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Regulating Oil & Gas Activities to Protect Drinking Water:

The Safe Drinking Water Act's Underground Injection Control Program — Overview and Concerns

When the U.S. Congress first passed the Safe Drinking Water Act (SDWA) in 1974, it authorized the U.S. Environmental Protection Agency (EPA) to develop a program to protect vital underground drinking water resources from risks of industrial activities in which fluid is injected into the ground. However, Congress also included language mandating that EPA not "interfere with or impede" oil and gas production unless it is "absolutely essential" in order to protect underground sources of drinking water.[1] The regulatory and legislative history of the SDWA Underground Injection Control Program (UIC) demonstrates the impact of this language on the UIC program's evolution. The UIC program regulation of oil and gas underground injection activities is characterized by a pattern of exemptions, exceptions and lack of transparency resulting from the effort not to "interfere with or impede" oil and gas activities. Combined with "flexible" regulatory oversight added by Congress in 1980 and a dramatic record of underfunding, this raises questions about whether underground sources of drinking water are being protected.

As the 40th anniversary of the passage of SDWA approaches, changing circumstances suggest that review of the UIC program regulation of oil and gas underground injection activities is merited. Forty-four percent of Americans rely on groundwater for drinking water from Public Water Systems and private wells. This critical resource is stressed by drought, impacts of climate change and excessive withdrawal for human and agricultural use. Assumptions about the physical characteristics which make groundwater suitable for drinking water are based on technologies of forty years ago, but water treatment has dramatically changed.[2] Lastly, but by no means least important, the dramatic increase in oil and gas production using new "unconventional" technologies, including but not limited to high volume hydraulic fracturing, presents challenges not anticipated when the UIC program was developed.

This paper provides an overview of how the Safe Drinking Water Act's Underground Injection Control Program regulates oil and gas underground injection activities and aspects of the program that are out of date and could be ineffective at meeting the statutory goal of protecting underground sources of drinking water.

SAFE DRINKING WATER ACT and UIC PROGRAM BACKGROUND

The goal of SDWA, first passed in 1974, is to protect public health by regulating the nation's public water supply. Significant amendments were added by the U.S. Congress in 1986 and 1996 and amendments related to state oversight of oil and gas underground injection activities were added in 1980. SDWA gives EPA the authority to set national health-based standards to protect against natural and man-made contaminants. Public Water Systems are the regulated entities that must comply with SDWA standards. Congress also instructed EPA to set up a program to protect underground sources of drinking water from the risks of injection wells used for a variety of purposes. In order to ensure continued access to safe drinking water from groundwater sources, the SDWA prohibits injection which endangers any underground source of drinking water (USDW).

Underground injection wells have been used as a method of waste disposal for oil and gas waste, mining waste, salt water, toxic waste

and other types of waste since the early 1930s. The UIC program set up in the wake of the 1974 SDWA classifies wells into five categories; (a sixth was added in 2010 for potential carbon sequestration wells). *[See Table below]* Class II was developed specifically to regulate three aspects of oil and gas activity: a type of oil and gas extraction called "Enhanced Recovery" (ER), disposal of wastewater from oil and gas activities and storage of hydrocarbons. There are over 170,000 Class II wells in the United States injecting over 2 billion gallons each day.[3] In 1980, Congress exempted oil and gas field waste from the hazardous waste provisions of the primary federal waste management law — the Resource Conservation and Recovery Act (RCRA). This exemption from classification as hazardous waste RCRA Class C) was codified in regulation in 1988. Therefore oil and gas waste that might otherwise be handled by the more protective requirements of UIC Class I (used for hazardous waste) is instead regulated in the UIC Class II program.[4]

Implementation of the UIC Class II program is funded by a combination of federal and state funding. Government Accountability Office (GAO) analysis of EPA grants to states between 2003 and 2012 found that accounting for rising costs and inflation, federal funds available for the program had actually declined. During GAO's investigation, EPA staff reported that funding for the UIC program has remained essentially flat since the 1990's.[5]

DEFINING UNDERGROUND SOURCES OF DRINKING WATER AND AQUIFER EXEMPTIONS

EPA published the first UIC regulations in 1980. These regulations included requirements for permitting UIC Class II wells, the first definition of Underground Sources of Drinking Water (USDW) and provisions for the Aquifer Exemption Program. Because the UIC program prohibits injection into USDWs, the definition is critical to implementation of the UIC program. Injection is prohibited into water which meets the definition, except when the water is an "exempted aquifer." The Aquifer Exemption Program allows water which would otherwise be defined as a source of drinking water to be exempted from the prohibition on injection. The American Petroleum Institute (API) sued EPA over the 1980 UIC regulations, claiming that both the USDW definition and the Aquifer Exemption requirements were overly restrictive and did not reflect

Table 1: **Well Class Descriptions from EPA**

Source: http://water.epa.gov/type/groundwater/uic/wells.cfm

CLASS	Use	Inventory
CLASS I	Inject hazardous wastes, industrial non-hazardous liquids, or municipal wastewater beneath the lowemost USDW.	680 wells
CLASS II	Inject brines and other fluids associated with oil and gas production, and hydrocarbons for storage.	172,068 wells
CLASS III	Inject fluids associated with solution mining of minerals beneath the lowermost USDW.	22,131 wells
CLASS IV	Inject hazardous or radioactive wastes into or above USDWs. These wells are banned unless authorized under a federal or state ground water remediation project.	33 sites
CLASS V	All injection wells not included in CLASSES I-IV. In general CLASS V wells inject non-hazardous fluids into or above USDWs and are typically shallow, on-site disposal systems. however, there are some deep CLASS V wells that inject below USDWs.	400,000 to 650,000 wells. Note: A range is presented because a complete inventory is not available.
CLASS VI	Inject Carbon Dioxide (CO2) for long-term storage, also known as Geologic Sequestration of CO2.	6–10 commercial wells expected to come online by 2016

Congressional intent.[6] EPA settled this lawsuit and published revised final UIC regulations in 1982. These regulations include the USDW definition which remains in place today* and criteria and process requirements for granting Aquifer Exemptions.

In order to exempt an aquifer from SDWA protections, it must meet criteria outlined in the UIC regulations. These criteria include whether the aquifer contains hydrocarbons or minerals in commercially producible quantities, whether the aquifer is located at a depth or is contaminated to an extent that makes it technically or economically unpractical to serve as drinking water source or whether the aquifer is located over a Class III well and mining operation. The criteria also take into account the Total Dissolved Solids (TDS) content of the water, a broad screen for treatability of the water to be used as a drinking water source. Primacy states review the exemption application and forward it to the relevant Regional Administrator or Federal EPA Administer, under certain circumstances, for final approval.[7]

IMPLEMENTATION OF THE SAFE DRINKING WATER ACT

State agencies generally take responsibility for implementing SDWA regulations. This "primacy" is granted to states that show they can meet or exceed the federal standards. Every state and territory other than the District of Columbia and Wyoming has taken primacy for most aspects of SDWA implementation. However, primacy and implementation for the six classes of wells in the SDWA UIC Program are more complicated.

Ten states have chosen not to run the program themselves and in those states EPA's regional offices run the UIC program. Thirty-three states and three territories have taken primacy for the program and in seven, depending on the class of the well, the state and EPA share responsibility. Currently, EPA Headquarters oversees the Class VI program for geologic sequestration of carbon dioxide.

In states that have taken primacy, the UIC program is not always housed in the same agency that implements the rest of SDWA. In some states most of SDWA is implemented by a state's public health agency but the UIC program is in the state's environmental or natural resources agency. In states with a good deal of oil and gas activity, the UIC Class II program — which is exclusively related to that industry's activities — is often housed in the state's oil and gas agency. Interactions among these agencies are outlined in Memoranda of Understanding to provide clarity on responsibility for compliance with federal law.

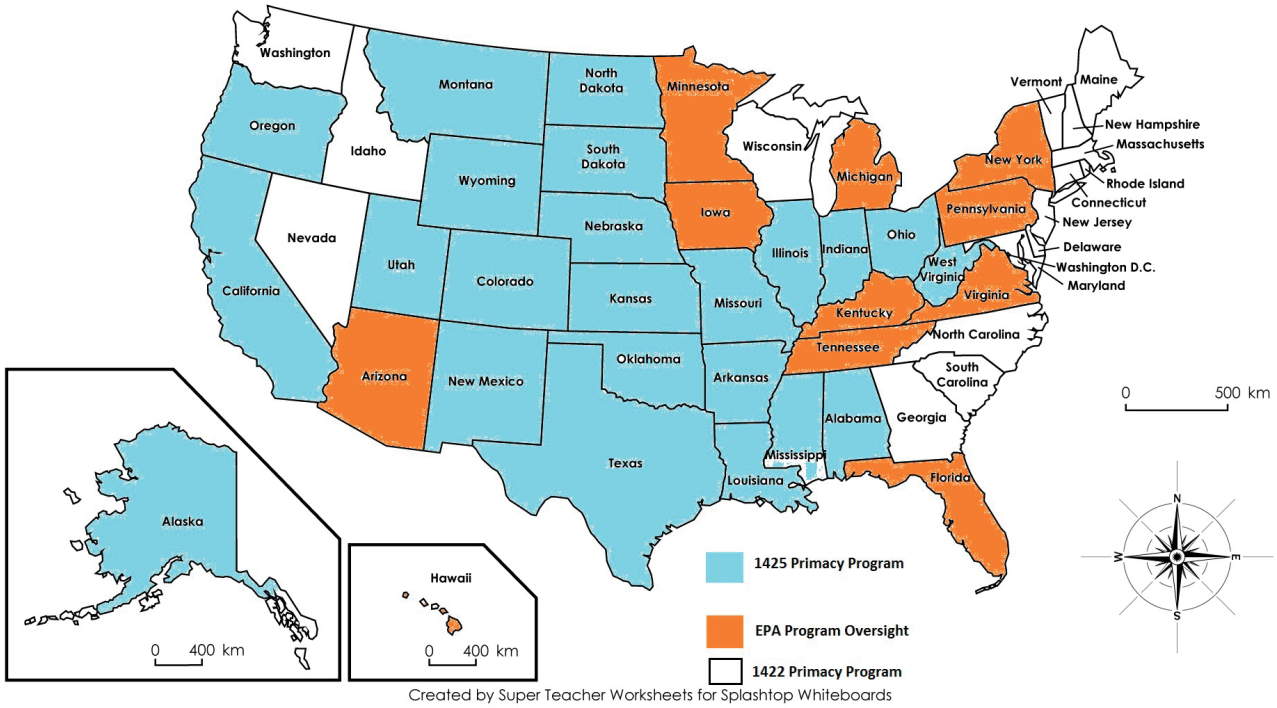
Weakening State Requirements: In 1980, the oil and gas industry successfully lobbied Congress to amend SDWA to allow a less rigorous interpretation of whether a state's program meets the minimum federal standards of the UIC program for Class II wells. UIC primacy granted under the original SDWA Section 1422 requires the state program to mirror the requirements of the regulations developed by EPA. For UIC Class II, states can choose to obtain primacy under Section 1425, added to SDWA in 1980 and applying only to Class II wells. When applying for primacy under SDWA Section 1425, state programs do not have to meet the exact EPA requirements, but instead demonstrate that their program "represents an effective program to prevent underground injection which endangers drinking water sources." *[See Map, page 4]*

The significance of Section 1425 is that it allows states to apply for primacy to run the Class II UIC program in a more flexible way than they could for any other UIC Class or for any other part of the SDWA, for which they would be required to adopt language and provisions which are at least as stringent as and mirror the federal regulations in substance and process.** EPA Guidance on granting primacy under SDWA Section 1425 is intended to meet the statutory

**Underground source of drinking water (USDW) means an aquifer or its portion: (1)(i) Which supplies any public water system; or (ii) Which contains a sufficient quantity of ground water to supply a public water system; and (A) Currently supplies drinking water for human consumption; or (B) Contains fewer than 10,000 mg/l total dissolved solids; and (2) Which is not an exempted aquifer. Source: 40 CFR 146.3*

***So long as the statutory requirements are met, the states are not obligated to show that their programs mirror either procedurally or substantively the Administrator's regulations. Source: Report to accompany H.R. 8117, No. 96-1348, September 19, 1980, p. 5.*

Map: UIC Class II Primacy Programs



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goal of preventing endangerment of underground sources of drinking water is met. However, a 2014 Government Accountability Office (GAO) report found deficiencies in EPA oversight of the UIC Class II program, including inconsistencies in performing annual on-site program reviews to ensure that the program is working as approved to protect drinking water sources.[8] A 2011 EPA Region IX review of California's UIC Class II program found deficiencies requiring immediate attention and made recommendations to the California Department of Oil, Gas and Geothermal Resources to ensure compliance with federal law.[9]

UIC CLASS II ACTIVITIES AND EMERGING CONCERNS

Enhanced Recovery (ER): ER wells inject brine, water, steam, polymers, or carbon dioxide into oil formations in order to recover residual oil or natural gas in an existing production well. The injected fluids free oil or gas that remained in the underground formation after the initial extraction process. EPA estimates that 80% of UIC Class II permits in the United States are for ER wells. Hydraulic fracturing is a form of enhanced recovery because water, sand, and chemicals are injected at high pressures to fracture the source rock and free the remaining oil. However, due to the exemption granted by Congress in the 2005 Energy Policy Act, EPA only regulates this process if diesel fuels are used in the fracture fluid.

Disposal Wells: Class II disposal wells are used for permanent disposal of wastewater from oil and gas production. Oil and gas waste water includes "flowback" water and "produced" water. Flowback water is composed mostly of the water and fluids used in hydraulic fracturing and other extraction processes, which flows back out of the well after the fracturing or other type of stimulation of the underground formation is complete. Produced water flows back out of the well along with gas or oil, and contains fracturing or other process fluid as well as salts, metals, chemicals and naturally-occurring radioactive materials that were present in the underground formation.[10] Class II wells inject over 2 billion gallons of fluid per day; 60% of this is injected into ER wells.[11] **Hydrocarbon storage** is used to store hydrocarbons that can be retrieved for

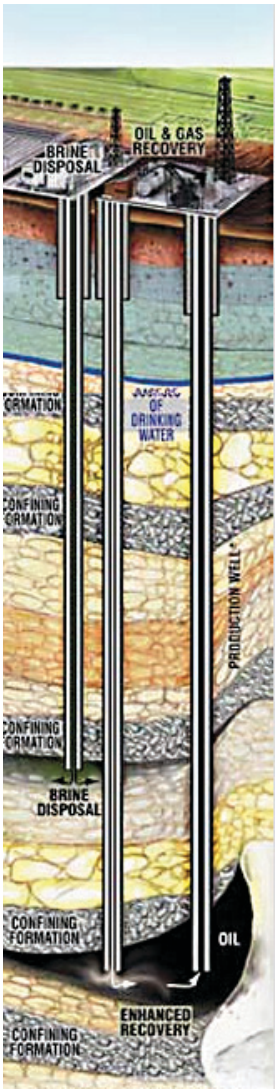
later use, including for the Strategic Petroleum Reserve program.[12]

There are several areas of emerging concern around UIC Class II underground injection activities in the oil and gas sector. Class II injection activities are implicated in increased seismic activity in several states. The large volumes and composition of wastewater produced in unconventional oil and gas extraction have drawn attention to underground injection waste disposal. In Texas, large volume and pressure is being investigated as the cause of several incidents of over-pressurization of the injection formation, which causes fluid to come back up the well and onto the surface. This water, contaminated with both chemicals from fracturing fluid or other production activities and contaminants brought up from underground, can make its way into underground sources of drinking water closer to the surface.[13] Revelations of irregularities and confusion in implementation of the Aquifer Exemption Program in California and other high-profile Exemption applications have illuminated the need for a thorough review of this aspect of the UIC Class II program.[14]

Hydraulic Fracturing and the UIC Program

As coalbed methane extraction and hydraulic fracturing drilling technologies developed, water resource advocates questioned whether the UIC program should cover these extraction processes. In 1994, the Legal Environmental Assistance Federation (LEAF) petitioned EPA to withdraw UIC Class II primacy approval for the state of Alabama due to its failure to regulate hydraulic fracturing coalbed methane extraction. EPA denied the LEAF petition in 1995, arguing that Congress never intended for the activity to fall under UIC jurisdiction. LEAF challenged EPA in the U.S. Court of Appeals for the 11th Circuit and in 1997 the Court ruled that with a plain language interpretation of the UIC program, hydraulic fracturing was subject to the SDWA UIC program. EPA published a controversial report in 2004 finding that hydraulic fracturing did not pose significant risk to underground sources of drinking water.[15]

Class II Well



Source: http://water.epa.gov/type/groundwater/uic/class2/

In 2005, Congress passed the Energy Policy Act (EPAct), which changed the SDWA definition of "underground injection" to exclude hydraulic fracturing except in cases where diesel fuel is used. In 2010, Congress instructed EPA to undertake a study into the relationship between hydraulic fracturing and drinking water. *The Potential Impacts of Hydraulic Fracturing on Drinking Water Resources* study,[16] due to be released for public comment in early 2015, focuses on five potential pathways of contamination in the hydraulic fracturing lifecycle.

Diesel in Hydraulic Fracturing:

During the debate around the EPAct, concern about groundwater contamination from diesel used in hydraulic fracturing led to this exception being written into SDWA. Diesel is of particular concern because of the toxic chemicals it contains which are highly mobile in groundwater and associated with serious health impacts. At the time, industry representatives claimed that diesel was no longer used in hydraulic fracturing operations, but there is increasing evidence that the use of diesel remains widespread.[17]

In 2014, EPA finalized *Permitting Guidance for Hydraulic Fracturing Oil and Gas Activities Using Diesel Fuels*.[18] Absent such guidance, primacy agencies are challenged to issue permits for drilling operations using diesel because existing permit guidance is for activities which are very different from hydraulic fracturing. As of Fall 2014, no permits have been issued despite continued evidence that diesel is being used.

Significance of the Hydraulic Fracturing Exemption: The exemption of most hydraulic fracturing activities from the UIC program is significant. The UIC program was developed specifically to protect underground sources of drinking water from endangerment resulting from injection activities. UIC Class II program requirements are designed to ensure that this goal is met. State permitting programs for oil and gas activities do not include all of the UIC Class II permitting provisions designed specifically to protect underground sources of drinking water. These include requirements for site characterization and Area of Review analysis to identify pathways by which a USDW could be disrupted or contaminated, well construction, well operation, mechanical integrity, monitoring and reporting. The UIC's public notification requirements are also more robust than state requirements.

EPA's *Permitting Guidance for Oil and Gas Hydraulic Fracturing Activities Using Diesel Fuels* demonstrates that permitting requirements can be developed to address concerns specific to hydraulic fracturing activities. While establishing an appropriate program for UIC permitting for hydraulic fracturing would not eliminate all of the risks posed by this activity, it would establish important limitations and protections that would not only meet the SDWA-mandated goal of preventing endangerment to USDWs but provide critical information to state officials and to the public that could help in addressing other public health and environmental concerns.

CONCLUSION

Oil and gas industry representatives and many state and federal policymakers argue that state oil and gas permitting programs are sufficient and that federal authority is not needed over these activities. However, the idea of federal minimum requirements to protect public health and natural resources is fundamental to federal health and environmental laws including the Safe Drinking Water Act, the Clean Water Act and the Clean Air Act. While the oil and gas industry has been remarkably successful in obtaining exemptions to federal laws and regulatory loopholes, there is nothing intrinsic in their activity that makes it less of a risk to public health, clean water or clean air than other regulated activities.

The UIC program was created by Congress and implemented by EPA because injection wells have been known to contaminate underground drinking water sources. In light of the increased strain on groundwater resources, changes in water demand and treatment, development of unconventional oil and gas extraction methods including hydraulic fracturing and a dramatic increase in oil and gas production, key aspects of the UIC Class II program merit scrutiny. These include:

- The 1974 Safe Drinking Water Act (SDWA) language mandating that EPA not "impede or interfere" with oil and gas production;
- The definition of underground sources of drinking water and the Aquifer Exemption Program in its entirety;
- Delegation of primacy authority for the UIC Class II program under SDWA Section 1425;
- Class II permitting requirements for Enhanced Recovery, disposal wells and any other injection activities in EPA and state-run programs in light of emerging concerns including fluid contents and increased volume and pressure;
- Permitting and enforcement for hydraulic fracturing activities using diesel fuels;
- The 2005 Energy Policy Act language exempting hydraulic fracturing from the UIC program, except when diesel fuel is used; and,
- Funding for EPA and state implementation of the UIC program.

Table 2: SDWA and UIC Action Timeline

Year(s)	Action
1974	SDWA first passed, standard setting and established that underground injection activities would be regulated by EPA.
1980	First UIC regulations. American Petroleum Institute lawsuit around USDW definition and aquifer exemptions.
1982	Revised UIC regulations published with amended USDW definition and aquifer exemption criteria.
1982–1990	20 state UIC programs given primacy under Section 1425.[19]
1986	SDWA Amendments: Included provisions for "non-community" systems, monitoring for regulated and unregulated contaminants and public notification for violations.
1988	Oil and gas industry waste exempted from hazardous waste provisions in the Resources Conservation and Recovery Act under Class C.
1994	*Legal Environmental Assistance Foundation (LEAF)* petitioned EPA to rescind approval of Alabama's UIC primacy program because it did not regulate hydraulic fracturing.
1995	EPA denied the *LEAF* petition stating that hydraulic fracturing did not fall within the definition of "underground injection" as used in the SDWA.
1996	SDWA Amendments: Sought to ensure protection from source to tap and authorized specific source water protection provisions, set up the annual "Consumer Confidence Reports," and created the Drinking Water State Revolving Fund (SRF) modeled on a similar Clean Water Act SRF.
1997	U.S. Court of Appeals 11th Circuit Court disagreed with EPA, stating the hydraulic fracturing did fall within the SDWA definition and ordered EPA to reconsider the *LEAF* petition.
2000	*LEAF II:* EPA approved Alabama's revised primacy program under Section 1425. *LEAF* appealed this decision arguing that under Section 1425 Alabama did not subject hydraulic fracturing to the same regulatory requirements as other Class II wells. The court agreed stating that wells using hydraulic fracturing must be categorized under one of the five well classes in the UIC program.
2004	EPA publishes report indicating that hydraulic fracturing in coal bed methane formations did not pose a significant threat to drinking water resources.
2005	Energy Policy Act amended the SDWA to exclude hydraulic fracturing activities from the definition of "underground injection" and thus relinquished federal authority over the practice except when diesel fuels are used.
2010	Congress directs EPA to conduct a study on the relationship between hydraulic fracturing and drinking water resources.
2011	EPA consultancy releases report critical of California's UIC Class II program and lists areas for improvement.
Winter 2014	EPA publishes permitting guidance for hydraulic fracturing activities using diesel fuels.
Summer 2014	Government Accountability Office releases report on UIC Class II wells indicating the program needs urgent improvement.
Fall 2014	Despite documented cases of diesel fuel use in hydraulic fracturing activities, no UIC permits for diesel use have been issued.
2015	Expected release of the draft assessment portion of the EPA study on hydraulic fracturing and drinking water resources.

NOTES

1 42 U.S.C. § 1421 (a) (2)

2 The definition of Underground Sources of Drinking Water (USDW) developed by the U.S. Environmental Protection Agency as part of the UIC program assumes that water containing over 3,000 parts per million (ppm) Total Dissolved Solids (TDS) is unlikely to be suitable for drinking water and that water with over 10,000 ppm TDS will never be used for drinking water. These assumptions may be out of date in light of water treatment technologies over the last three decades.

3 *Drinking Water: EPA Program to Protect Underground Sources From Injection of Fluids Associated with Oil and Gas Needs Improvement*, U.S. Government Accountability Office (GAO), June 12, at 1.

4 *Drilling Down: Protecting Western Communities from the Health and Environmental Effects of Natural Gas Production*, Natural Resources Defense Council, October 2007 at 17.

5 GAO at 18.

6 Freeman, Bill. Arthur, Daniel. *Aquifer Exemptions: Wise Use of Environmental Protection Resources*. Society of Petroleum Engineers, 29760. 1995.

7 40 CFR 144.7.

8 GAO at 39-41.

9 EPA Region IX letter to California Department of Conservation Division of Oil, Gas and Geothermal Resources, July 18, 2011.

10 *Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources: Progress Report* (EPA Drinking Water Study), EPA, December 2012 at 18.

11 *Underground Injection Wells: Introduction to Their Use, Operation & Regulation*, Groundwater Protection Council, September 1, 2013 at 14.

12 http://water.epa.gov/type/groundwater/uic/class2/.

13 GAO at 36.

14 *Poisoning the Well: How the Feds Let Industry Pollute the Nation's Underground Water Supply*, Propublica, December 11, 2012.

15 *Hydraulic Fracturing and Safe Drinking Water Act Regulatory Issues*, Congressional Research Service, January 10, 2013.

16 EPA: *Drinking Water Study: Progress Report*.

17 *Fracking Beyond the Law*, Environmental Integrity Project, August 2014.

18 Revised Guidance: *Permitting Guidance for Oil and Gas Hydraulic Fracturing Activities Using Diesel Fuel: Underground Injection Control Program Guidance #84*, EPA, February, 2014.

19 Ground Water Protection Council, *State Oil & Natural Gas Regulations Designed to Protect Water Resources*, 2014 Edition, p. 113.

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