The Fracturing Responsibility and Awareness of Chemicals Act of 2011

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This report is the culmination of the two-semester Workshop in Applied Earth Sciences Management, an integral component of the Master of Public Administration in Environmental Science and Policy at Columbia University's School of International and Public Affairs. Over the summer of 2011, the authors were tasked with completing an in-depth environmental and political analysis of The Fracturing Responsibility and Awareness of Chemicals Act of 2011, S.587, also known as the FRAC Act. In the fall, the team focused on the policy's implementation. This report summarizes the key scientific findings and recommends a program design and implementation plan that will position the FRAC Act for success, if it should become law.

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List of Abbreviations

ATSDR – Agency for Toxic Substances and Disease Registry

CAA – Clean Air Act

CAS – Chemical Abstract Service

DOE – Department of Energy

DOT – Department of Transportation

EIA – Energy Information Administration

EPA – Environmental Protection Agency

FRAC Act – Fracturing Responsibility and Awareness of Chemicals Act

GS – General Schedule

GSA – General Service Administration

IT – Information Technology

LEAF – Legal Environmental Assistance Foundation

MSDS – Material Safety Data Sheet

OEI – Office of Environmental Information

OPM – Office of Personnel Management

SDWA – Safe Drinking Water Act

UI – User Interface

UIC – Underground Injection Control

USDW – Underground Sources of Drinking Water

USGS – United States Geological Survey

Executive Summary

Hydraulic fracturing is a technology used to stimulate production from unconventional oil and gas deposits, such as those found in shale rock and coal-bed formations. While hydraulic fracturing has been used for several decades, advancements in horizontal drilling technology have allowed for the extraction of previously inaccessible natural gas reserves throughout the United States. As the process has proliferated, so too have citizen complaints about the contamination of drinking water sources, resulting in calls for investigations into the potential risks. As it stands, there remains a lack of consensus among stakeholders regarding the problems associated with hydraulic fracturing. This ambiguity is compounded by the fact that the process is exempt from federal regulation and operators are not required to disclose chemical information. The lack of understanding and transparency, combined with the current patchwork of state regulations of varying stringencies has also led to calls for uniform federal oversight.

To address some of these concerns, on March 15, 2011 Senator Robert Casey Jr. of Pennsylvania introduced the Fracturing Responsibility and Awareness of Chemicals Act (FRAC Act) to the Senate. The FRAC Act has both a regulatory and disclosure component. The regulatory component classifies hydraulic fracturing as underground injection, placing the practice under the purview of the Safe Drinking Water Act. The disclosure component mandates the disclosure and publication of hydraulic fracturing chemicals to the public, except for proprietary information.

To meet the requirements of the FRAC Act, we designed the FRAC Program. Regarding the regulatory component, hydraulic fracturing would be designated as a Class II well under the Underground Injection Control (UIC) Program of the Environmental Protection Agency (EPA). The disclosure of chemicals would occur during the UIC regulatory processes of well permitting and closure. The FRAC Program stipulates that operators must apply through the permitting process to receive trade secret status for specific chemicals. The EPA or the administrating state regulators would have the authority to decide if chemicals are considered trade secret. The disclosed chemicals would be displayed on a website hosted by the EPA. Finally, the full chemical formulas—including trade secret constituents—would be released to medical personnel during emergencies by the Agency for Toxic Substances and Disease Registry (ATSDR).

The first year of implementation of the FRAC Program would consist of three concurrent phases of preparatory work. The Rulemaking Phase would revise the existing UIC rules to include hydraulic fracturing while the IT Implementation Phase would see the creation of a website to display the disclosed chemicals and establish the necessary connections between the UIC National Database and the ATSDR. A crucial part of the implementation process is the State Assessment phase, which is designed to address the large variations in state shale gas reserves and the differences in state and regional UIC Program capacity and funding. The FRAC Program would significantly increase the workload of the underfunded UIC Program, so we must ensure that UIC has the staffing and budget it needs for effective regulation. The budget for the first year would be nearly $1.6 million and would mostly cover personnel services. Staffing for the first year would draw largely upon existing staff for the Rulemaking and IT Implementation Phases but would require the use of contractors for the bulk of the State Assessment Phase.

The FRAC Program, while not addressing all potential environmental and health problems related to hydraulic fracturing, would be a crucial first step in the federal regulation of the growing practice. The State Assessment Phase would ensure that the program would be effective in its regulation of hydraulic fracturing.

Introduction

Natural gas extraction by hydraulic fracturing is already a major component of America's energy sector. The practice can enable access to vast reserves of natural gas in the United States, greatly increasing domestic energy security. While the wide economic and energy benefits are generally understood, concrete information about the environmental and human health risks associated with hydraulic fracturing is only beginning to appear. This is due in part to the lack of full disclosure of the chemicals used during hydraulic fracturing. Furthermore, there is currently no federal regulation of hydraulic fracturing because of several regulatory exemptions created by federal laws. Instead, there is a patchwork of state and local regulations that vary widely in scope and degree.

This report is the product of a comprehensive scientific and political analysis and simulated program design for the implementation of The Fracturing Responsibility and Awareness of Chemicals Act, or FRAC Act, of 2011. The FRAC Act aims to bring added oversight and transparency to the practice of hydraulic fracturing through federal regulation and a requirement for the disclosure of chemical information to the Environmental Protection Agency (EPA).

What is Hydraulic Fracturing?

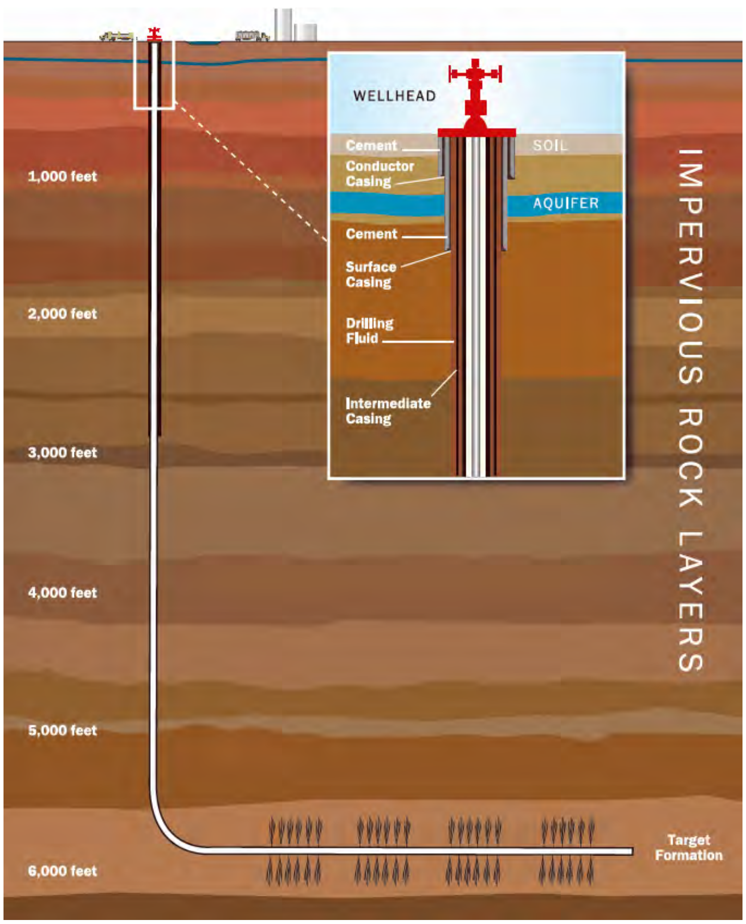

Figure 1: The Hydraulic Fracturing Process (API)

Process

Hydraulic fracturing is a method for extracting gas or oil trapped in shale rock formations. These deposits are formed by the sedimentation of organic matter in slow moving bodies of water over millions of years. Continual layering of sediment loads builds extreme pressure and slowly converts the organic matter into hydrocarbons such as oil and natural gas (Sumi, 2008, p.2). The extraction process begins with the selection and preparation of an appropriate site, based on geology and recoverable gas (EPA, 2011a, p.10). A well is then drilled into the shale rock formation, with one of the following shapes: vertical, horizontal or S-shaped (EPA, 2011a, p. 11). The walls of the well are then cased with steel and concrete to protect from leakage at the soil and aquifer level.

Once the well is prepared, the operator perforates its lower reaches with small explosives to create initial cracks in the shale formation. Large volumes of hydraulic fracturing fluid are injected at very high pressures into the well to break apart the shale formation. The hydraulic fracturing fluid is mostly comprised of water, but contains chemicals that act perform various functions such as lubrication, corrosion inhibition and pH control (EPA, 2011a, p.86) and proppants—such as sand—to hold the fractures open so that oil and natural gas can return to the wellhead (Tiemann & Vann, 2011, p.1). After the injection process, the flow of fluids is reversed and twenty five to seventy five percent of the injected fluids return to the surface (cite). The natural gas is then separated from the wastewater (known as "flowback"), the injected fluids, and other naturally occurring substances from the shale rock.

History of Hydraulic Fracturing

Hydraulic fracturing is not a new practice, but the recent advances in drilling technology have resulted in a nationwide boom. Until the early 2000s, the technique was used to stimulate production from oil and gas wells with declining productivity – a process known as "enhanced recovery" (Tiemann & Vann, 2011, p.1) (Yergin, 2011). Advancements in horizontal drilling technology then opened up previously inaccessible reserves to "primary recovery" by allowing for productive drilling at greater depths. More and more companies began to use the process, most notably to develop the extensive natural gas reserves present in the United States (Yergin, 2011). More than 35,000 hydraulic fracturing wells are drilled every year, making up 90% of new oil and gas development in the US (EPA, 2011a, p.19) (Carillo, 2005). These wells are spread across much of the country, as there are many different shale formations in the United States.

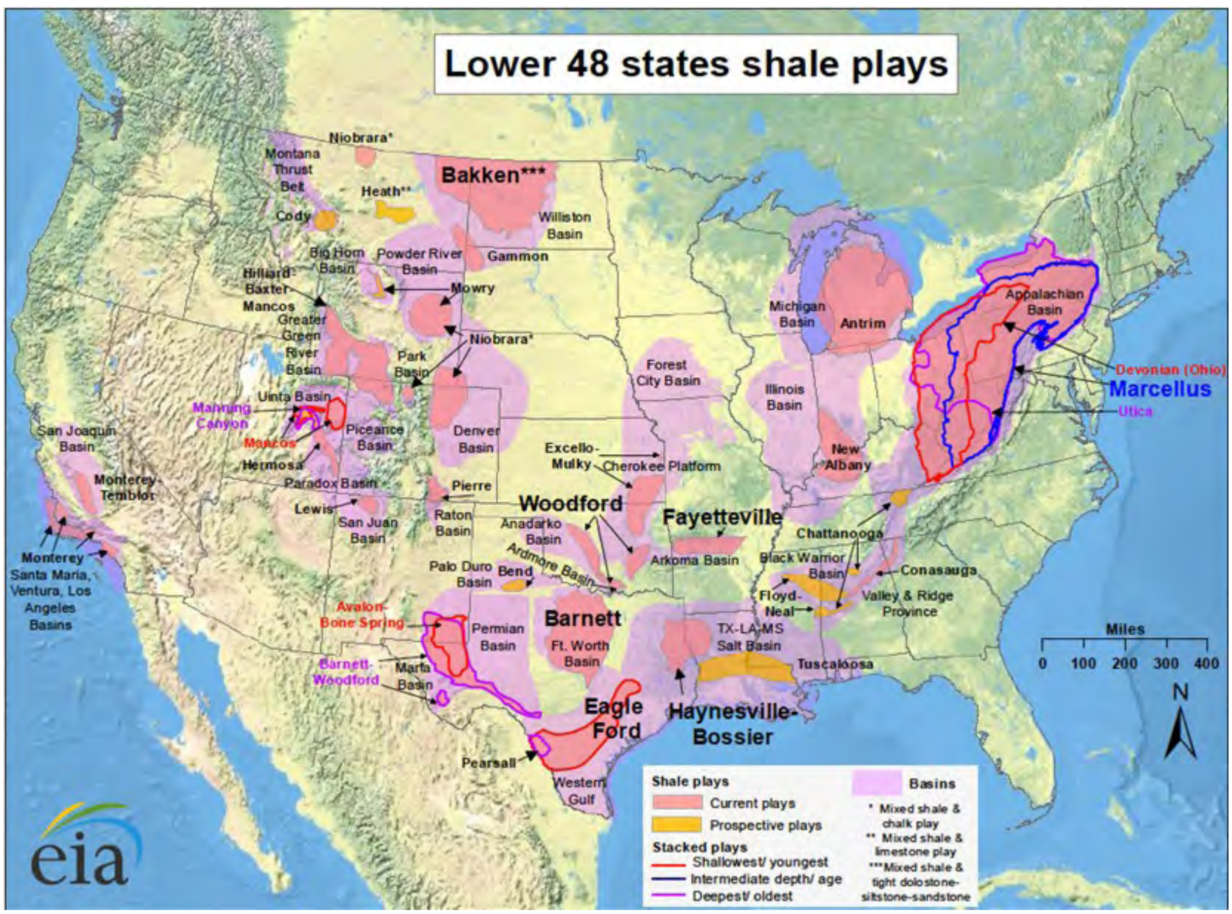

Figure 2: Shale gas formations in the United States. (US EIA)

Why is Shale Gas Important?

These technological advancements have significant implications for the energy future of the United States, which has the second largest shale gas reserves in the world (EIA, 2011b). High-end estimates gauge the newly accessible volume of domestic natural gas at 2,500 trillion cubic feet, which would provide for approximately 100 years of current rates of American consumption (Yergin, 2011). Furthermore, natural gas plants are projected to account for up to 60% of new capacity in the coming decades under the Energy Information Administration's (EIA) projections (EIA, 2011a, p.79). The new natural gas finds have been hailed as a blessing (Rowe, 2011), in part because they will likely stimulate the expansion of the natural gas power sector. Indeed, as illustrated in Figure 3, the EIA reports that shale gas currently accounts for around 20% of US domestic production and estimates predict that it will grow to 45% by 2035 (EIA, 2011a, p.79). It is important to note, however, that these estimates might be overstated. The United States Geological Survey (USGS) recently downgraded an EIA estimate for the Marcellus Shale – one of the largest shale gas formations in the United States. Using different methods and parameters, the USGS estimated a figure 80% smaller than what the EIA had estimated in April 2011(Marritz, 2011). If the EIA estimates for other shale formations are similarly overstated, this might significantly drop the reserve estimate in the US and minimize the impact of natural gas in the future. Nevertheless, even the low-end estimates suggest that that natural gas will play a critical role in the energy future of the United States.

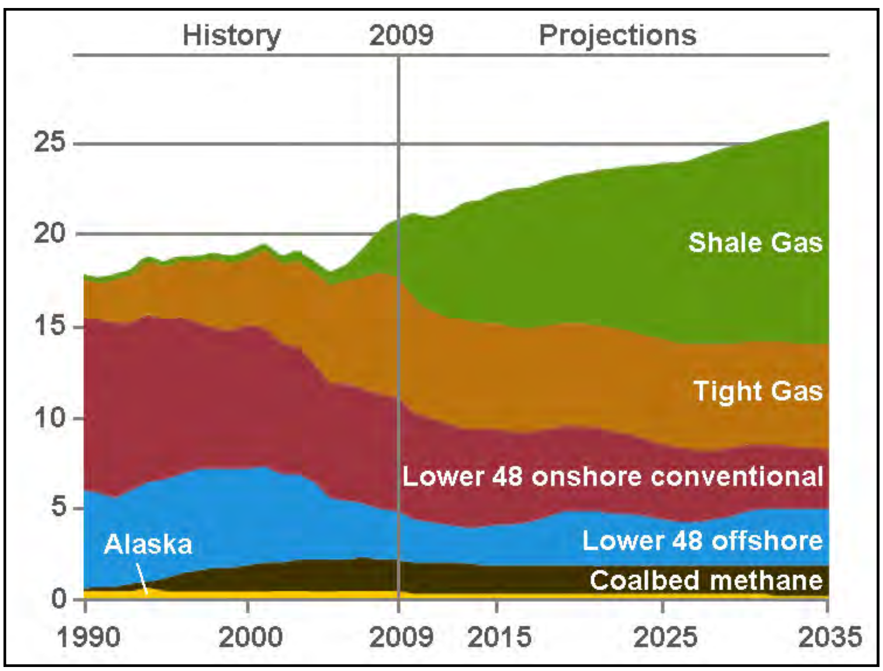

Figure 3: US natural gas production, 1990-2035 (trillion cubic feet per year) (US EIA)

Figure 3 shows how shale gas is expected to grow rapidly over the next 25 years compared to other forms of natural gas. Conventional gas, shown here in red and blue, are found in porous and rock formations and do not require additional stimulation for extraction. Shale gas is represented in green. Tight gas, shown here in orange, is recovered from sandstone formations or carbonates with low permeability (EPA, 2011a, p. 10). Coal-bed methane, shown here in brown, is found in coal formations in varying concentrations. Shale gas, tight gas and coal-bed methane are all known as unconventional sources of natural gas, as they require additional stimulation for extraction.

Environmental Concerns

There are a number of environmental concerns surrounding hydraulic fracturing, including groundwater contamination by chemicals and methane, surface water contamination by wastewater. Non-water related risks include water depletion air pollution and seismic concerns.

Groundwater Contamination

Groundwater contamination through the leaking of fracturing chemicals is the most common environmental concern cited by environmental and citizen groups. Hydraulic fracturing operators are not required by federal law to disclose the chemical constituents of their hydraulic fracturing fluids. Many citizens and environmental groups have pointed to these chemicals as causing a variety of health problems, such as skin boils, respiratory difficulty, and livestock death (Griswold, 2011). In April 2011, the House of Representatives Committee on Energy and Commerce released a report documenting voluntarily disclosed hydraulic fracturing chemicals used between 2005 and 2009. The report found that 29 of the hundreds chemicals disclosed were either carcinogenic or regulated under the Safe Drinking Water Act or the Clean Air Act. These 29 chemicals were used in 650 different hydraulic fracturing fluid mixtures. Because only 25-75% of the injected hydraulic fracturing fluids return to the surface as flowback (EPA, 2011a, p.36), concern abounds that the remaining fluids could migrate to underground sources of drinking water. While there are currently no peer-reviewed scientific studies conclusively linking hydraulic fracturing fluids with contaminated sources of drinking water, the EPA found relevant chemicals in an aquifer in a county in Wyoming where the practice is widespread (Lustgarten, 2011). The data collected by the EPA has yet to be interpreted and the causal mechanisms are currently under investigation. There is also an EPA documented case of well contamination in West Virginia that was caused by hydraulic fracturing in 1984 (Urbina, 2011a). Similarly, the causal mechanism for contamination was not determined.

Figure 4: Contaminated drinking water from a residential well suspected to be due to hydraulic fracturing nearby in Hickory, Pennsylvania. (NRDC)

While groundwater contamination from hydraulic fracturing chemicals is still poorly understood, methane migration into aquifers has been thoroughly documented. Although methane contamination in water is not a health hazard for human consumption, it is an asphyxiant in closed spaces and is a fire hazard (Osborn et al, 2011, p.2). A peer-reviewed study conducted by a group from Duke University found that methane contamination of underground sources of drinking water has been associated with hydraulic fracturing operations. However, this contamination was not caused by migration of hydraulic fracturing fluid from fractures in shale rock, but rather by direct infusion from poorly constructed well sections passing through aquifers (Osborn et al, 2011, p.1). This shows that hydraulic fracturing may contaminate aquifers with methane under certain circumstances.

Wastewater

The wastewater produced by hydraulic fracturing presents the most immediate risks to human health and the environment. It contains both the hazardous chemical additives included in hydraulic fracturing fluid as well as naturally occurring corrosive salts and highly radioactive elements such as radon (Urbina, 2011b). Once wastewater returns to the surface, it is usually stored in holding ponds or pits before being injected deep underground, transported to wastewater treatment plants or released into waterways. A *New York Times* investigation showed that flowback received by treatment plants can be over 2000 times the EPA standard for radioactivity – a level that wastewater treatment plants are simply unable to effectively neutralize or filter out (Urbina, 2011b). There is also the potential for the direct release of wastewater through the failure or overflow of holding ponds.

Figure 5: Hydraulic fracturing holding pond for flowback fluids (Fair)

Other Risks

There are other environmental risks associated with hydraulic fracturing beyond the potential contamination of drinking water sources. The process is extremely water-intensive, which raises concerns about water resource depletion. Each hydraulic fracturing operation uses upwards of 4 million gallons of water (Lustgarten, 2009). Considering that the EPA estimates that more than 35,000 wells are fractured each year (EPA, 2011a, p.19), this means that hydraulic fracturing companies use between 70 and 140 billion gallons of water per year. This volume is roughly equal to the water demands of one to two cities the size of Chicago (EPA 2011a, p.19). This is particularly problematic in areas west of the Mississippi, where freshwater resources are scarce and drought is widespread.

In addition, there are seismic risks associated with hydraulic fracturing. In the United Kingdom, the natural gas company Cuadrilla Resources released a report stating that there was a high probability that hydraulic fracturing caused minor earthquakes (Vukmanovic, 2011). Cuadrilla Resources was quick to point out that the earthquakes were the result of a unique combination of geological factors and claimed that the overall safety of the method is still sound. The disposal of wastewater via underground injection from hydraulic fracturing methods is also thought to contribute to seismic activity. In March 2011, Arkansas saw a period of increased earthquake activity in an area of the state where injection wells were present. After the Arkansas Oil and Gas Commission shut down the wells, the Arkansas Geological Survey reported an immediate decrease in earthquake occurrence. Nevertheless, there is still uncertainty surrounding the cause of the seismic activity (Eddington, 2011).

Finally, greenhouse gas emissions are also a concern surrounding hydraulic fracturing. The life cycle of conventional natural gas is believed to involve fewer fossil fuel emissions than coal (Howarth, 2011, p.1). Natural gas companies extend this belief to gas recovered from shale through hydraulic fracturing, but scientists have not yet determined the validity of this claim. One study demonstrated that the escape of fugitive methane from wells during the extraction process causes the total carbon footprint of shale gas to be higher than that of coal (Howarth, 2011, p.1), while a contradictory study by researchers at Carnegie Mellon University stated that natural gas produced from the Marcellus Shale is not as carbon intensive as coal during its life cycle (Kirkland, 2011). Debate over the carbon footprint of natural gas extracted through hydraulic fracturing is ongoing.

Figure 6: Methane flare (Cohn)

Uncertainties of Risk

There is much uncertainty as to the level of risk posed by the expansion of hydraulic fracturing across the United States. An EPA study on hydraulic fracturing released in 2004 found no "confirmed evidence" of contamination to underground sources of drinking water (EPA, 2004, p. ES-1). Environmental groups and independent analysts heavily criticized the study, saying that it was incomplete and left out crucial information (Sumi, 2005, p. vii). In response to the criticism, Congress commissioned another EPA study in 2011 directed at the effects of hydraulic fracturing on sources of drinking water. The EPA will publish interim findings in 2012 and complete the report in 2014. In the meantime, a new local study by the EPA shows the contamination of Wyoming aquifers by chemicals used in hydraulic fracturing. While the causal pathway of hydraulic fracturing contamination has yet to be established, this is the first study by a reputable source that provides concrete evidence of aquifer contamination in an area known for its high levels of hydraulic fracturing (Lustgarten, 2011).

The primary reason for the dearth of studies on hydraulic fracturing fluid and its impacts is that well operators are not required to disclose the chemical constituents of their fluid mixtures. Instead, they protect many of these compounds as confidential business information or "trade secrets", making it extremely difficult for scientists to study the effects of hydraulic fracturing on the environment. The Fracturing Responsibility and Awareness of Chemicals Act of 2011 (FRAC Act) seeks to mitigate these uncertainties by bringing transparency and oversight to the hydraulic fracturing process.

Why Isn't Hydraulic Fracturing Regulated?

Despite the various risks presented above, hydraulic fracturing is currently exempt from several major federal environmental regulations. Understanding the regulatory context of the FRAC Act requires a particular understanding of the history behind the process's exemption to the Safe Drinking Water Act.

The Safe Drinking Water Act

Congress promulgated the Safe Drinking Water Act (Pub. L. No. 93-523) in 1974, authorizing the EPA to set standards for drinking water quality and to oversee those who implement them (states, localities and suppliers) (EPA, 2011e). Sections 1421-1426, 1431, 1442, and 1443 of the Act address "underground injection" and serve as a basis for preventing the contamination of underground sources of drinking water resulting from these activities. It requires the establishment of UIC programs – regulatory programs for the protection of underground sources of drinking water – in each state, including the oversight and limitation of underground injections that could affect aquifers (Tiemann & Vann, 2011, p.7). The EPA directly enforces these programs in some states, while in others the state government acts as the local authority (Safe Drinking Water Act, 1974, §§1421,1422).

The EPA did not initially regulate hydraulic fracturing under the SDWA until a regional lawsuit prompted change. The discrepancy arose because UIC programs originally regulated "disposal" wells, meaning that the more extractive process of hydraulic fracturing was not considered an "underground injection" (Puder, 1999, p. 508-509). In 1997, the Legal Environmental Assistance Foundation (LEAF) petitioned the EPA to withdraw approval of Alabama's UIC program, arguing that it did not regulate hydraulic fracturing in accordance with the SDWA. They were denied on the grounds that hydraulic fracturing did not constitute an "underground injection". The case went to the 11th Circuit Court of Appeals, which ultimately ruled in

LEAF's favor, stating that hydraulic fracturing did involve "underground injection" (Puder, 1999, p.523-524). This forced the EPA to reevaluate its oversight responsibility for hydraulic fracturing under the SDWA and the UIC Program.

An Official Exemption: The Energy Policy Act of 2005

While the EPA was preparing to regulate hydraulic fracturing under the UIC Program, the issue reemerged with the Energy Policy Act of 2005 (Pub. L. No. 109-58). This act amended the SDWA to exclude from the definition of "underground injection" those substances (other than diesel fuels) involved in hydraulic fracturing operations. In this way, the act stripped the EPA of its authority to regulate hydraulic fracturing under the Safe Water Drinking Act. This exemption is commonly referred to as the Halliburton Loophole, because then Vice President Dick Cheney, former Chief Executive of Halliburton, a major energy and hydraulic fracturing services company, was involved in its creation.

Figure 7: Marcellus Shale rig (Acker)

Current Regulation: A State Patchwork

Hydraulic fracturing in the US is currently regulated to varying degrees in a patchwork of local and state laws. Many state governments have formulated laws placing hydraulic fracturing under the purview of various state agencies. Some have even enacted or proposed chemical disclosure requirements and certain states have broadened the scope of regulation beyond the parameters of the FRAC Act. For a sampling of current state regulation of hydraulic fracturing, refer to Appendix B. Overall, the natural gas industry considers state regulation to be the best form of government oversight, as it allows authorities to tailor solutions to local geological conditions (American Petroleum Institute, 2010). However, proponents of the FRAC Act believe a federal standard for regulation is necessary to ensure a baseline of safety standards and transparency regarding disclosure of chemicals used in hydraulic fracturing nationwide.

Regulation of Similar Injection Practices: Underground Injection Control

Under the Safe Drinking Water Act, all major injection activities, including oil and gas related practices, are regulated under the UIC Program. This program is responsible for protecting public drinking water supplies through the regulation of the construction, operation, permitting and closure of all injection wells that place fluids underground for storage or disposal (EPA, 2011b). These wells are categorized in six distinct groups, or "classes," based on the type of liquid or gas injected, well depth and activity and their potential endangerment to underground sources of drinking water (EPA, 2011b). The six categories are briefly described below (EPA, 2011b).

UIC Program Well Classifications

Class I	Injection of hazardous wastes, industrial non-hazardous liquids, or municipal wastewater beneath the lowermost Underground Sources of Drinking Water (USDWs)
Class II	Injection of brines and other fluids associated with oil and gas production, as well a hydrocarbons for storage
Class III	Injection fluids associated with solution mining of minerals beneath the lowermost USDW
Class IV	Injection of hazardous or radioactive wastes into or above USDWs
Class V	All injection wells not included in Classes I-IV
Class VI	Injection of carbon dioxide for long-term storage, also known as geologic sequestration of carbon dioxide

The UIC Program involves separation of regulatory oversight between the EPA and states. Some states have control, or "primacy", over the regulation and monitoring activities of wells within that state. In order to receive primacy status, states must apply to the EPA and meet the minimum federal requirements. Most states have primacy over all well classes, but some states have a joint state and EPA program in which the state has primacy over certain well classes. Finally, some states do not have primacy over any well classes and thus the EPA oversees all of their well regulation through "direct implementation" (EPA, 2011c). Currently, UIC programs in both primacy and direct implementation states share a federal grant from the EPA in the amount of $11 million per year (Tiemann & Vann, 2011, p. 30). Each year this grant is allocated based on an allotment formula that considers several criteria identified in the Safe Drinking Water Act, such as well status, well type, state population and state size (EPA, 2011d).

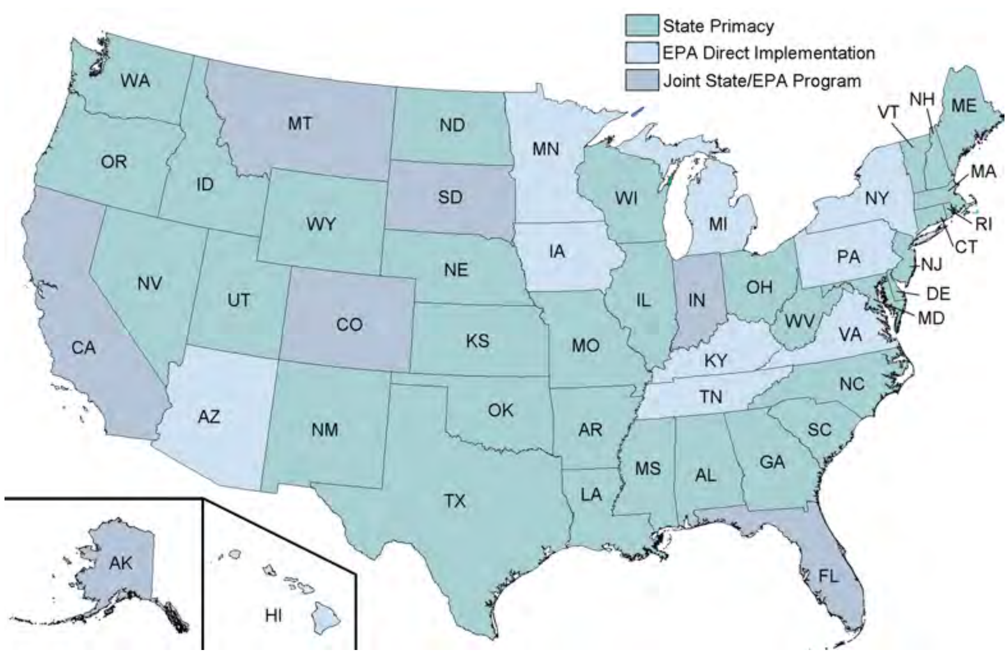

Figure 8: Map of Primacy, Direct EPA Implementation and Joint State/EPA Program states for UIC Class II injection.

The Fracturing Responsibility and Awareness of Chemicals Act

In the context of a federal regulatory exemption and the patchwork of state regulatory schemes, the FRAC Act aims to bring a uniform level of national transparency and oversight to the practice of hydraulic fracturing. In the most basic sense, it does so by repealing the existing exemption to the SDWA. In addition to this regulatory component, it also requires the detailed disclosure of chemical information.

The first iteration of the FRAC Act was introduced to the 111th Congress on June 9th, 2009 in both the United States House of Representatives and the United States Senate. Representative Diana DeGette (CO-1) introduced the House bill while Senator Robert Casey Jr. of Pennsylvania introduced the bill in the Senate. The FRAC Act was unable to move out of its respective House and Senate committees during the 111th Congress (Status of the House FRAC Act, 2009) (Status of the Senate FRAC Act, 2009).

The second iteration of the FRAC Act was introduced to the Senate Environment and Public Works Committee by Senator Casey on March 15th of 2011 with seven co-sponsors and has not since left the Committee, though hearings have been held. In conjunction with Senator Casey, Representative DeGette introduced the House version on the same day. The House version has had even less success than its Senatorial counterpart in moving forward in its respective subcommittee (Status of the House FRAC Act of 2011). Given both bills' lack of success in the 111th Congress, which was favorable to similar legislative and regulatory goals, it is hard to envision a scenario where the FRAC Act is made into law in the polarized political atmosphere of the 112th Congress.

Components of the FRAC Act:

The FRAC Act is a short piece of legislation comprised of two components: one pertaining to regulation and the other to chemical disclosure. Appendix A contains the full text of the FRAC Act.

Regulation:

The first provision of the FRAC Act would bring hydraulic fracturing under the authority of the EPA. Section 2(a) of the FRAC Act amends section 1421(d) of the SDWA through the addition of a clause stating that the term "underground injection" includes the underground injection of substances involved in hydraulic fracturing operations relating to oil and gas production (S.587, 2011, §2(a)). This change implies that hydraulic fracturing wells would be regulated under the UIC Program (Tiemann & Vann, 2011, p.20).

Disclosure:

The second provision of the FRAC Act amends Section 1421(b) of the SDWA by specifically addressing the disclosure of chemical constituents though the addition of four additional measures. First, an operator conducting hydraulic fracturing is required to provide the relevant administrator with a list of the names, basic facts and volumes of all injected chemicals involved, both before and after operations. This would require their Chemical Abstract Service (CAS) numbers–unique numerical identifiers for chemicals-–and their Material Safety Data Sheets (MSDS), which are comprehensive chemical information documents. Second, the administrator is required to make non-proprietary information available to the public. Third, a person conducting hydraulic fracturing must immediately disclose the specific identity of a proprietary chemical formula to a medical professional in the event of a medical emergency where such information would facilitate patient treatment. Finally the bill affirms that no other case requires the public disclosure of any proprietary chemical formula (S.587, 2011, §2(b)).

Program Design

The following sections detail the program design and implementation simulation that our team undertook under the guidance of the FRAC Act. We designed a hypothetical regulatory program to administer the FRAC Act should it be made into law, and detailed the budget, staffing requirements and calendar for the first year of implementation.

Approach: Assumptions and Limitations

The FRAC Act has several mandatory and flexible provisions that need to be addressed in the program design. We analyzed the existing regulatory agencies and processes that apply to similar oil and gas operations in order to create a program that is balanced, in line with current operations, and time- and cost-efficient to implement. Based on these criteria, we determined that our program should fit within the existing UIC structure, which would make it quicker and cheaper to implement. However, the current UIC program is neither sufficiently funded nor staffed to meet its mandated goals (Tiemann & Vann, 2011, p.31). This was one of the primary challenges that we had to address in our design. Furthermore, our program design must fit into the current state primacy and direct implementation scheme that governs the UIC structure between states and the EPA.

Areas of Discretion

The FRAC Act is a very brief bill, while hydraulic fracturing is a very complex process. The combination of these two facts resulted in many areas of discretion and flexibility in the creation of the FRAC Program Design. To address the regulatory requirements, we had to first decide whether to place hydraulic fracturing under an existing UIC well type, or whether to create a new class for the process. We also had to address many discretions related to the chemical disclosure requirements. The Act does not specify a timeframe for the disclosure of chemicals, nor is there any defined process for that disclosure. Once the chemicals have been disclosed to the relevant Administrator, the Act does not cover how chemical data would be stored, catalogued and made available to the public, other than specifying that chemicals be made available through an "appropriate" website. The Act also does not designate whether the administrator or the operator would determine whether a chemical formula is considered a valid trade secret. If operators were allowed to designate all chemicals as proprietary, the intent of the Act would be circumvented. Finally, we had to determine how to appropriately define the term "medical emergency" and create a streamlined process for the disclosure of confidential chemicals in the case of a medical emergency.

While there were many areas of discretion that we had to address in order to meet the requirements of the Act, there were two areas that were not mentioned at all that have serious implications for the efficacy of regulation: funding and treatment of wastewater. The Act does not include any funding mechanisms to support an increase to the already overstretched UIC workload, which is problematic in a time of unilateral federal budget cuts and an anti-regulatory political atmosphere. It also makes no mention of wastewater treatment, which is one of the primary threats to drinking water sources and is an area not explicitly covered within the SDWA. This is a glaring omission in an Act designed to protect public health. However, this issue could potentially be addressed through the Clean Water Act, which governs water discharges into surface waters.

Variables Considered in the Program Design

We considered four key factors in our program design. First, we ensured that our program elements would satisfy the objectives of the FRAC Act. Second, we chose to capitalize on existing regulatory structures, which allows us to phase in our regulations more quickly and seamlessly than if we decided to create a new structure. Third, we tried to streamline the regulatory and disclosure processes so that they could fit together with minimum strain on existing staff. We also aimed to reduce the regulatory burden that would be placed on hydraulic fracturing operators so as to mitigate potential industry pushback. Finally, we strove to maximize the political feasibility of our program. Hydraulic fracturing is a hotly debated issue and any new regulation would likely be contested by industry and industry-supporters. As such, we attempted to design a pro-

FRAC Program Design

Our program design, henceforth referred to as the FRAC Program, has five components that will address both the mandated and flexible provisions of the bill. These are outlined below.

Well Class

The FRAC Program would designate hydraulic fracturing as a Class II well under the EPA's UIC Program. However, we would create a new subclass of well in order to accommodate the differences between hydraulic fracturing, which is a primary recovery process, and the other types of Class II wells, which are generally enhanced recovery processes. By placing hydraulic fracturing under the Class II well system we hope to capitalize on the existing UIC regulatory structure while granting the UIC program the flexibility to adapt UIC rules to hydraulic fracturing. In addition it would be more politically feasible, as using an existing regulatory structure would prevent the creation of additional bureaucracy, which could potentially allow for faster implementation. UIC regulations require a permitting process for the construction of new wells, periodic mechanical integrity tests for the safety of each well and a well completion process. New hydraulic fracturing wells would need to pass through all of these regulatory processes during their life cycles.

Chemical Disclosure to Administrator

The FRAC Act states that a list of chemicals must be disclosed both before and after each hydraulic fracturing operation. The disclosure of chemical constituents before the operation would be made available through the existing well permitting process. The enforcement agency would require that operators include a list of chemical constituents and mixtures, CAS numbers and MSDSs in their permit application, saving operators the need to fill out additional paperwork. As for the disclosure of chemical constituents after the operation, hydraulic fracturing companies would use existing well completion reports as the means for making this information available to the Administrator. This report covers areas such as casing integrity, injection pressure and fluid volumes used during the fracturing process. Again, this solution would minimize the level of additional paperwork required from industry while meeting the program's requirements. While using existing avenues both streamlines and simplifies the disclosure process, Administrators would need to develop new internal procedures for handling these forms, as they would contain proprietary chemical formulas or trade-secret chemical information. As such, access to these forms would be restricted so that the identity of such chemicals is kept secure and confidential.

Determining Proprietary Status

While the FRAC Act prohibits the disclosure of proprietary chemicals to the public unless there is a medical emergency, it does not describe a method for determining if a chemical compound is a trade secret. The FRAC Program would give UIC officials the authority to make this determination. Companies would apply for trade-secret status for their chemicals through the permitting process and UIC officials would determine the validity of their requests. This process is modeled on those in place in Wyoming, Texas and Arkansas, where companies must request proprietary status for their chemicals from state administrators (See Appendix B). This places the burden of proof on industry. It further gives UIC officials a greater degree of control over the number of chemicals that are deemed proprietary, lowering the risk of companies requesting blanket exemptions that would circumvent chemical disclosure requirements entirely and render the FRAC Act inadequate.

Public Disclosure Mechanism

The FRAC Act stipulates that an "appropriate" website be created for the public disclosure of chemicals used during the hydraulic fracturing process. A new website hosted by the EPA would display the non-proprietary chemicals disclosed to regulators. This hydraulic fracturing-specific website would provide reliable, easily accessible and comprehensive access to full information on chemical constituents and well locations. In addition, it can be linked with other EPA websites that describe chemical information and health risks, such as toxicity. This EPA website would be connected to the UIC National Database, an existing database used for storing well information for the other classes of wells.

Medical Emergency Disclosure

Finally, the FRAC Act mandates that trade secret chemical formulas must be released to medical personnel in the case of a medical emergency. The Agency for Toxic Substances and Disease Registry (ATSDR) would be tasked with the release of the relevant chemical information during medical emergencies. The ATSDR is a federal public health agency of the US Department of Health and Human Services, which provides trusted health information to prevent harmful exposures and diseases related to toxic substances (ATSDR, 2011). Designated ATSDR staff would have access to the proprietary information in the UIC National Database. In keeping with FRAC Act requirements, these staff would need to sign a confidentiality agreement with hydraulic fracturing operators as necessary. The ATSDR already has significant expertise in this field, and their 24-hour Emergency Response Teams would handle calls dealing with emergency situations and would use their knowledge to assist the medical professionals requesting the disclosure of confidential information for medical treatment purposes. ATSDR staff also has experience in information dissemination and could provide medical treatment advice along with the chemical information.

Figure 9: A worker pours salt into a mixer as he prepares drilling fluid – a combination of water, sand, and chemicals for hydraulic fracturing (Dougherty)

The FRAC Program Implementation: Year 1

The first year of the FRAC Program (calendar year 2012) would involve three overlapping preparatory phases: Rulemaking, Information Technology Implementation, and State Assessment (Figure 10). These phases would lay the groundwork and gather the information necessary for implementation of the FRAC Program's specific design elements in Year 2. All three phases would be coordinated from various departments within the US Environmental Protection Agency (EPA) in Washington, D.C. and would rely heavily on existing staff and resources, as well as contracting services.

The Federal UIC Branch Director would serve as overall Project Manager, acting as a liaison between staff in each phase to ensure open communication and consistency. An organizational chart of all Year 1 staff is illustrated in Figure 11.

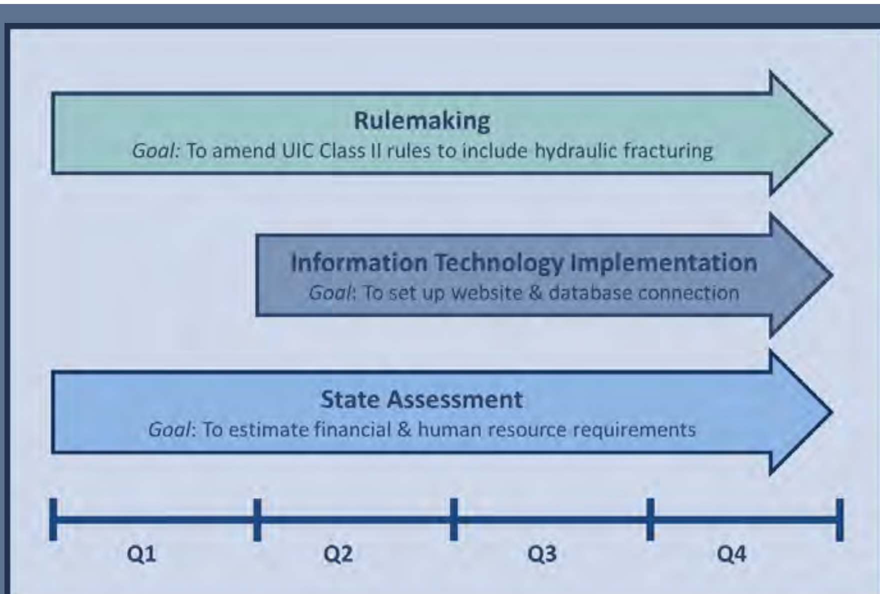

Figure 10: Year One Timeline

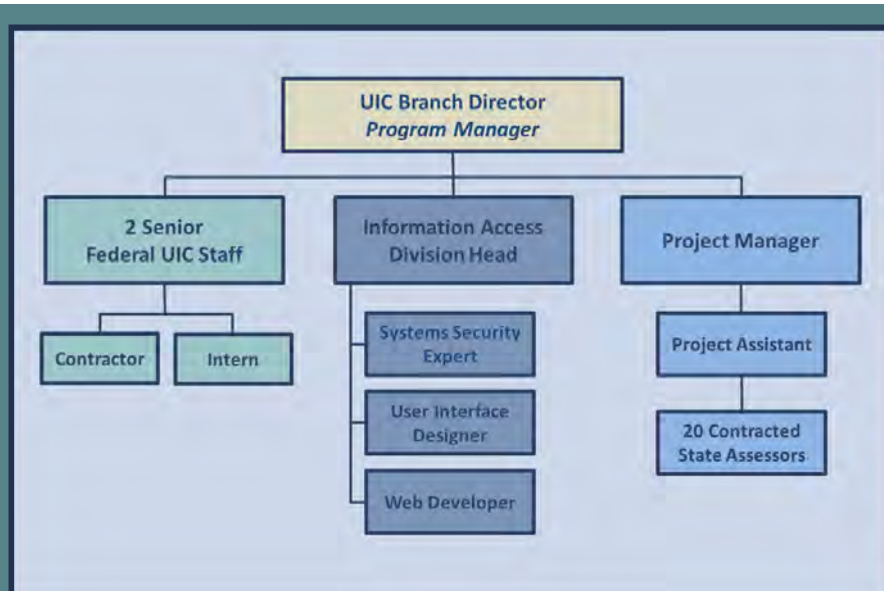

Figure 11: Year 1 Organizational Chart

What follows is a description of each phase's particular goal, staffing plan, budget requirements, and general timeline.

Rulemaking Phase

The goal of the Rulemaking Phase is to revise the existing UIC rules and regulations for Class II wells by amending them to include a new Class II well sub-type specific to hydraulic fracturing. Doing so would officially place hydraulic fracturing operations under the purview of the UIC Program and codify the unique requirements set forth in the FRAC Program design.

A "Core Rulemaking Team" within the Federal UIC Branch would take primary responsibility for the project. It would consist of five staff: the UIC Branch Director (to supervise the team on a part-time basis), two full-time senior employees (reassigned from their existing responsibilities in the Federal UIC office to draft the FRAC Program rules), a contractor (to provide hydraulic fracturing expertise) and an intern (to provide general administrative assistance). Additionally, the Regional EPA UIC Branch Chiefs would hold quarterly input meetings with the Core Rulemaking Team to ensure that any new rules are developed in accordance with local needs. To guarantee the enforceability and legality of regulations, additional federal EPA offices, such as the Office of General Counsel and Office of Enforcement and Compliance Assurance, would also offer continued support where relevant, actively participating in shaping the final rules.

This process would take place over 12 months. EPA staff would draft the rule during Q1 & Q2 and submit it for public comment at the beginning of Q3. Due to the controversial nature of the hydraulic fracturing issue and its regulation, the public comment period would take place over the full three months of Q3. EPA staff would then polish the rule in Q4 and publish it in the Federal Register at the end of the year. This phase would cost a total of $538,377, the bulk of which covers personnel services.. Consult Appendices C, D and E for more detailed staffing, budget and scheduling information.

Information Technology (IT) Implementation Phase

This phase is directed at implementing the two IT-related FRAC Program tasks: setting up the National UIC database connection with the Agency for Toxic Substances & Disease Registry (ATSDR) and creating a hydraulic fracturing-specific public disclosure webpage on the EPA website. This process would occur over 9 months, (Q2 to Q4, 2012) while Rulemaking is underway.

Existing staff at the EPA Office of Environmental Information (OEI) in Washington, D.C. would dedicate a portion of their work hours to these tasks over the course of the project timeline. The main project leaders – the Web Developer (in charge of building the public website), the User Interface (UI) Designer (in charge of making the website attractive and user-friendly), and the Security Systems Expert (responsible for granting ASTDR access to the UIC Database and creating log-in credentials for those staff with appropriate security clearance) – would all invest 30% of their time into their respective tasks. As their supervisor, the Information Access Division Head would dedicate 10% of his time to overseeing all of their work and communicating with the UIC Branch Director to ensure all requirements set forth in rulemaking are being met. Apart from paying the appropriate portion of these personnel salaries, the FRAC Program budget would supplement the cost of nominal office expenses and supplies, for a total phase cost of $68,522. For details, refer to Appendices D and E.

State Assessment Phase

The FRAC Program would require additional UIC Program staffing and funding to meet the requirements in the FRAC Act. For example, incorporating hydraulic fracturing would increase Class II well permitting, inspection and data entry workload and may require a new staff position to manage proprietary chemical information. UIC programs are already quite varied in terms of existing size, structure and Class II well inventory. Furthermore, shale gas reserves are unevenly dispersed across the country, existing in some states but not others. Given these discrepancies, the financial and personnel requirements for implementing the FRAC Program will vary widely among the various UIC programs. First and foremost, an understanding of the current and future status of hydraulic fracturing activity on a state by state basis is crucial to forecasting each program's individual needs and ultimately developing a sound federal FRAC Program. As it stands, however, projections of gas reserves are conducted at the level of shale formation, making it difficult to extrapolate impacts by state. Additionally, information about hydraulic fracturing activity is generally held by industry, and methodologies for projecting gas reserves vary widely among gas companies and government agencies. The combination of these factors makes information scarce and inconsistent.

In light of this uncertainty and variation, the first year of the FRAC Program would include a 12-month "State Assessment Phase" where the EPA would gather detailed information about every primacy and direct implementation state in the nation to gauge the unique needs of each. This would involve thorough research to project future levels of hydraulic fracturing activity (in tandem with each state's natural gas regulatory agency) as well as an audit of the relevant UIC Program office (State or EPA Regional) to assess current Class II well workload, organizational structure, and additional staffing needs. These findings would ultimately dictate proportional budget allocations from the Federal EPA for the FRAC Program in Year 2.

The State Assessment Phase would take place over the full first year. The project team would consist of two primary staff members from the Federal UIC Branch – a Project Manager and a Project Assistant, who would devote a portion of their time to this project. They would report to the UIC Branch Director.

In Q1, the two primary staff would focus on developing a framework for the State Assessment and determining the relevant criteria for evaluation. The two primary staff would also be accountable for hiring a team of 20 State Assessors during Q1, all of whom would be identified from an existing EPA contract. Each of the EPA's 10 Regions would be allocated 2 State Assessors.

During Q2 and Q3, these State Assessors would work full-time, traveling to their assigned states and carrying out the assessment for all the UIC programs within their jurisdiction (both Primacy and EPA Regional Direct Implementation programs). The Project Manager and Assistant would serve as Federal EPA contacts and supervisors to the contracted State Assessors.

In Q4, the Project Manager and Assistant would compile the findings of all State Assessments. They would generate a funding recommendation report and submit it to the EPA Office of the Chief Financial Officer for appraisal and consideration in the EPA budget development process. In addition to personnel and contracting service expenses, the budget for this phase includes travel expenses for State Assessors. It would cost a total of $963,022. For more details, consult Appendices D and E.

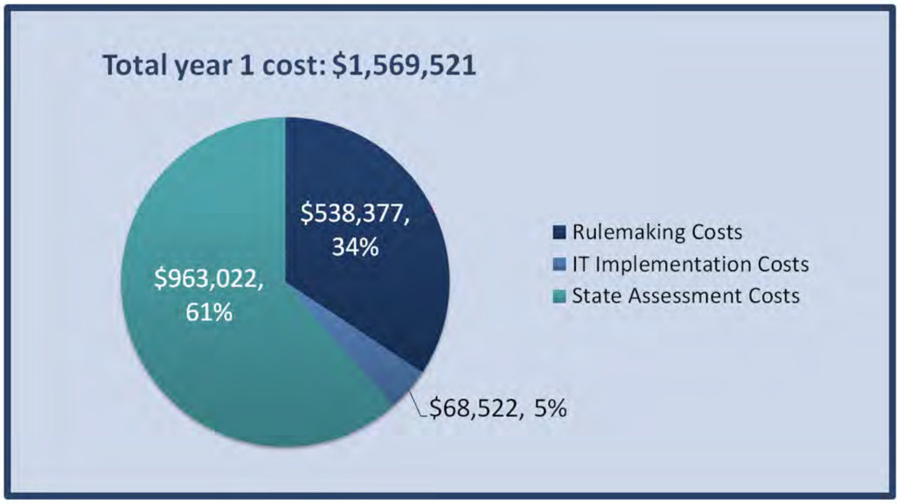

Figure 12: Year 1 Budget

The bulk of the Year One implementation budget would be devoted to the State Assessment Phase, followed by Rulemaking and IT Implementation phases. Most of the costs of these phases would come from personnel services. Consult Appendix D and for a more detailed budget.

Challenges

While the FRAC Program provides significant opportunity for mitigating risks associated with hydraulic fracturing, underfunding represents a major challenge to its efficacy. The current annual budget for the entire UIC Program is $11 million per year, a sum that has not increased in the last 30 years, with the exception of inflation adjustments (Tiemann and Vann, 2011, p. 30). The result is a program that is stretched incredibly thin – a sentiment expressed by many of the Regional UIC Program staff we interviewed in our research process According to the Ground Water Protection Council, this budget would need to increase to $100 million per year to simply to meet current program needs (Tiemann and Vann, 2011, p. 31). Given that incorporating 35,000 new hydraulic fracturing wells annually into the UIC Program's 150,000 existing Class II well inventory could drastically increase the UIC Program's workload, the need for an adequate funding increase is imperative (EPA, 2010) (EPA, 2011a, p. 19). Without it, the overall effectiveness of the program would suffer. Furthermore, states unable to cope with the extra costs may choose to return the burden of regulation to EPA.

Generating more accurate estimates of each UIC program's unique needs through our State Assessment is key to ensuring efficient allocation of scarce funds and ultimately effective implementation of the FRAC Program. These estimates would provide missing information on the size and scope of state and regional gas reserves and the capacity of UIC programs. Furthermore, these well-researched figures could help to make a case for additional funding to the overall UIC Program within the EPA budget. Given the concurrent expansion of hydraulic fracturing and public concern over its potential environmental and health impacts, strong political support for the funding increases necessary for effective regulation could make such increases likely in the near future.

The State Assessment phase is essential in light of these scientific and budgetary challenges. Any program designed to regulate hydraulic fracturing would need to address the lack of information through a robust data collection phase in order to adequately address disparate state and regional natural gas resources and related UIC staffing needs. Without sufficient funding and baseline information, future regulatory success is unlikely. The State Assessment provides this basis, allowing for an informed and efficient implementation of the FRAC Program moving forward. We believe that this will ultimately contribute to the protection of public drinking water.

Conclusion

The rapid proliferation of hydraulic fracturing in combination with new horizontal drilling techniques in the United States has resulted in a situation where science, policy, and subsequent regulation are not keeping pace with technology. Hydraulic fracturing is already widely used to access unconventional US shale gas reserves. There is a growing effort to transition the US away from coal and natural gas is largely expected to take its place in the near term. Thus, it is clear that the practice is here to stay, at least until alternative energy sources can meet a larger portion of the total demand. In light of this, it is imperative that hydraulic fracturing be done as safely as possible, with continued study and increased oversight. Although uncertainties persist, there are an increasing number of reports linking hydraulic fracturing to environmental and health impacts. As these reports come out, calls for increased transparency and uniform federal oversight are growing.

In focusing exclusively on mitigating risks to drinking water resources, the FRAC Act does not address the host of other environmental and health issues associated with hydraulic fracturing. These risks include air pollution at the site from machinery and leaking methane, environmental damage at and near drill sites, and increased earthquakes. Despite this somewhat limited scope, we believe that the FRAC Act represents a critical first step by requiring chemical disclosure and regulatory oversight of the process. It sets the stage for an increasing level of public accountability among hydraulic fracturing companies as we move forward through an unprecedented era of natural gas development in the United States. Finally, we believe that the FRAC Program's Year 1 State Assessment Phase is vital in ensuring that the UIC Program receives enough funding to make new regulations effective.

Figure 13: Natural gas well in Michigan's Antrim Shale (Rousseau)

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Appendix A: The FRAC Act

112th CONGRESS

1st Session

S. 587

To amend the Safe Drinking Water Act to repeal a certain exemption for hydraulic fracturing, and for other purposes.

IN THE SENATE OF THE UNITED STATES

March 15, 2011

Mr. CASEY (for himself, Mr. SCHUMER, Mrs. FEINSTEIN, Mrs. GILLIBRAND, Mr. LAUTENBERG, Mr. WHITEHOUSE, Mr. SANDERS, and Mr. CARDIN) introduced the following bill; which was read twice and referred to the Committee on Environment and Public Works

A BILL

To amend the Safe Drinking Water Act to repeal a certain exemption for hydraulic fracturing, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the 'Fracturing Responsibility and Awareness of Chemicals Act' or the 'FRAC Act'.

SEC. 2. REGULATION OF HYDRAULIC FRACTURING.

(a) Underground Injection- Section 1421(d) of the Safe Drinking Water Act (42 U.S.C. 300h(d)) is amended by striking paragraph (1) and inserting the following:

'(1) UNDERGROUND INJECTION-

'(A) IN GENERAL- The term 'underground injection' means the subsurface emplacement of fluids by well injection.

'(B) INCLUSION- The term 'underground injection' includes the underground injection of fluids or propping agents pursuant to hydraulic fracturing operations relating to oil or gas production activities.

'(C) EXCLUSION- The term 'underground injection' does not include the underground injection of natural gas for the purpose of storage.'.

(b) Disclosure- Section 1421(b) of the Safe Drinking Water Act (42 U.S.C. 300h(b)) is amended -by adding at the end the following:

‘(4) DISCLOSURES OF CHEMICAL CONSTITUENTS-

‘(A) IN GENERAL- A person conducting hydraulic fracturing operations shall disclose to the State (or to the Administrator, in any case in which the Administrator has primary enforcement responsibility in a State), by not later than such deadlines as shall be established by the State (or the Administrator)--

‘(i) before the commencement of any hydraulic fracturing operations at any lease area or a portion of a lease area, a list of chemicals intended for use in any underground injection during the operations (including identification of the chemical constituents of mixtures, Chemical Abstracts Service numbers for each chemical and constituent, material safety data sheets when available, and the anticipated volume of each chemical to be used); and

‘(ii) after the completion of hydraulic fracturing operations described in clause (i), the list of chemicals used in each underground injection during the operations (including identification of the chemical constituents of mixtures, Chemical Abstracts Service numbers for each chemical and constituent, material safety data sheets when available, and the volume of each chemical used).

‘(B) PUBLIC AVAILABILITY- The State (or the Administrator, as applicable) shall make available to the public the information contained in each disclosure of chemical constituents under subparagraph (A), including by posting the information on an appropriate Internet website.

‘(C) IMMEDIATE DISCLOSURE IN CASE OF MEDICAL EMERGENCY-

‘(i) IN GENERAL- Subject to clause (ii), the regulations promulgated pursuant to subsection (a) shall require that, in any case in which the State (or the Administrator, as applicable) or an appropriate treating physician or nurse determines that a medical emergency exists and the proprietary chemical formula or specific chemical identity of a trade-secret chemical used in hydraulic fracturing is necessary for medical treatment, the applicable person using hydraulic fracturing shall, upon request, immediately disclose to the State (or the Administrator) or the treating physician or nurse the proprietary chemical formula or specific chemical identity of a trade-secret chemical, regardless of the existence of--

‘(I) a written statement of need; or

‘(II) a confidentiality agreement.

‘(ii) REQUIREMENT- A person using hydraulic fracturing that makes a disclosure required under clause (i) may require the execution of a written statement of need and a confidentiality agreement as soon as practicable after the determination by the State (or the Administrator) or the treating physician or nurse under that clause.

‘(D) NO PUBLIC DISCLOSURE REQUIRED- Nothing in subparagraph (A) or (B) authorizes a State (or the Administrator) to require the public disclosure of any proprietary chemical formula.’.

Appendix B: Regulation of Hydraulic Fracturing by Selected States

Regulation	Pennsylvania	New York	Texas	Wyoming
Proximity of drilling site to drinking water well.	2000 feet setback between new gas wells and existing water wells.	N/A	N/A	Identification of all water supply wells within 0.25 meters of drilling site.
Discharge of treated Waste Water.	Permitting of waste water to prohibit discharge of high Total Dissolved Solids waste water into Pennsylvania surface water.	Discharge to groundwater and surface water.	N/A	N/A
Surface Water contamination from Storm runoff	Permit for implementation of erosion & sediment control including storm water management if site dist. >5Acres.	Soil erosion and sediment control at sites regardless of area of site disturbance. Delaware river basin controls Marcellus Shale also has controls.	N/A	N/A
Disclosure of Hydraulic fracturing chemicals	Disclosure of well specific information.	Submission of hydraulic fracturing comp prior to issuing a well permit.	Full mandatory disclosure on website detailing chemicals in each well.	First state to require well by well of chemicals.
Waste Water Disposal	Permit if recovery fluids are to be stored in disposal wells. Currently four wells in use.	Permit if disposal if FRAC fluids is deep well injection. are to be stored in disposal wells.	Waste water is stored in class II injection wells regulation?	N/A
Ground water Contamination	If a well operator contaminates drink supply it must mitigate and restore . Also permit application for disposal of waste hydraulic fracturing fluid.	N/A	N/A	N/A
Water Quantity	N/A	N/A	Registration of users above 250000 gallons/month.	N/A

Table B1: A selection of state hydraulic fracturing regulations. (Andrews et al, 2009, p.25-41) and (American Petroleum Institute, 2011)).

Appendix C: Rulemaking Staffing

The Core Rulemaking Team would comprise of a team lead, two existing GS UIC staff, one contractor and one intern. Below is a brief description of the responsibilities of each team member.

Rulemaking Team Lead (UIC Branch Director)

The Rulemaking Team Lead is responsible for overseeing the entire rulemaking process and delivering the final set of rules. This senior staff member is fully familiar with the UIC program and is responsible for ensuring that the process runs effectively and that all necessary resources required are available to his or her staff. This staff member is also responsible for liaising with the appropriate Headquarter Offices to ensure the rule meets all necessary statutory and regulatory requirements, and for coordinating input and feedback from the Regional Offices involved in the process.

UIC Program Staff (Federal EPA)

These two staff members are responsible for the bulk of the rule-writing process. They would be senior UIC staff with extensive experience in the UIC program, specifically Class II. They would be responsible for creating the proposed regulations, revising them accordingly, based on management reviews, public comments and any other changes, and issuing the final rule. They would work in tandem with the contractor, who would provide the necessary technical expertise, and with the team lead.

Contractor

This non-EPA staff member would be contracted out (from an existing contract) and would provide the technical expertise necessary in the rulemaking process. This position requires knowledge of existing UIC technical requirements as well as extensive understanding of hydraulic fracturing the technologies involved in this process. A background in engineering is required.

Intern

The intern would support GS employees and the Team Lead as necessary. He or she would conduct literature reviews, prepare spreadsheets and presentations, and provide administrative assistance as required.

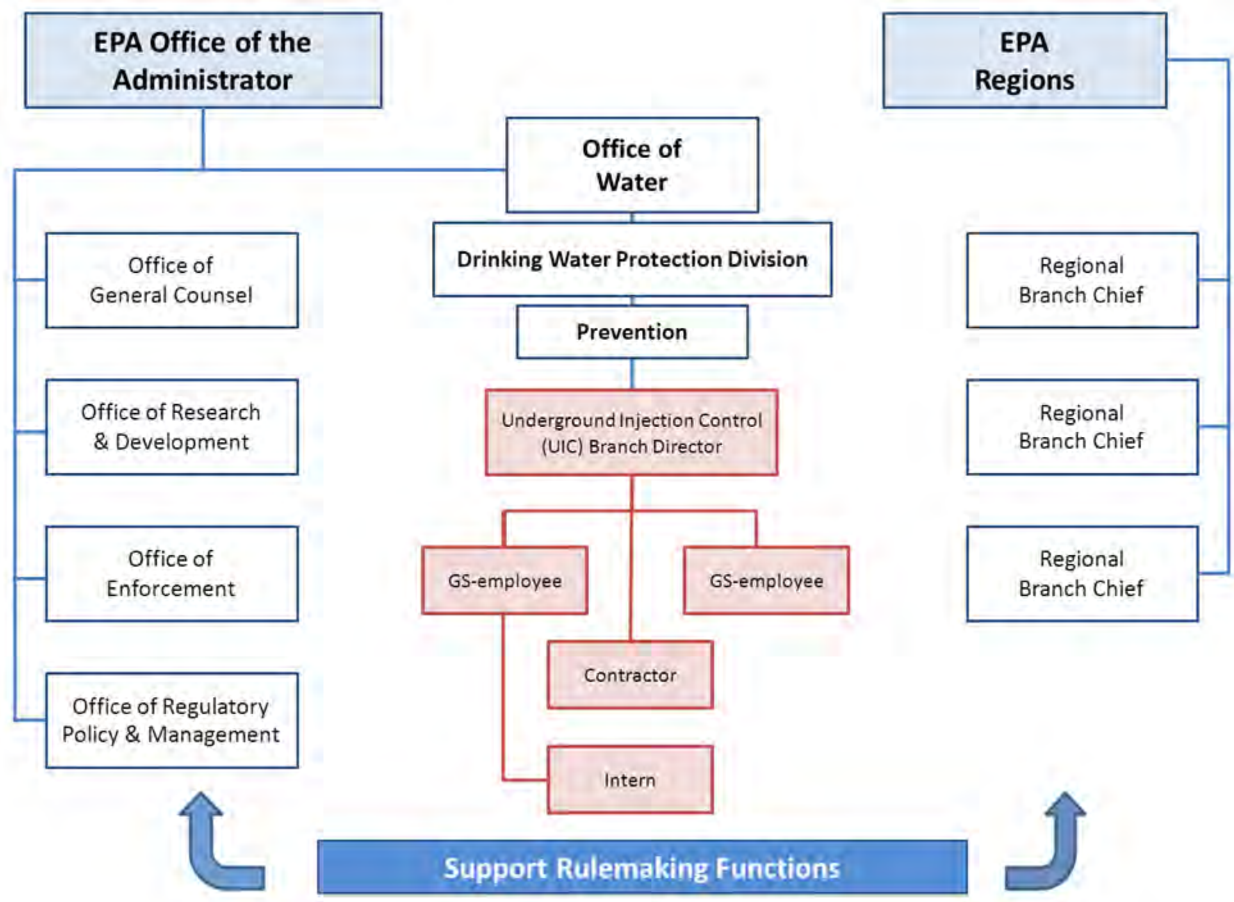

Figure C1: Summary of Proposed Rulemaking Structure showing components of Rulemaking Workgroup. (Core Rulemaking Team in red and support functions in blue)

Rulemaking Support Functions

In addition to the Core Rulemaking Team, several other EPA divisions, both at the national and regional levels, would have a stake in the rulemaking process and participate in the Rulemaking Workgroup. Selected EPA Regional Offices and EPA headquarter offices would play an important support role to the Core Rulemaking Team, and would help them ensure that the final rules are in line with local needs as well as statutory and regulatory requirements.

EPA Regional Offices

EPA Regional Offices administer UIC Direct Implementation programs and oversee Primacy programs managed by state agencies that have been delegated primary enforcement authority (EPA, 2011c). The participation of EPA Regional Offices in this process is vital in that they are responsible for the execution and enforcement of the UIC program within their respective states and territories. As such, they have a vested interest in ensuring that any new rules are developed in accordance to local needs.

In the interest of conducting an efficient and effective rulemaking process, three Regional Offices would be invited to directly contribute to this task. As is often the case in EPA rulemaking processes, each Region would represent one or more neighboring Regions in an effort to ensure full participation of all ten Regions (Callahan, 2011). The Region's UIC Branch Chief would be the staff member taking part in the rulemaking process.

The three EPA Regional Offices to be involved were selected based on three main criteria:

- Number of Class II wells under its purview – this criterion indicates the level of experience a Region has with Class II wells.
- Prevalence of hydraulic fracturing activity in the area – this criterion would indicate the degree to which the new rules would impact that Region
- Geographic location – this criterion would ensure that all four corners of the country are equally represented.

Appendix D: Budget

General assumptions made in the compilation of the following year 1 budget for the FRAC Program were as follows:

- Salaries of EPA staff positions under the budget plan range from General Schedule (GS) levels GS-9 to GS-15, depending on degree of expertise.
- GS salaries to Federal EPA staff incorporate a 24.22% increase on the base amount for the locality pay area of Washington, D.C. (OPM, 2011).
- GS salaries to EPA Regional Section Chiefs involved in the Rulemaking Process incorporate the following locality pay increases on the base: 21.29% for Region 3, 20.6% for Region 6, and 22.52% for Region 8 (OPM, 2011).
- The budget assumes the median value of step 5 experience level for existing employees and step 1 for contractors (OPM, 2011).
- Fringe benefits for EPA staff are estimated at 30% of base salary (Nielson, 2011).
- All contractors recruited would be identified from existing EPA contracts in order to avoid lengthy bidding processes. For the purposes of this budget, we assume that contractor's salaries would be paid at the equivalent of a GS-11 level (Weiss, 2011).
- Travel Expenses include round trip airfare, lodging, per diem meals and incidental expenses for each day of travel and car rental (when appropriate). Lodging and per diem expenses were calculated based on US General Service Administration averages (GSA, 2011). Airfare costs are based on the domestic average from the Bureau of Transportation Statistics (DOT, 2011) and car rental costs are averaged estimates derived from a major car rental website.
- Office expenses include average energy use per employee and average phone bill per employee. Energy use costs were based on an estimated in-office energy use per capita and cost per kWh figures, and phone bill costs on $45 per quarter per employee.
- Space rental was not included in office expenses because this program, utilizes existing staff at the federal EPA level, who presumable already have designated office space. We also assume EPA owns the commercial space where staff work.
- Contractors (with the exception of the rulemaking contractor), when not in the field, would work from home. Therefore not additional office space is required.
- Office Supplies are based on an estimated cost of $125 per employee per quarter.

Line Item Budget

The line item budget below shows the breakdown across all three implementation phases in year 1 into three categories; Personnel, Other Than Personnel and Contracting Services. It is worth noting that 37% of the total costs would be used for personnel services ($574,198), mainly to cover the salaries of existing EPA staff that would be temporarily allocated to run the three implementation phases in the first 12 months. Other Than Personnel Services, which include categories such as supplies, office expenses, travel costs and equipment account for 12% of the total costs. Finally, over half of the total budget, or 51%, would be allocated to hiring several temporary contractors who would be instrumental in defining the rules and outlining any additional costs required by the Program.

Personnel Services	
Salaries	$459,359
Fringe Benefits	$114,840
Total Personnel Services	**$574,198**
Other Than Personnel Services	
Supplies	$8,000
Office Expenses	$16,507
Travel	$136,240
Field Notebooks	$20,000
Field Cell Phones	$1,800
Total Other Than Personnel Services	**$182,547**
Contracting Services	
Contracted personnel	$790,208
Total Contracting Services	**$790,208**
Total Operation Costs	**$1,546,953**

Figure C1: Line Item Budget

Rulemaking Costs

EPA Office	Job Title/ Line item	GS Level	Base Annual Salary/Cost	# Of Quarters	% devoted to FRAC Program	Quantity	Totals
Personnel Services							
EPA OGWDW	UIC Branch Director	GS-15	$140,259	4	50%	1	*$70,130*
	Senior Rulemaking Staff	GS-14	$119,238	4	100%	1	*$119,238*
	Rulemaking Staff	GS-13	$100,904	4	100%	1	*$100,904*
EPA Regional Offices	Region 3 Section Chief	GS-14	$116,985	4	15%	1	*$17,548*
	Region 6 Section Chief	GS-14	$115,830	4	15%	1	*$17,375*
	Region 8 Section Chief	GS-14	$117,606	4	15%	1	*$17,641*
					Total Base Salaries		$342,835
					Fringe Benefits 30%		$102,850
					Total Personnel Services		**$445,685**
Other Than Personnel Services							
	Supplies						*$3,500*
	Office Expenses						*$7,215*
	Travel Costs						*$10,140*
					Total OTPS		***$20,855***
Contracting Services							
	Contractor	GS-11 eq.	$71,837.05	4	100%	1	*$71,837*
					Total Contracting Services		**$71,837**
					Total Rulemaking		**$538,377**

Information Technology Implementation

EPA Office	Job Title/ Line item	SES/GS Level	Base Annual Salary/Cost	# Of Quarters	% devoted to FRAC Program	Quantity	Totals
Personnel Services							
EPA OEI	Information Access Division Head	GS-13	100,904	3	10%	1	$7,568
	Web Developer	GS-9	58,511	3	30%	1	$13,165
	User interface Designer	GS-10	64,439	3	30%	1	$14,499
	Security Systems Expert	GS-10	64,439	3	30%	1	$14,499
					Total Base Salaries		$49,730
					Fringe Benefits 30%		$14,919
					Total Personnel Services		**$64,649**
Other Than Personnel Services							
	Supplies						$1,500
	Office Expenses						$2,372
					Total OTPS		**$3,872**
					Total IT Implementation		**$68,522**

State Assessment

EPA Office	Job Title/ Line item	SES/GS Level	Base Annual Salary/Cost	# Of Quarters	% devoted to FRAC Program	Quantity	Totals
Personnel Services							
EPA Federal	UIC Branch Director	GS-15	$140,259	4	5%	1	$7,013
	Project manager	GS-13	$100,904	4	38%	1	$37,839
	Project Assistant	GS-9	$58,511	4	38%	1	$21,942
					Total Base Salaries		$66,794
					Fringe Benefits 30%		$20,038
					Total Personnel Services		**$86,832**
Other Than Personnel Services							
	Supplies						$3,000
	Office Expenses						$6,920
	Travel						$126,100
	Field Notebooks					20	$20,000
	Field Cell phones					20	$1,800
					Total OTPS		**$157,820**
Contractors							
	State Assessors	GS-11 eq.	$71,837.05	2	100%	20	$718,371
					Total Contracting Services		**$718,371**
					Total Reg. Implementation		**$963,022**

Total Program Costs	**$1,569,921**

Figure C2: FRAC Program Budget

Travel Costs - Rulemaking Phase			
Category	Average Unit Price	Quantity	Total
Airfare	$356	12	$4,272
Lodging	$105	36	$3,780
Meals and Incidental Expenses	$58	36	$2,088
Total			**$10,140**
Assumptions:			
4 trips to HQ per year			
Average of 3 business days per visit			

Travel Costs - State Assessment Phase			
Category	Average Unit Price	Quantity	Total
Airfare	$356	100	$35,600
Lodging	$105	500	$52,500
Meals and Incidental Expenses	$58	500	$29,000
Car rental	$36	250	$9,000
Total			**$126,100**
Assumptions:			
50 US States			
Average of 5 business days per assessment			

Figure C3: Travel Cost Calculations

Utility Costs						
Implementation phase	Average energy consump-tion (kWh/year)	Unit price	Number of staff (inc. Con-tractor)	Average Time spent in Program	Number of quarters	**Total**
Rulemaking	6,360	$0.12	7	56%	4	**$3,015**
IT Implementation	6,360	$0.12	4	25%	3	**$572**
State Assessment	6,360	$0.12	8	73%	3	**$3,320**
Total:						**$6,907**

Assumptions:
Average office based gas and electricity consumption per employee per year = 6,360 kWh
Average kWh cost = .12
Pro-rate consists in the average % time and number of quarters devoted to the FRAC program at each phase
No rent has been included - assuming EPA owns its buildings.

Phone Costs				
Implementation phase	Unit price	Number of staff (inc. Contractor)	Number of quarters	**Total**
Rulemaking	150	7	4	**$4,200**
IT Implementation	150	4	3	**$1,800**
State Assessment	150	8	3	**$3,600**
Total:				**$9,600**

Assumptions:
Average phone bill cost estimated to be $150 per quarter per employee

Total Office Expenses	
Implementation phase	**Total**
Rulemaking	**$7,215**
IT Implementation	**$2,372**
State Assessment	**$6,920**
Total:	**$16,507**

Figure C4: Office Expenses

SALARY TABLE 2011-DCB

INCORPORATING A LOCALITY PAYMENT OF 24.22%

FOR THE LOCALITY PAY AREA OF WASHINGTON-BALTIMORE-NORTHERN VIRGINIA, DC-MD-VA-WV-PA

(See http://www.opm.gov/oca/11tables/locdef.asp for definitions of locality pay areas.)

RATES FROZEN AT 2010 LEVELS

EFFECTIVE JANUARY 2011

Annual Rates by Grade and Step

Grade	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7	Step 8	Step 9	Step 10
1	$ 22,115	$ 22,854	$ 23,589	$ 24,321	$ 25,056	$ 25,489	$ 26,215	$ 26,948	$ 26,977	$ 27,663
2	24,865	25,456	26,279	26,977	27,280	28,082	28,885	29,687	30,490	31,292
3	27,130	28,034	28,938	29,843	30,747	31,651	32,556	33,460	34,364	35,269
4	30,456	31,471	32,486	33,501	34,516	35,531	36,546	37,560	38,575	39,590
5	34,075	35,210	36,346	37,481	38,616	39,752	40,887	42,022	43,158	44,293
6	37,983	39,249	40,514	41,780	43,046	44,312	45,578	46,843	48,109	49,375
7	42,209	43,616	45,024	46,431	47,838	49,246	50,653	52,061	53,468	54,875
8	46,745	48,303	49,861	51,418	52,976	54,534	56,092	57,649	59,207	60,765
9	51,630	53,350	55,070	56,791	58,511	60,232	61,952	63,673	65,393	67,114
10	56,857	58,752	60,648	62,544	64,439	66,335	68,230	70,126	72,022	73,917
11	62,467	64,548	66,630	68,712	70,794	72,876	74,958	77,040	79,122	81,204
12	74,872	77,368	79,864	82,359	84,855	87,350	89,846	92,341	94,837	97,333
13	89,033	92,001	94,969	97,936	100,904	103,872	106,839	109,807	112,774	115,742
14	105,211	108,717	112,224	115,731	119,238	122,744	126,251	129,758	133,264	136,771
15	123,758	127,883	132,009	136,134	140,259	144,385	148,510	152,635	155,500 *	155,500 *

Figure C5: GS-Salary Table (Washington, D.C. locality)

Appendix E: Calendar

RULEMAKING MAJOR TASKS	STAFF	DUE DATES
Project Definition Assemble Rulemaking workgroup Project Kickoff meeting	UIC branch director (FRAC Program Manager)	1-Jan-12
Hire Staff One contractor, one intern	FRAC Program Manager	1-Jan-12
Advanced Notice of Proposed Rule	Core Team	1-Feb-12
Draft Proposed Rule Review by EPA General Counsel on Water Review by Interagency Team Review by Office of Information and Regulatory Affairs Approval by Office of Management & Budget	Core Team	1-Jan-12 to 1-Jul-12
Notice of Proposed Rulemaking Publish in Federal Register	Core Team	1-Jun-12
Public Comment Period	Industry Groups and other interested parties	1-Jul-12 to 30-Sep-12
Include public comments Address concerns of major interest groups Develop draft final rule Review by interagency teams and Office of Information and Regulatory Affairs	Core Team	1-Oct-12 to 31-Dec-12
Office of Management & Budget Review	Core Team	28-Dec-12
Publish Final Rules in Federal Register	Core Team	31-Dec-12

Figure E1: Rulemaking Major Tasks and Milestones

IT MAJOR TASKS	STAFF	DUE DATES
Project Definition	IT Team	1-Apr-12 to 31-May-12
Project Scope Kickoff Meeting	IT team, ATSDR	1-Apr-12
Develop Work Groups	IT Team Leader	1-Apr-12
UIC/ATSDR database connection team		
Hydraulic fracturing public disclosure website team		
UIC/ATSDR Database Connection		
Request list of regional EPA staff	IT Team Leader	1-May-12
ATSDR provide staff names for security clearance	ATSDR	1-May-12
Give login access to ATSDR	Systems Security Expert	31-Jul-12
Creation of database interface	User Interface	31-Jul-12
Quality Assurance/Quality Control Testing Review	Project Team	1-Jul-12 to 31-Aug-12
ATSDR Training Manual Complete	IT Team Leader	31-Dec-12
Database goes lives	Project Team	31-Dec-12
HF Public Disclosure Website		
Review of website guidelines with Online Publishers Association	Designer	30-Apr-12
Creation of website	Web Developer	31-May-12
Establish UIC database connection	Systems Security Expert	1-Jun-12 to 31-Jul-12
Test website goes live		30-Sep-12
Website Testing	Project Team	1-Oct-12 to 30-Nov-12
Review with EPA admin offices and UIC	IT Team Leader	30-Nov-12
Website Goes Live		31-Dec-12

Figure E2: IT Implementation Major Tasks and Milestones

STATE ASSESSMENT MAJOR TASKS	STAFF	DUE DUTES
Develop a framework for the State Assessment and determine criteria for evaluation.	Project Manager and Assistant	1-Jan-12 to 31-Mar-12
Hire team of 20 State Assessors from an existing EPA contract (2 State Assessors per Region)	Project Manager and Assistant	31-May-12
State Assessors travel to assigned states and carry out assessment for both Primacy and EPA Regional Direct Implementation program States (5 days in the field for each assessment)	State Assessors	1-Jun-12 to 31-Sep-12
Coordinate with Federal EPA	Project Manager and Assistant	1-Jun-12 to 31-Sep-12
Supervise the contracted State Assessors (biweekly calls and daily emails)	Project Manager and Assistant	1-Jun-12 to 31-Sep-12
Compile the findings of all State Assessments	Project Manager and Assistant	1-Oct-12 to 31-Dec-12
Estimate national funding needs, plus 5% extra for Tribal needs, and generate funding recommendation report to submit to EPA Office of the Chief Financial Officer for appraisal and consideration in the EPA budget development process.	Project Manager and Assistant	1-Nov-12 to 31-Dec-12
Submit funding report to the EPA Office of the Chief Financial Officer	Project Manager	31-Dec-12

Figure E3: State Assessment Major Tasks and Milestones

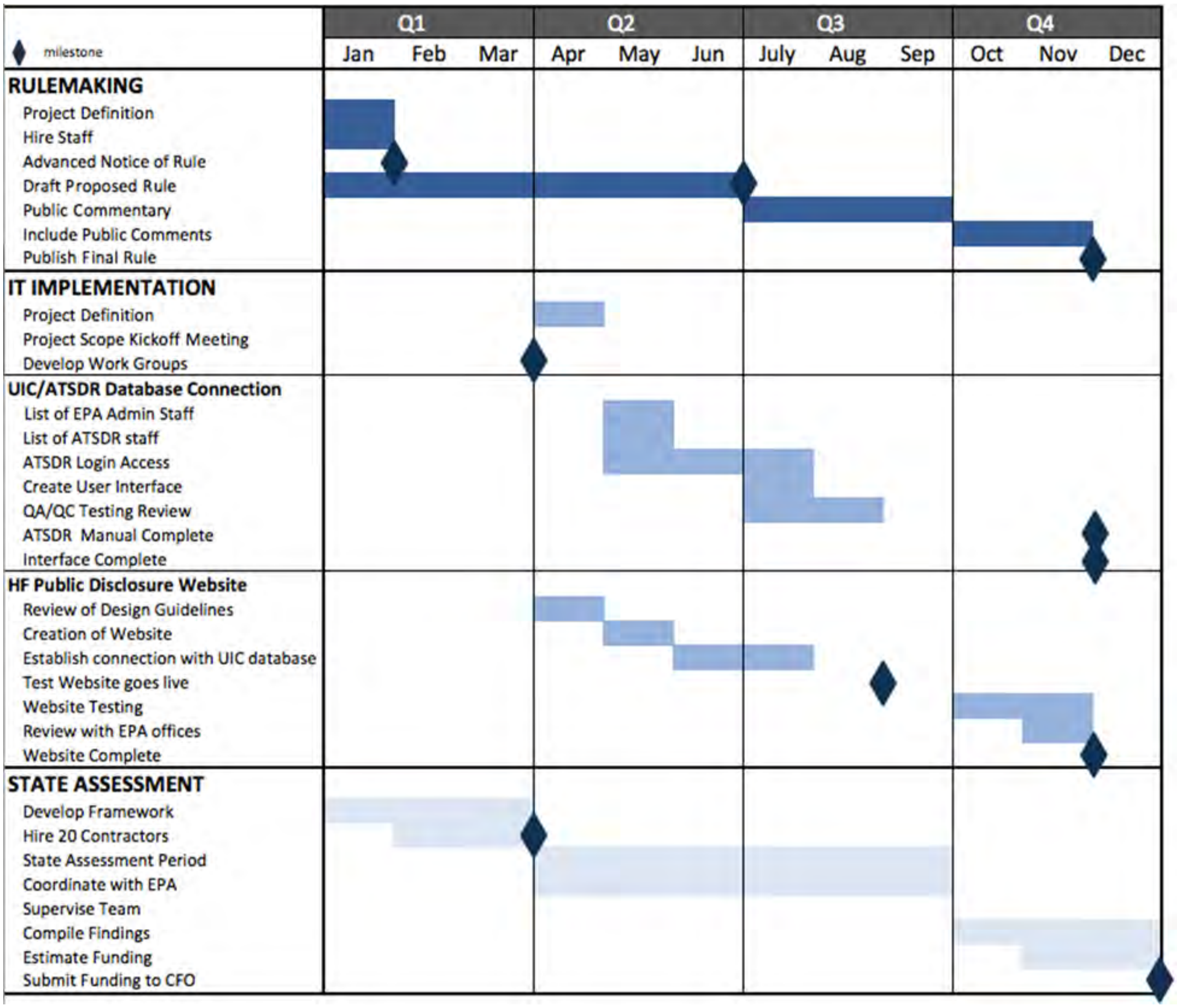

Figure E4: Master Calendar