the concentration of diesel and other BTEX chemicals in all fracking fluids, regardless of potential proprietary, trade secret claims. This is important both for the safety of communities impacted by fracking and to preserve and protect current and future sources of drinking water.
- Companies that continue to supply diesel-containing fracking products should be required to label their products and notify operators of the need to obtain permits prior to fracking.
- States should list diesel-based fracking products that require a permit.
- The operators of FracFocus should improve the database's transparency and accountability, and address the under-identification issue.

Taking these steps would help alleviate the public health concerns that arise when private economic and political interests, not science, dictate environmental decision-making.



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Background

In 2005, Congress enacted the Energy Policy Act, which among other things, exempted hydraulic fracturing activities from key requirements of the Safe Drinking Water Act and the Clean Water Act. Adding to the oil and gas industry's vast list of exemptions from other federal environmental laws, these exemptions have come to be known as the Halliburton Loophole—named for then-Vice President Dick Cheney's former company that is largely credited with inventing the controversial technique in the 1940s.



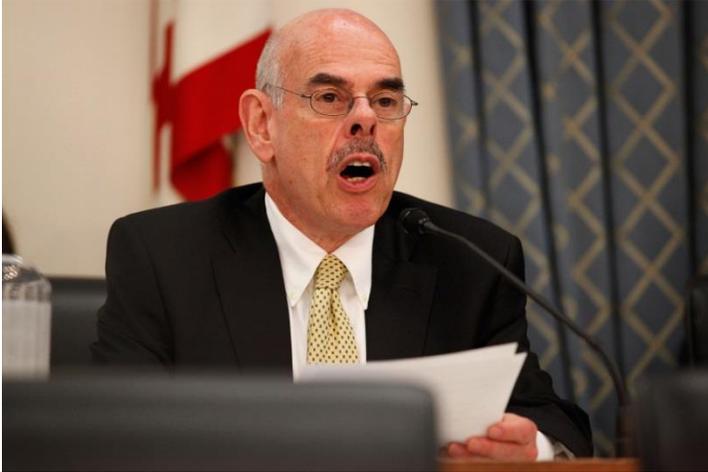
Because of the Halliburton Loophole, chemicals used to frack wells and the wastes generated from production can be stored or disposed in ways that other industries using similar chemicals are prohibited from doing. This is particularly problematic because wells are fracked using an array of chemicals that are known carcinogens or that create significant other health risks when consumed or inhaled, including neurological damage, liver and kidney damage, or anemia. After all, human exposure to fracking chemicals such as benzene (a component of diesel fuel) is dangerous regardless of its source and irrespective of whether Congress stripped EPA of its authority to prevent its release into the environment.

Hydraulic fracturing produces large amounts of waste water that often contains pollutants and toxic chemicals. Shown here is a wastewater containment pond in Pennsylvania.

But sometimes even loopholes have loopholes. Despite Congress' sweeping move to undercut EPA's authority to protect public health and the environment from fracking, lawmakers allowed the agency to retain its authority in the Safe Drinking Water Act to regulate underground injection of diesel fuels.³ This is because diesel contains chemicals such as benzene, toluene, ethylbenzene, and xylene (known as BTEX) that are highly mobile in groundwater and pose significant threat to human health. EPA regulates the injection of diesel fuels by prohibiting the practice except where the permitting authority (either EPA or states that have been granted primacy to enforce the program) has issued a Safe Drinking Water Act permit.⁴

This seems simple enough. Well operators who inject diesel fuels must first obtain a permit designed to ensure that no fluid escapes the well and threatens an underground source of drinking water. This is especially important during the fracturing process, where up to five million gallons of liquid is injected under very high pressure. Well operators who inject diesel fuels without first obtaining a Safe Drinking Water Act permit are in violation of the act and are subject to enforcement, including the assessment of civil penalties.

This surviving permit requirement—which includes safeguards such as mechanical integrity testing and groundwater monitoring—should be good news for both public health and the environment. But there is a problem: the requirement is not being enforced. EIP's investigation did not uncover a single permit or pending permit



U.S. Representative Henry Waxman and House Democrats led a 2011 investigation of diesel in hydraulic fracturing that found a lack of required permits and apparent violations of the Safe Drinking Water Act. Years later, the problem continues, despite denials by the drilling industry.

representing the majority of U.S. oil and gas producers, that “diesel fuel is simply not used in fracturing operations,” the Congressional investigation concluded otherwise.⁶ In fact, 12 of the 14 companies that agreed to voluntarily disclose the ingredients of their fracking fluids to Congressional investigators—including proprietary and trade secret products—admitted using millions of gallons of diesel fuels between 2005 and 2009. The letter to Lisa Jackson concluded by noting that the failure of these companies to obtain permits for diesel fuel use in hydraulic fracturing appeared to be a violation of the Safe Drinking Water Act.⁷

application and neither EPA nor the states are taking steps to address the industry’s apparent lack of compliance. This is concerning, especially since the problem is not new. In 2011, House Democrats sent a letter to then-EPA Administrator Lisa Jackson highlighting the results of an investigation into the continued unpermitted use of diesel fuel in fracking fluids.⁵ Despite industry assurances that diesel use had been discontinued, dating back as far as 2003 and including a 2010 statement by Energy In Depth, a group

New EPA Guidance on Diesel in Fracking Fluids

A little over a year later (May 2012), EPA sought comments on draft guidance clarifying the definition of “diesel fuels” for Safe Drinking Water Act permitting purposes.⁸ The draft guidance proposed that permit writers should consider the term “diesel fuels” to include products or ingredients identified by one of six Chemical Abstracts Services Registry Numbers (CASRN or CAS) or their associated common synonyms, including diesel fuel, diesel oil, kerosene, kerosine, distillates, and light distillate fuel oils. EPA stated that it selected the six CAS numbers (and associated common synonyms) because they met the chemical and physical properties of “diesel fuel” as provided in the Toxic Substance Control Act Inventory:

Diesel fuel is a complex combination of hydrocarbons produced by the distillation of crude oil. It consists of hydrocarbons having carbon numbers predominantly in the range of C₉ through C₂₀ and boiling in the range of approximately 163 °C to 357 °C (325 °F to 675 °F).⁹

EPA issued its final guidance on February 12, 2014, citing the health risk and high mobility of certain aromatic hydrocarbon compounds, including BTEX, present in diesel fuel.¹⁰ Instead of adopting the definition of diesel fuels proposed in 2012, or any of the other broader, more inclusive definitions considered in the draft guidance, the agency directed federal and state permit writers to consider a smaller

group of products encompassing five CAS numbers.¹¹ EPA's stated rationale for narrowing the definition was that the diesel fuels identified in the final guidance contain up to 25 percent aromatic hydrocarbons by weight and can also contain 20 to 60 percent polynuclear aromatic hydrocarbons by volume.¹² This represented a significant tailoring of EPA's scope of authority to regulate this activity under the Safe Drinking Water Act.

EPA's carefully tailored, final guidance illustrates the agency's historic reluctance to enforce this important provision of the Safe Drinking Water Act, even though the use of diesel fuels in fracking poses a clear health risk. Ten years ago, EPA stated that a voluntary 2003 Memorandum of Agreement between the agency and the three largest hydraulic fracturing companies at the time (BJ Services Company, Halliburton Energy Services, Inc., and Schlumberger Technology Corp.) "accomplished the intended goal of removing diesel from hydraulic fracturing fluids in a matter of months."¹³ Some state governments continue to believe that diesel fuel is no longer used in fracking. For instance, a 2010 list of chemicals used by hydraulic fracturing companies still posted on the Pennsylvania Department of Environmental Protection's website includes the notation "Diesel: Use Discontinued."¹⁴ A report issued by the United States Government Accountability Office (GAO) in June 2014 stated that seven of the eight state programs it reviewed were under the impression that diesel was no longer being used in their states.¹⁵

In 2014, more than three years after being confronted with a Congressional investigation that yielded irrefutable evidence to the contrary, EPA seems to have wakened. However, the final guidance issued by the agency significantly narrowed the universe of diesel fuels now deemed subject to Safe Drinking Water Act permitting requirements. Following the release of the 2014 guidance, the drilling industry continues to suggest that use of diesel fuel in fracking is a non-issue because it has been discontinued. "Based on actual industry practices, diesel fuel use has already been effectively phased out of hydraulic fracturing operations," said Lee Fuller, Vice President of Government Affairs at the Independent Petroleum Association of America, in a February 2014 statement to the media.¹⁶



The Environmental Integrity Project's Investigation

The Environmental Integrity Project (EIP) wanted to know whether the problem was as small—even nonexistent—as industry and regulators perceive. Thus, EIP purchased data from PIVOT Upstream Group, a Houston-based consulting firm that has taken the well-known FracFocus data and aggregated it into a searchable database that can be readily analyzed. Although PIVOT aggregates the data and packages it for sale, the firm retains copies of all of the disclosures it obtained through FracFocus and records the date on which each disclosure was collected.¹⁷

Analysis of the PIVOT data by EIP revealed there were 465 wells fracked with one of the five CAS numbers identified in the February 2014 guidance at the time PIVOT collected the data. EIP's subsequent verification of PIVOT's data—which entailed entering each API well number and comparing PIVOT's data to the current FracFocus disclosure—revealed that six operators, who collectively fracked 143 wells in 2011 and 2012, changed their FracFocus disclosures *after* PIVOT collected their data (PIVOT's collection of these disclosures occurred mostly in June 2012, but a few were obtained in August and October 2012). In other words, the indication of diesel use had been removed from all 143 of these well disclosures.

But at some point between June and October 2012 (when PIVOT conducted its data collections), the six operators of these 143 wells reported the combined injection of 168,971 gallons of diesel fuel as defined by EPA in its February 2014 guidance.¹⁸ Yet searching FracFocus today, there is no way to discover that these companies *ever* had reported *any* diesel use. Curiously, all of these disclosures were changed *after* EPA issued the May 2012 draft guidance. Through the process of verification of PIVOT's data, as well as subsequent FracFocus searches and responses obtained from EPA public records requests,¹⁹ EIP determined there were at least 351 wells fracked with diesel, by 33 different operators across 12 states, between 2010 and mid-July 2014.²⁰ Most of these wells were fracked with either kerosene (CAS no. 8008-20-6) or diesel (CAS no. 68476-34-6). EIP verified, at least once between June 18 and August 5, 2014, that the FracFocus disclosures for all 351 wells indicated the use of diesel.²¹

However, recent spot checks by EIP reveal that some of the 351 well disclosures were changed just in the last few weeks, and no longer indicate diesel injection.²² The fact that operators can replace original FracFocus disclosures—without leaving any record of or providing any justification for the change—is a serious problem. These operators, who removed reference to diesel use after significant EPA action, should be asked to account for their changed disclosures.²³ All of the 143 well disclosures from the PIVOT data were changed after issuance of EPA's May 2012 draft guidance and some portion of the 351 disclosures identified in this report were changed after issuance of the final guidance in February 2014. Evidence of diesel use should not simply disappear from public disclosures because EPA issues guidance signaling its renewed interest in enforcing the Safe Drinking Water Act prohibition against diesel fuel injection. This phenomenon illustrates well why regulatory environmental programs, and not voluntary measures, are necessary both to ensure transparency and accountability and to provide appropriate human health and environmental safeguards.

Like PIVOT, EIP retained copies of the well disclosures analyzed between June 18 and August 5, 2014. Because there is no way to account for operators who are removing the indication of diesel use from their disclosures, this report focuses on the 351 wells identified during this time period.

TABLE 1: TOTAL VOLUME OF DIESEL CHEMICALS INJECTED AND TOTAL WELLS, BY STATE²⁴

State	Total Volume Diesel of Chemicals Injected (gal)	Total Wells
TX	12,808.25	27
CO	9,173.06	16
ND	4,778.51	32
AR	1,989.67	172
OK	1,465.68	23
WY	1,310.32	3
NM	751.92	40
UT	496.91	1
KS	153.71	4
PA	21.96	25
WV	0.74	7
MT	N/A	1
Total	32,950.73	351

It is important to keep in mind that both the number of wells identified in this report and the corresponding volume of diesel injected do not account for the complete universe of wells fracked using one of the five diesel fuel products identified in EPA’s February 2014 guidance. There are a number of reasons for this, including: 1) very few operators disclosed to FracFocus in 2010 and data has only begun coming in for 2014; 2) some, but not all, states require disclosure to FracFocus; 3) many operators may have injected one of the five diesel CAS numbers without indicating so on the disclosure form;²⁵ 3) EIP’s comparison of PIVOT data to current FracFocus disclosures revealed that companies can simply change previous disclosures without leaving a record of or justification for the change; 4) 15 of the 351 well disclosures failed to indicate the volume of diesel injected;²⁶ 5) FracFocus’ search engine under-identifies the number of wells fracked with a particular CAS number or ingredient; and 6) nearly 80 percent of the total volume of fluid injected across all 351 wells identified in this report was marked either as trade secret, confidential business information, proprietary information, or with a non-identifying notation, and was therefore not disclosed or the contents were ambiguously described.²⁷

These last two points are particularly important. In addition to the problem of transparency created by the fact that FracFocus allows companies to change disclosures without maintaining an accessible record of (or reason for) the change, problems with the search program itself result in under-identification of wells. For example, EIP searched FracFocus using every possible search function other than entering specific well numbers—what are known as the American Petroleum Institute (API) numbers—and only identified 46 of the 351 wells identified in this report. The only way to confirm that each of the 351 wells was fracked with one of

the five CAS numbers identified in EPA's February 2014 guidance was to enter each API number individually.

Without the API numbers in hand—which EIP had to *purchase* from PIVOT—87 percent of the 351 wells that disclosed diesel injection could not have been identified. Moreover, since PIVOT's last data pull occurred in early 2014, there likely are dozens more wells fracked with diesel in 2013 and 2014 that EIP is unable to identify through FracFocus searches alone. This means that searching FracFocus data—without API numbers in hand—results in an under-identification of wells fracked by a particular CAS number or ingredient. Regulators and the public do not have access to reliable information if FracFocus searches do not accurately and consistently produce the correct number of relevant disclosures and operators are free to change their disclosures for any reason at any time.

The second significant point to keep in mind with regard to under-estimation is the fact that the Congressional investigators who sent the January 31, 2011 letter to former EPA Administrator Jackson, referencing the injection of approximately 32 million gallons of diesel between 2005 and 2009, had access to confidential, trade secret information that companies do not disclose to FracFocus.²⁸ Without access to trade secret information, or the chemical composition of contaminated water used as base fluid (known as “flowback” or “produced water”),²⁹ there is no way for the public or regulators to quantify, monitor, or curtail the unpermitted injection of diesel fuels under the Safe Drinking Water Act.

Operators posting on FracFocus currently have sole discretion to determine whether to disclose or claim “trade secret” protection pursuant to Occupational Safety and Health Administration (OSHA) standards or any other state or federal standard. No substantiation of operators' claims is required, no verification by federal or state agencies occurs, and there is no process for the public to challenge proprietary, trade secret claims.³⁰

At a minimum, the industry should stop hiding behind trade secret claims and disclose the concentration of diesel fuel ingredients as well as any other EPA-regulated toxic, hazardous or carcinogenic constituents, including BTEX. Similarly, industry should disclose the chemical composition of any flowback or produced water used as base fluid. According to a Secretary of Energy Advisory Board Task Force report released March 28, 2014, full disclosure of all chemicals to FracFocus could “be accomplished with little or no risk to disclosing proprietary information.”³¹ Noting that since June 1, 2013, 84 percent of wells registered with FracFocus invoked a trade secret claim, the report further recommends the disclosure of the contents and percentages of “recycled fracturing fluid” in base fluid.³² Disclosure of base fluid composition is crucial because, as the U.S. Government Accountability Office acknowledged in 2012, flowback and produced water contain a wide range of contaminants that can jeopardize groundwater quality.³³

Finally, it should be noted that for purposes of this report, the volume of diesel injected per well was determined based upon the disclosed mass of the diesel ingredient or product, stated as a percentage of the total base flow. Because there is not always uniformity in the way operators fill out the FracFocus disclosure forms,

and because operators often report the “Total Base Water Volume (gal)” but leave blank or denote a zero for the “Total Base Non Water Volume,” it was not always possible to determine these combined numbers, which would represent the total volume of fracking fluid injected. Thus, EIP conservatively calculated the volume of diesel per well, according to the FracFocus disclosures, as follows: Total Base Water Volume (gals) x Maximum Ingredient Concentration in HF Fluid/100 = Volume of Diesel (gals). EIP’s estimation of the total volume of diesel injected is therefore a close approximation, but a definite under-estimation, of the amount of diesel used by the 33 operators identified in this report.

TABLE 2: TOTAL WELLS AND VOLUME OF DIESEL CHEMICALS INJECTED, BY OPERATOR

	Operator	Wells	Total Volume of Diesel Chemicals Injected (gal)	Avg. Volume of Diesel Chemicals per Well (gal)
1	SEECO, Inc.	169	1,830.83	10.83
2	Oasis Petroleum LLC ³⁴	23	9.22	0.40
3	Williams Production	23	8.78	0.38
4	XTO Energy	21	164.63	7.84
5	Seneca Resources	18	15.95	0.89
6	PDC Energy	12	12,104.84	1,008.74
7	Mid-Con Energy Operating, LLC	12	26.16	2.18
8	Energen Resources Corporation	8	0.42	0.05
9	Pioneer Natural Resources	7	57.96	8.28
10	Mountain V Oil & Gas	7	0.74	0.11
11	Hess Corporation	5	2,003.02	400.60
12	Anadarko Petroleum Corp.	5	673.88	134.78
13	Paul Burton, LLC	5	55.34	11.07
14	Chevron USA Inc.	5	3.57	0.71
15	Apache Corporation	4	5,110.13	1,277.53
16	Cabot Oil & Gas Corp.	3	3,629.56	1,209.85
17	Devon Energy Production Co. LP	2	1,208.30	604.15
18	Samson Resources Corp.	2	921.47	460.74
19	Marathon Oil	2	170.58	85.29
20	Shell/Woolsey Operating Co.	2	148.02	74.01
21	Midstates Petroleum Company	2	13.14	6.57
22	Ranken Energy Corporation	2	8.28	4.14
23	WPX Energy	2	0.26	0.13
24	QEP Energy Company	1	1,215.02	1,215.02
25	Denbury Onshore, LLC	1	924.07	924.07
26	Occidental Oil and Gas	1	739.96	739.96
27	Bill Barrett Corporation	1	496.91	496.91
28	GEORESOURCES Inc.	1	477.35	477.35
29	Brigham Oil & Gas LP	1	443.38	443.38
30	Century Exploration Houston, LLC	1	353.97	353.97
31	Fidelity Exploration & Production	1	134.80	134.80
32	Range Resources Corporation	1	0.21	0.21
33	Forest Oil Corporation ³⁵	1	0.00	0.00
	Total	351	32,950.73	93.88

Risk to Human Health from Diesel Fuel Injection

The potential impact on human health and the environment related to the 351 wells identified in this report is significant. EPA determined that any exposure to benzene, a component of diesel fuels and known carcinogen, presents risk to human health and set the achievable Maximum Contaminant Level (MCL) in drinking water at .005 mg/L (5 parts per billion).³⁶ To put this in perspective, a quarter teaspoon of benzene is enough to make an average swimming pool exceed the benzene MCL. As noted in the Congressional Record for the Energy Policy Act of 2003, EPA estimated that 39 to 75 percent of injected fracking fluids remain in the ground, unrecovered. According to a 2003 article in *Environmental Science and Technology*, cited in the Congressional Record, even if only 20 to 30 percent of diesel-containing fracking fluid remains underground, it may be enough to render an aquifer unfit for human consumption for generations.³⁷

For instance, of the 351 wells identified in this report, up to 25,896 gallons of diesel fuel identified as CAS No. 68476-34-6 was used to frack 61 wells. This CAS number is commonly known as Diesel Fuel #2. According to the National Institutes of Health (NIH), anywhere from 0.003 to 0.1 percent of Diesel Fuel #2 consists of pure benzene.³⁸ Using the low range (0.003 percent), this means that 0.78 gallons of pure benzene were injected across these 61 wells. Continuing the swimming pool analogy, that's 599 teaspoons of benzene. The high range (0.1 percent) yields a calculation of 25.9 gallons of benzene contained in the 25,896 gallons of diesel fuel injected. This equates to 19,891 teaspoons of benzene. Even if only 20 percent of this benzene remains underground, which studies indicate is a conservative estimate, the operators of these 61 wells alone are responsible for introducing anywhere from 120 to 3,978 teaspoons of benzene into formations that could potentially contaminate underground sources of drinking water. That's the equivalent of rendering the water in 480 to 15,912 medium-sized swimming pools unsafe for human consumption.

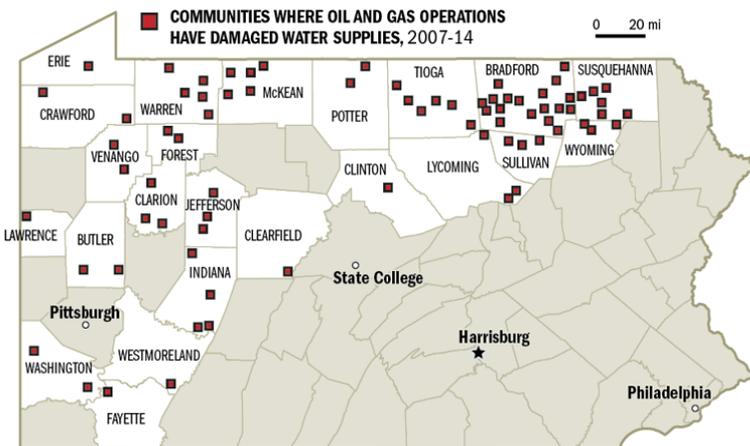
Analysis of the BTEX concentration in kerosene (CAS No. 8008-20-6), which was used to frack 286 of the 351 wells, yields similar results. For example, using mid-range concentrations obtained from a Material Safety Data Sheet (MSDS)³⁹ for kerosene reveals the injection into these wells of 1.94 gallons of benzene (or 1,490 teaspoons).⁴⁰

And these are not just hypothetical risks. Pennsylvania, a state where fracking has skyrocketed in recent years in the Marcellus Shale region, is learning this lesson the hard way. On July 22, 2014, the Pittsburgh Post-Gazette reported that the Pennsylvania Department of Environmental Protection (PA DEP) is about to release data indicating that fracking has “damaged” public water supplies 209 times since the end of 2007.⁴¹ According to the article, PA DEP released the database to the Post-Gazette in response to an open records request. Other than listing the 209 public water supplies affected by county, municipality, and date, additional details have not yet been provided—including what constitutes “damage.” However, the Post-Gazette reports that PA DEP plans to release additional information when the data is posted to its website.⁴²

FIGURE I: PENNSYLVANIA WATER SUPPLIES DAMAGED BY OIL AND GAS ACTIVITY, 2007-2014

Drilling-related water impacts

Since 2007 the state has determined oil and gas operations have either polluted or reduced the flow to water supplies in 77 communities.



Source: Pennsylvania Department of Environmental Protection

Post-Gazette

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The June 2014 GAO report criticizes EPA (and to some extent, the states) for not fully understanding and quantifying what the report refers to as “emerging risks” of underground injection associated with oil and gas production.⁴³ According to the report, these risks include seismic activity, over-pressurization of geological formations, which can lead to surface outbreaks of fluids, and potential contamination of underground sources of drinking water by the continued injection of diesel fuels.⁴⁴

What Permits Require

Had the operators of the 351 wells discussed in EIP’s report properly applied for Safe Drinking Water Act permits, EPA and state authorities would have required them to undergo a review process designed to ensure that their injection activities did not endanger an underground source of drinking water. For instance, the Underground Injection Control regulations found at 40 C.F.R. Part 144, which implement this part of the Safe Drinking Water Act, require permit holders, among other things, to: 1) map the proposed well area to identify whether there is a nearby source of underground drinking water and any natural or manmade pathways to it; 2) provide an appropriate analysis of the chemical and physical characteristics of the proposed injection fluids; 3) notify nearby land owners; 4) undergo extensive testing to determine the integrity of the well structure and its ability to withstand high pressure injection; 5) conduct pre-drilling (baseline) water quality monitoring and periodic post-fracking monitoring to determine whether any fluids from the well leaked or migrated;⁴⁵ 6) submit a plugging and abandonment plan once the well no longer produces; and 7) provide financial assurance in case the well is not plugged

and abandoned properly. In addition, the permitting process provides an important opportunity for public comment and notice prior to permit issuance.

The Public's Right to Know

The public's right to know about pollution and contaminants that threaten health and degrade air and water quality is a centerpiece of federal environmental law. The oil and gas industry's continued use of diesel fuels, without benefit of the safeguards



The oil and gas industry is one of the biggest sources of toxic chemical releases in the U.S., yet it benefits from a loophole that allows it to avoid reporting to the public or government through the federal Toxic Release Inventory. Fourteen states require disclosure to the fracking industry chemical disclosure database, FracFocus. But FracFocus is incomplete, under reports, and allows drillers to change their disclosures after the fact.

afforded by the Safe Drinking Water Act permitting process, further highlights the need for EPA to require the oil and gas industry, as one of the nation's biggest sources of toxic releases, to report to the Toxic Release Inventory (TRI).

The TRI is a powerful public resource that gives communities information needed to challenge permits or siting decisions, spurs facilities to reduce toxic emissions, informs emergency responders, and provides a critical foundation for regulation. The continued and significant use of diesel fuel by an industry that has denied its use for years only highlights the need for more public

information. FracFocus is a good start, but it is incomplete and under-reports, as recently acknowledged in the Secretary of Energy Advisory Board Task Force's report and confirmed by EIP's investigation. State regulators cannot know what is occurring in their states by reviewing disclosures or conducting searches on FracFocus alone. This is especially true when operators, as EIP discovered, are free to change their disclosures, whether for legitimate reasons or to avoid regulatory or public scrutiny. Despite this, 14 states, including Texas, Pennsylvania and North Dakota, currently require operators to disclose to FracFocus.⁴⁶

Because of this continued lack of transparency, EIP filed a petition in October 2012 on behalf of sixteen local, regional, and national groups asking EPA to close this loophole and require oil and gas facilities to report toxic releases to land, air, and water in the same manner that other industries are required to disclose.⁴⁷ Though it may take effort, EIP expects that the agency will make the correct decision to require the oil and gas industry to report to the TRI.

The Continued Sale of Fracking Products Containing Diesel

Despite the Safe Drinking Water Act’s prohibition against the injection of diesel in the absence of a permit issued by EPA or an authorized state, companies continue to produce diesel-containing products for well fracturing, including Halliburton Energy Services. In fact, a review of Halliburton’s products list reveals over a dozen products offered for sale that contain high concentrations of diesel. According to EPA’s February 2014 guidance, injection of any of these products—in any amount—requires a Safe Drinking Water Act permit. Clearly, operators are buying these products. For example, several of the 351 wells identified in this report were fracked with either LGC-35, CL-22 M Crosslinker, or BC-200, products which contain up to 60 to 100 percent diesel (CAS No. 68476-34-6).⁴⁸ Yet as EIP’s investigation has shown, no permits or permit applications exist for these or any of the 351 wells identified in this report.

If “diesel fuel use has already been effectively phased out of hydraulic fracturing operations,” as an industry representative stated as recently as February 2014, then why are these products still for sale?⁴⁹

The right thing to do, both for public health and the safety and future of our water supply, is to remove these products from the shelf. But if Halliburton and other suppliers continue offering diesel products for sale—products that contain benzene and other BTEX chemicals known to cause cancer and other serious health effects—they at least should agree to warn well operators that use of these products requires a Safe Drinking Water Act permit. In addition, any advertisement of such products online or elsewhere should include clear, concise labels indicating the prohibition against injection of diesel.

TABLE 3: EXAMPLES OF HALLIBURTON WELL PRODUCTS THAT CONTAIN DIESEL FUELS (AS PER MSDS)⁵⁰

Product Name	Diesel CAS No.	% Diesel in Product	Product Application
EZ MUL	68476-34-6	10 – 30	Emulsifier
FORTI-MUL	68476-34-6	10 – 30	Emulsifier
FR-P	8008-20-6	10 – 30	Friction Reducer
LGC-IV with DIESEL	68476-34-6	30 – 60	Liquid Gel Concentrate
LGC-VI (Diesel with Flash Point > 55C)	68476-34-6	30 – 60	Liquid Gel Concentrate
LGC-IV with KEROSENE	8008-20-6	30 – 60	Liquid Gel Concentrate
N-VER-SPERSE O with DIESEL	68476-34-6	60 – 100	Dispersant
RSP FLUID with DIESEL	68334-30-5	30 – 60	Additive
TOLUENE/DIESEL BLEND	68476-34-6	30 – 60	Solvent ⁵¹
WLC-4 DIESEL SLURRY	68476-34-6	30 – 60	Fluid Loss Additive
KEROSENE	8008-20-6	60 – 100	Solvent
LGC-35	68476-34-6	30 – 60	Liquid Gel Concentrate
CL-22M CROSSLINKER	68476-34-6	30 – 60	Crosslinker ⁵²
BC-200	68476-34-6	30 – 60	Crosslinker ⁵³



Conclusions and Recommendations

The fact that the oil and gas industry continues to inject diesel fuels, and can change what is “disclosed” on FracFocus to conceal their use, is alarming. Congress created the Halliburton Loophole which stripped EPA of most of its authority to ensure safe well production practices, but industry is still trying to expand the loop. Despite Congress’ decision to leave intact EPA’s authority to closely regulate the injection of diesel fuel—which is prohibited in the absence of a Safe Drinking Water Act permit—well operators continue to use diesel products and companies like Halliburton continue to supply them. When EPA shows signs of concern and issues draft and then final guidance clarifying the diesel prohibition, evidence of past diesel use begins to disappear from FracFocus disclosures. Operators are free to erase past evidence of diesel use, whether to correct an honest error or to avoid regulatory or public scrutiny, because FracFocus allows disclosures to be revised or replaced without leaving a record of or providing an explanation for the change. This is just wrong.

Diesel fuels, like other BTEX-containing mixtures or products, pose significant risks to human health and potential drinking water supplies. As with any fossil fuel extraction method, accidents, spills, and leaks happen with hydraulic fracturing. For example, on February 27, 2014, a North Dakota oil well failed during hydraulic fracturing by Halliburton and spewed approximately 8,400 gallons of oil and up to nearly 3,000 gallons of fracking fluid per day for at least 3 days.⁵⁴ As recently as June 28, 2014, what became a multi-day fire with more than 30 explosions erupted

at a well pad in Clarington, Ohio. The accident, which occurred during a well frack by Halliburton, resulted in the evacuation of 25 residences and caused a significant fish kill (approximately 70,000) as far downstream from the site as three and a half miles. Representatives of Halliburton and Statoil, the well pad owner, were on site at the time of the accident. In addition to radiological materials, an EPA, Region 5 on-scene coordinator (emergency responder) catalogued the presence of at least 16 different chemical products on the well pad, including 9,000 gallons of diesel fuels:

Materials present on the Pad included but was not limited to: diesel fuel, hydraulic oil, motor oil, hydrochloric acid, cesium-137 sources, hydrotreated light petroleum distillates, terpenes, terpenoids, isoproponal, ethylene glycol, paraffinic solvents, sodium persulfate, tributyl tetradecyl phosphonium chloride and proprietary components. As a result of fire-fighting efforts and flow back from the well head, significant quantities of water and unknown quantities of products on the well pad left the Site and entered an unnamed tributary of Opossum Creek that ultimately discharges to the Ohio River.⁵⁵

The EPA report, made public by a local NBC affiliate on July 22, 2014, indicated that the fire burned over the course of five days. Because flowback from the well could not be contained, and was flowing toward the creek, the well head was “shut-in” on June 29, 2014. Subsequent sampling of run-off from the well pad indicated the presence of numerous toxic chemicals, including benzene, xylene, naphthalene, and toluene. Although the impact to drinking water (both to surface and underground sources) as a result of this accident is not yet known, plans to assess surrounding drinking water wells are underway.⁵⁶ According to one report, it took Halliburton five days to produce to EPA and Ohio officials a full list of the “proprietary” fracking chemicals used at the site.⁵⁷

As first responders in Ohio publicly stated, lack of complete disclosure of the chemical composition of the fracking fluids on site resulted in “some questionable moments” when it came to keeping the fire fighters safe.⁵⁸ In addition to the public’s right to know, the issue of full disclosure, at its most fundamental, is an issue of safety. Faulty well construction and lack of precautions to prevent movement of fracking fluids into underground sources of drinking water only compound the risk posed by recent accidents like those in North Dakota and Ohio. A well properly constructed and operated pursuant to the conditions and requirements of a Safe Drinking Water Act permit might have prevented some of this risk to human health and devastation of natural resources.

As previously noted, it appears that all 351 wells identified in this report were constructed and fracked outside the Safe Drinking Water Act permitting process, and in violation of the law. For these reasons, EIP recommends the following:

- 1) EPA and the states authorized to implement the Safe Drinking Water Act should consider taking appropriate enforcement against all 33 operators identified in this report and, at a minimum, require the immediate submittal of permit applications.

EPA and the states should also launch their own comprehensive investigations into the continued unpermitted use of diesel fuel in fracking. As the June 2014 GAO report notes, EPA needs to provide guidance to states on the information

needed to properly and completely identify and permit diesel use in fracking operations.⁵⁹ EIP's investigation into diesel use by the oil and gas industry began in March 2014. A significant percentage of disclosures that originally indicated diesel use no longer indicate that these wells were fracked with diesel. The operators of those wells should be required to account for the change in their disclosures.

Although not all of the protective requirements of a Safe Drinking Water Act permit can be realized after a well is drilled, many measures should still be required in these cases, including identification of nearby sources of underground drinking water, submittal of a chemical analysis of all fracking fluids, mechanical integrity testing, water quality monitoring, submittal of a plugging and abandonment plan, and financial assurance.

- 2) Well operators also should voluntarily agree to disclose the concentration of diesel and other BTEX chemicals in *all* fracking fluids, regardless of potential proprietary, trade secret claims.

This is important both for the safety of communities impacted by fracking and to preserve and protect current and future sources of drinking water. As this investigation reveals, there have been hundreds of wells fracked with diesel in the last five years—and the true number may be much higher. Regulators cannot understand the risk posed to the public as a result of these operations if they cannot accurately quantify the amount and type of chemicals used in any given location at any given time. As EPA acknowledged in its 2014 guidance, diesel fuels are not the only fracking products that contain BTEX or other aromatic hydrocarbons that are known to be carcinogenic or otherwise dangerous to human health.⁶⁰

- 3) Companies that continue to supply diesel-containing fracking products should be required to label their products and notify operators of the need to obtain Safe Drinking Water Act permits prior to well drilling.
- 4) States should list diesel-based fracking products that require a permit.
- 5) FracFocus must endeavor to improve the transparency and accountability of these disclosures and address the problems that result in under-identification of wells.

EPA and the states have an obligation to protect the public and our water supply from the potential hazards of hydraulic fracturing. Federal and state regulators should be required to use every tool in their tool belt to protect public health by enforcing the law. Exercising their authority to regulate and permit the use of diesel fuels in hydraulic fracturing activities would be a good—and long overdue—place to start.

NOTES

¹ EIP staff submitted public information requests to and contacted EPA and state officials by phone for every state mentioned in this report in an attempt to verify the permitting status of the wells. All public information inquiries are on file with EIP. All twelve states and EPA Region 3, which implements this portion of the Safe Drinking Water Act (known as the Underground Injection Control (UIC) program) in Pennsylvania, confirmed either in writing or orally to EIP staff that no permit applications had been received and no permits had been issued for any of the wells as of June 5, 2014. Follow-up calls to UIC programs in Oklahoma and Texas, which had well disclosures (indicating diesel use) that were posted to FracFocus after June 5, 2014, revealed no new information.

² The 351 wells identified in this report all reported the injection of diesel at the time EIP viewed and downloaded the FracFocus disclosures between June 18 and August 5, 2014 (copies of the disclosures viewed by EIP during this timeframe are on file with EIP). *See also*, Endnote 17, *infra*.

³ *See* 42 U.S.C. § 300h(d) (exempting “the underground injection of fluids or propping agents (other than diesel fuels) pursuant to hydraulic fracturing operations”).

⁴ 40 C.F.R. § 144.11. Pursuant to the UIC regulations, the Safe Drinking Water Act’s implementing regulations, injection wells associated with oil and gas storage and production are categorized as Class II wells that require a Class II UIC permit. 40 C.F.R. § 144.6(b)(2). Note that for purposes of this report, these UIC Class II permits are referred to as Safe Drinking Water Act permits or SDWA permits.

⁵ *See* Letter from Rep. Henry A. Waxman *et al.*, to Lisa Jackson, Administrator, EPA (Jan. 31, 2011), available at <http://democrats.energycommerce.house.gov/index.php?q=news/waxman-markey-and-degette-investigation-finds-continued-use-of-diesel-in-hydraulic-fracturing-f>.

⁶ Energy in Depth, When Gummy Bears Attack (Jan. 20, 2010), <http://www.energyindepth.org/2010/01/when-gummy-bears-attack/> (accessed August 1, 2014).

⁷ *See* Endnote 5, *supra*.

⁸ Permitting Guidance for Oil and Gas Hydraulic Fracturing Activities Using Diesel Fuels—Draft: Underground Injection Control Program Guidance #84, 77 Fed. Reg. 27,451 (May 10, 2012).

⁹ *See* EPA, TSCA Chemical Substance Inventory, <http://www.epa.gov/oppt/existingchemicals/pubs/tscainventory/> (accessed August 1, 2014).

¹⁰ EPA, Permitting Guidance for Oil and Gas Hydraulic Fracturing Activities Using Diesel Fuels: Underground Injection Control Program Guidance #84 (Feb. 2014), available at <http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/upload/epa816r14001.pdf>. BTEX compounds are highly mobile in groundwater and are regulated under the SDWA’s national primary drinking water regulations because they pose significant risk to human health. *Id.*

¹¹ The five CAS numbers are 68334-30-5, 68476-34-6, 68476-30-2, 68476-31-3, and 8008-20-6. *Id.* at 4-5.

¹² PAHs are known for their carcinogenic, mutagenic, and teratogenic properties. High prenatal exposure to PAHs is associated with lower IQ, heart malformations, childhood asthma, and DNA damage linked to cancer. *See* Agency for Toxic Substances and Disease Registry, *Polycyclic Aromatic Hydrocarbons (PAHs) (1996)*, available at <http://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=121&tid=25>. *See also*, Endnote 9, *supra*.

¹³ *See* Letter from Rep. Henry A. Waxman *et al.*, to Lisa Jackson, Administrator, EPA (Jan. 31, 2011) (citing letter from Benjamin Grumbles, Acting Assistant Administrator, EPA, to Sen. Jim Jeffords (Dec. 7, 2004)).

¹⁴ Pennsylvania Department of Environmental Protection, *Chemicals Used by Hydraulic Fracturing Companies in Pennsylvania For Surface and Hydraulic Fracturing Activities* (June 30, 2010), available at <http://files.dep.state.pa.us/OilGas/BOGM/BOGMPortalFiles/MarcellusShale/Frac%20list%206-30-2010.pdf>.

¹⁵ *See* GAO, Report to Congressional Requesters, Drinking Water: EPA Program to Protect Underground Sources from Injection of Fluids Associated with Oil and Gas Production Needs Improvement, June 2014, available at <http://www.gao.gov/assets/670/664499.pdf>. The eight state programs reviewed as part of the GAO report were: California, Colorado, North Dakota, Oklahoma, Ohio, Texas, Kentucky and Pennsylvania. According to EIP’s investigation, wells have been fracked with diesel in all but California and Kentucky between 2012 and 2014.

¹⁶ *See, e.g.*, Neela Banerjee, *EPA Begins Regulating the Use of Diesel in Fracking*, L.A. Times, Feb. 11, 2014, available at <http://www.latimes.com/business/la-fi-fracking-regulations-20140212-story.html>; Alan Kovski, *EPA Issues Final Guidance on Fracking When Injected Fluid Includes Diesel Fuels*, Env’t Reporter, Feb. 14, 2014, available at <http://www.bna.com/epa-issues-final-n17179882105/>.

¹⁷ *See* <http://environmentalintegrity.org/archives/6934> (link to EIP’s data) to view data on these 143 wells, including the dates PIVOT obtained the disclosures. In addition, EIP reconfirmed PIVOT’s disclosure retention policy by telephone on August 1, 2014.

¹⁸ These operators were El Paso E&P Company (30 wells), Energy Corporation of America (33 wells), Pioneer Natural Resources (62 wells), SWEPI LP (1 well), Triana Energy (2 wells), and XTO Energy (15 wells) (PIVOT data on file with EIP).

¹⁹ EIP sent a Freedom of Information Act (FOIA) request letter to EPA that produced records indicating the use of diesel fuel by seven companies operating in Pennsylvania and West Virginia. The EPA letter and attachments, dated March 13, 2014, in response to EIP's September 27, 2013 FOIA request, are on file with EIP. Note that Energy Corporation of America, an operator EPA identified as using diesel fuel, is one of the six operators who changed its disclosure sometime after the release of EPA's May 2012 draft guidance and PIVOT's data pull in mid-June 2012. See Endnote 18, *supra*.

²⁰ See <http://environmentalintegrity.org/archives/6934>.

²¹ If a well disclosure no longer indicates the injection of diesel after the publication of this report, the disclosure has been changed. Downloaded copies of the 351 disclosures accessed for this report are on file with EIP.

²² *Id.*

²³ See <http://environmentalintegrity.org/archives/6934>.

²⁴ The data that EIP obtained from PIVOT Upstream Group dates from 2010 through 2013, with one entry from January 2014. EIP conducted an additional search of the five CAS numbers on FracFocus, which revealed 28 additional wells fracked with diesel chemicals in 2014. EIP excluded duplicate entries from the data, but included seven instances where operators clearly reported additional events at the same well—i.e., “re-fracking.” For ease of handling this data, and because each of these “re-fracking” activities in fact used as much or more diesel chemicals as the original frac, EIP considered these additional events as separate wells.

²⁵ For instance, according to FracFocus, a well fracked on Jan. 25, 2014 (API No. 42-331-34821), in Milam County, Texas, by Slawson Exploration Company, Inc., indicates the use of diesel (85 percent concentration of the total fracking fluid) but the corresponding line for the CAS number contains a CAS number for water. It is unclear what kind of error this represents—either diesel-containing water was used that was misidentified by CAS number or the CAS number for uncontaminated water was described incorrectly as diesel. See FracFocus, Hydraulic Fracturing Fluid Product Component Information Disclosure, Slawson Exploration Co., Eastwood No 2, API No. 42-331-34821 (Jan. 25, 2014) (accessed August 1, 2014, and on file with EIP).

²⁶ All but one of these 15 wells were fracked with very large volumes of liquid (2.77 million gallons per well on average), which suggests that the amount of diesel used was also very large. See <http://environmentalintegrity.org/archives/6934>.

²⁷ This estimate excludes all fluids that were described by trade name or CAS number as “fresh water” or “freshwater” but includes other “water”—such as recycled water, treated water, water frac, and lease water—in the total volume of undisclosed fluids because these kinds of base fluids are likely flowback water or produced water, both of which can contain BTEX and other toxic and radioactive chemicals. See, e.g., Institute for Energy and Environmental Research of Northeastern Pennsylvania, What is flowback, and how does it differ from produced water?, <http://energy.wilkes.edu/pages/205.asp> (accessed August 1, 2014).

²⁸ See Letter from Rep. Henry A. Waxman *et al.*, to Lisa Jackson, Administrator, EPA (Jan. 31, 2011), available at <http://democrats.energycommerce.house.gov/index.php?q=news/waxman-markey-and-degette-investigation-finds-continued-use-of-diesel-in-hydraulic-fracturing-f> (accessed August 1, 2014).

²⁹ See Endnote 27, *supra*.

³⁰ See, e.g., Kate Konschnik *et al.*, Harvard Law School Environmental Law Program Policy Initiative *Legal Fractures in Chemical Disclosure Laws: Why the Voluntary Chemical Disclosure Registry FracFocus Fails as a Regulatory Compliance Tool* (2013), available at <http://blogs.law.harvard.edu/environmentallawprogram/files/2013/04/4-23-2013-LEGAL-FRACTURES.pdf>.

³¹ U.S. Department of Energy, *Secretary of Energy Advisory Board Task Force Report on FracFocus 2.0* (2014), available at http://energy.gov/sites/prod/files/2014/04/f14/20140328_SEAB_TF_FracFocus2_Report_Final.pdf.

³² *Id.* at 8, 11.

³³ See Endnote 15, *supra*.

³⁴ Oasis Petroleum did not disclose the maximum concentration of the diesel ingredient in the fracking fluid and therefore EIP could not compute the volume of the additive for 14 of the 23 wells.

³⁵ Forest Oil Corporation also failed to disclose the maximum concentration of additive in the frac fluid though it did disclose that the additive itself was composed of 100 percent diesel, supplied by Halliburton.

³⁶ See EPA, Basic Information about Benzene in Drinking Water, <http://water.epa.gov/drink/contaminants/basicinformation/benzene.cfm> (accessed August 1, 2014).

³⁷ 151 Cong. Rec. H2192-02 (daily ed. April 20, 2005).

³⁸ See Roger Brewer et al., *Risk-Based Evaluation of Total Petroleum Hydrocarbons in Vapor Intrusion Studies*, 10 Int. J. Environ. Res. Public Health 2441, 2441 Tbl. 1 (2013), available at <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3717746/>.

³⁹ MSDSs provide workers and emergency responders with chemical composition, handling and risk information of various chemical products and are required by OSHA.

⁴⁰ The MSDS is for Jet Fuel, lists kerosene as a synonym, and carries the same CAS number, 8008-20-6. See U.S. Oil & Refining Co., MSDS 941: Jet Fuel 1 (rev. July 9, 2013), available at <http://www.usor.com/files/pdf/4/Jet%20Fuel%20-%20SDS%20941%20-%20130709.pdf>. The Jet Fuel MSDS states that 90 to 100 percent of the product consists of a kerosene/hydrocarbon mixture. See also <http://environmentalintegrity.org/archives/6934> (link to EIP's data) to obtain a list of operators, by state, who fracked wells using a particular diesel fuel, such as kerosene, CAS no. 8008-20-6.

⁴¹ Laura Legere, *DEP: Oil and gas operations damaged water supplies 209 times since end of '07*, Pittsburgh Post-Gazette, July 22, 2014, <http://powersource.post-gazette.com/powersource/policy-powersource/2014/07/22/DEP-Oil-and-gas-endeavors-have-damaged-water-supply-209-times-since-07/stories/201407220069> (accessed August 1, 2014).

⁴² *Id.*

⁴³ The report is also critical of EPA's lack of state oversight and enforcement of the Class II UIC regulatory program as well as EPA's failure to adequately inform states of the risks to drinking water posed by fracking. See, Endnote 15, *supra*.

⁴⁴ *Id.*

⁴⁵ A few states, such as Colorado, have adopted baseline testing requirements but states with significant fracking activity, such as Pennsylvania, Texas, and North Dakota, have no pre-drilling baseline testing requirements. See FracFocus, Regulations by State, <http://fracfocus.org/regulations-state> (providing links to regulations by state) (accessed August 1, 2014).

⁴⁶ See Endnote 15, *supra*.

⁴⁷ See EIP, Petition to Add the Oil and Gas Extraction Industry, Standard Industrial Classification Code 13, to the List of Facilities Required to Report under the Toxics Release Inventory (2012), available at <http://www.regulations.gov/#!documentDetail;D=EPA-HQ-TRI-2013-0281-0005>.

⁴⁸ See <http://environmentalintegrity.org/archives/6934> (link to EIP's data) and Endnotes 52-53, *infra*.

⁴⁹ See Endnote 16, *supra*.

⁵⁰ The MSDSs can be obtained by entering the product name on Halliburton's MSDS search page, available at <http://www.halliburton.com/en-US/tools-resources/safety/material-safety-data-sheet-search.page>.

⁵¹ This product also contains up to 60% toluene, another BTEX chemical.

⁵² Five of the 351 wells were fracked with this product (API Nos. 33-053-03097, 33-023-00734, 33-053-03803, 33-105-12185, 33-023-00760). All five wells were fracked in North Dakota, one in 2011 and four in 2012.

⁵³ This product also contains naphthalene, a possible human carcinogen. Two of the 351 wells were fracked with this product (API Nos. 35-059-22582, 30-015-39118). These wells were fracked in Oklahoma and New Mexico in 2012.

⁵⁴ See *UPDATE 2-Oil well in North Dakota out of control, leaking*, Reuters, Feb. 14, 2014, available at <http://www.reuters.com/article/2014/02/14/energy-crude-blowout-idUSL2N0LJ15820140214> (accessed August 1, 2014).

⁵⁵ EPA Emergency Response Initial Removal POLREP, Statoil Eisenbarth Well Response, Clarington, OH (June 28, 2014), available at <http://www.nbc4i.com/story/26085529/federal-report-details-chemicals-used-at-drilling-site> (report embedded in news story) (accessed August 1, 2014) and on file with EIP.

⁵⁶ *Id.*

⁵⁷ See Seth Shulman, Sr. Staff Writer, Union of Concerned Citizens, *Got Science? Ohio Wake-up Call on Fracking Disclosure Laws*, Huffington Post, July 31, 2014, available at http://www.huffingtonpost.com/seth-shulman/got-science-ohio-wake-up_b_5639164.html?utm_hp_ref=green (accessed August 1, 2014).

⁵⁸ Rick Reitzel, *Federal Report Details Chemicals Used At Drilling Site*, WCMH-TV NBC4, July 22, 2014, <http://www.nbc4i.com/story/26085529/federal-report-details-chemicals-used-at-drilling-site> (accessed August 1, 2014).

⁵⁹ See Endnote 15, *supra*.

⁶⁰ See Endnote 9, *supra*, at 4.



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