U.S. ENVIRONMENTAL PROTECTION AGENCY PROPOSED RESEARCH APPROACH FOR STUDYING THE POTENTIAL RELATIONSHIPS BETWEEN HYDRAULIC FRACTURING AND DRINKING WATER RESOURCES	**[No Docket Assigned]**
75 Fed. Reg. 13,125 (March 18, 2010)	

COMMENTS OF

HALLIBURTON ENERGY SERVICES, INC.

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Halliburton Energy Services, Inc. ("HESI") hereby submits these comments to the U.S. Environmental Protection Agency Science Advisory Board ("SAB") on the recently-proposed hydraulic fracturing research study. On March 18, 2010, the U.S. Environmental Protection Agency ("EPA") announced in the *Federal Register* (75 Fed. Reg. 13,125) that it was seeking stakeholder input and advice from the SAB on research strategy and study design. These comments respond to that request, and to the Scoping Materials for Initial Design of EPA Research Study on Potential Relationships Between Hydraulic Fracturing and Drinking Water Resources ("Scoping Materials") released by EPA on March 22, 2010. HESI looks forward to working with EPA on the planning, design, and execution of this proposed study and requests that its comments be made part of the public record in connection with this study.

Executive Summary

HESI is a leading provider of services to the oil and gas industry and is the global leader with respect to hydraulic fracturing services. HESI helped pioneer the use of hydraulic fracturing in the 1940s and has been hydraulically fracturing wells in a wide variety of geographic settings and formations for over 60 years. During this time, HESI has fraced many hundreds of thousands of wells and has developed numerous innovations in the field of hydraulic fracturing. HESI has also conducted independent research on hydraulic fracturing technologies. This wealth of experience makes HESI particularly well qualified to comment on EPA's proposed study of hydraulic fracturing.

HESI strongly supports the statements made in the Scoping Materials that EPA plans to use a transparent process to conduct its proposed study and that it intends to provide for extensive stakeholder involvement. Unfortunately, HESI and other interested stakeholders have not had an adequate opportunity to fully review the Scoping Materials, which were released by EPA only shortly before the deadline for submission of these comments. The Scoping Materials are quite detailed and raise a number of very significant issues with respect to the scope of the study that EPA intends to undertake. HESI is encouraged by EPA's statement that the Scoping Materials represent merely the first step in the process of designing the study and that there will be further opportunities for stakeholder input regarding the study design, and HESI looks forward to continued involvement in the study design process.

Even at this early stage, the Scoping Materials raise a number of significant issues concerning the Agency's proposed approach to the study. These issues include the following:

- Scope of the study – HESI believes that the scope of the study as outlined in the Scoping Materials significantly exceeds EPA's mandate. As you are aware Congress has directed the Agency to conduct a study of the relationship specifically between hydraulic fracturing and drinking water. However, the Scoping Materials have suggested that the Agency has identified issues and potential research questions that go well beyond just the impacts to drinking water, and in some cases, have raised points that are not even related to hydraulic fracturing operations in the first place. Expanding the scope of the study in this fashion will prolong the study and not contribute to addressing the central issue as defined by Congress. HESI believes that EPA should

reconsider the proposed scope of its study and more closely follow the mandate imposed by Congress .

- Use of prior studies – While the Scoping Materials make reference to "compiling background data and information" to "inform the EPA study," it appears that in conducting its study EPA intends to go back instead to "square one," and begin "to reinvent the wheel." However, given its long history of use, the hydraulic fracturing process is well understood and has already been extensively studied; HESI submits that this prior information is quite valuable and should be used as a basis for any further work on the potential relationships between hydraulic fracturing and drinking water sources.

  Numerous highly-regarded studies of hydraulic fracturing have been undertaken through the years. For example, EPA itself has previously conducted its own comprehensive study regarding the potential impacts of hydraulic fracturing of coalbed methane ("CBM") wells on underground sources of drinking water ("USDWs") in which the Agency concluded that these fracturing operations pose little or no threat to USDWs. Since that time, another significant analysis has been undertaken by ICF International ("ICF") for the New York State Department of Environmental Conservation ("NYDEC"), which concluded that hydraulic fracturing of shale also "does not present a reasonably foreseeable risk of significant adverse impacts to potential freshwater aquifers." At the same time, state regulators and key organizations such as the Ground Water Protection Council ("GWPC") and the Interstate Oil and Gas Compact Commission ("IOGCC") have investigated particular allegations of impacts to drinking water as a result of hydraulic fracturing and have continually reaffirmed that there are no confirmed instances anywhere in the country of hydraulic fracturing causing contamination of drinking water aquifers.

  Accordingly, any new study should carefully consider existing knowledge and research during all study stages, including study design and data gap analysis. Utilizing existing knowledge and research will conserve valuable public and private resources while allowing the study to concentrate resources on questions requiring additional research.

- Consideration of state regulatory programs and industry practices – In making any assessment regarding the risks to drinking water associated with hydraulic fracturing operations, EPA should fully take into account existing regulatory programs and standard industry practices as they relate to hydraulic fracturing. The states have been regulating hydraulic fracturing operations as part of their oil and gas regulatory programs for many years and these programs have been very effective. Hydraulic fracturing operations are undertaken in wells constructed pursuant to longstanding industry practices that conform to these regulatory programs and that are specifically designed to protect water resources. These practices effectively preclude the materials in the wellbore from coming into contact with drinking water sources. EPA's study should include careful consideration of these programs and practices because they are

critical to assessing the potential for any completed exposure pathway involving drinking water.

In the comments that follow, HESI discusses the importance of hydraulic fracturing, various issues raised by the Scoping Materials and specific additional recommendations for the design of the proposed research study.

I. Introduction

HESI is a leading provider of services to the energy industry in connection with the development of oil and natural gas wells. HESI provides a variety of services to well operators, including but not limited to providing drilling fluids and cementing services as well as conducting related logging and perforating work and a wide variety of other services related to the development of oil and natural gas resources. In particular, HESI is one of the leading providers of stimulation services for oil and gas wells, having commercialized hydraulic fracturing technology in 1949. HESI provides its services to well operators in many areas of the country.

The science of hydraulic fracturing includes an understanding of the geologic, petrophysical and reservoir parameters of the hydrocarbon-bearing formation and its surrounding layers and the chemistry of the stimulation fluids themselves. To help assist in the development of the most effective stimulation methods possible – from both an energy production as well as an environmentally-satisfactory perspective, HESI undertakes significant research and development efforts to understand these parameters and their role in order to design stimulation programs that will successfully stimulate a formation in the manner desired, while ensuring the integrity of the production and water-bearing zones. As part of these efforts, HESI has specifically devoted a significant amount of resources to developing more effective and innovative fracture stimulation fluid systems for a variety of subsurface environments, and to ensure that natural gas resources are produced in the most efficient manner possible and in accordance with all applicable environmental requirements. HESI's research efforts cover fluids that can be effectively used in conventional and unconventional formations, including coalbeds, shales and tight sands.

HESI's innovations are not limited to those that directly increase production through the more effective creation and maintenance of induced fractures. HESI also devotes significant resources to developing effective solutions to issues raised by the industry with respect to other aspects of the hydraulic fracturing process, solutions that often have key environmental benefits. For example, HESI is developing fluid systems to facilitate the use of produced water rather than relying solely on fresh water as the base fluid for hydraulic fracturing. The reuse of produced water may have two benefits where such reuse is feasible: it limits the amount of produced water that must be disposed of, while at the same time limiting the amount of fresh water that must be withdrawn from groundwater and/or surface waters for hydraulic fracturing operations in the first place, thereby minimizing potential impacts on water users and/or aquatic ecosystems resulting from water withdrawals.

In addition, HESI is in the process of developing other new engineering solutions to various aspects of the hydraulic fracturing process that would minimize the use of chemicals. For example, HESI has been working, among other things, on developing a means of bringing

the gelling agent (typically guar) to the well site in dry form and mixing it with the frac fluids without the use of a liquid gel concentrate ("LGC"), thereby eliminating the use of one category of chemicals and reducing the amount of chemicals requiring transport to the well site. HESI also has been in the process of developing the Clean Stream system for controlling bacteria growth through the use of ultraviolet light. Thus, HESI's product innovations can yield significant environmental benefits when conditions permit their use.

II. Background

A. Natural Gas is Vital to Our Nation's Economy, Energy Security and Environmental Goals

Natural gas, including gas from unconventional sources, is becoming an increasingly important energy source for the United States. Most forecasters predict that demand for natural gas will remain strong and will likely increase in the coming decades as natural gas becomes a preferred energy source to meet our national environmental, economic, and energy security objectives. Hydraulic fracturing is a critical element in meeting this demand for natural gas.

As EPA recognizes, "[n]atural gas plays a key role in our nation's clean energy future."[1] Natural gas is a clean-burning and low-carbon alternative to other fuels that can act as a "bridge" fuel to address the problem of global warming.[2] Reduced greenhouse gas ("GHG") emissions make natural gas an important fuel for electricity generation, especially as generators face increasingly stringent standards under the Clean Air Act and the potential regulation of GHG emissions. In its most recent report, the U.S. Energy Information Administration ("EIA") increased forecasts for natural gas consumption and observed that "[n]atural gas plays a larger role . . . because growing concerns about GHG emissions make it more attractive than coal and because new natural-gas-fired plants are much cheaper to build than new renewable or nuclear plants."[3] As a result, the EIA projects that the United States' demand for natural gas for electricity generation will increase by about 13 % by 2035.[4]

Natural gas also is a domestically-produced resource – about 88 % of natural gas used in the United States is produced domestically, and most of the rest comes from Canada.[5] Recent forecasts have increased the estimates of domestic natural gas reserves and supply. An increasing abundance of domestic natural gas is also forecast to have a positive economic

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[1] U.S. Environmental Protection Agency, Office of Research and Development, *Scoping Materials for Initial Design of EPA Hydraulic Fracturing Research Study*, 1 (Mar., 2010) ("Scoping Materials"), *available at* http://yosemite.epa.gov/sab/SABPRODUCT.NSF/81e39f4c09954fcb85256ead006be86e/3B745430D624ED3B852576D400514B76/$File/Hydraulic+Frac+Scoping+Doc+for+SAB-3-22-10+Final.pdf.

[2] Natural gas produces about 37% less CO_2 per kilowatt hour than coal and is the "least carbon-intensive fossil fuel." Energy Information Administration , *Carbon Dioxide Emissions from the Generation of Electric Power in the United States* (July, 2000), *available at* http://www.eia.doe.gov/cneaf/electricity/page/co2_report/co2emiss.pdf.

[3] Energy Information Administration, Annual Energy Outlook 2010, *Annual Energy Outlook Early Release Overview* ("EIA 2010"), *available at* http://www.eia.doe.gov/oiaf/aeo/overview.html.

[4] Energy Information Administration, Annual Energy Outlook 2010, *Natural Gas Supply, Disposition, and Prices* ("EIA 2010 Gas Supply"), *available at* http://www.eia.doe.gov/oiaf/aeo/excel/aeotab_13.xls.

[5] *Id.*

impact, in part because "electricity prices are linked to natural gas prices."[6] Due to this linkage, an increase in the domestic natural gas supply is forecast to help moderate electricity prices over the next 25 years.[7] This combination of energy security, economic, and environmental benefits is expected to drive natural gas demand in the coming decades.

Importantly, the development of our future domestic natural gas supply depends heavily on unconventional sources such as tight sands, shales and coalbeds, which supply an increasing percentage of our natural gas. According to the EIA, unconventional natural gas production currently accounts for 30% of dry onshore gas production, and 24% of total domestic natural gas production. Unconventional sources are expected to play an increasingly important role, accounting for 49% of dry onshore gas production and 34% of total domestic natural gas production by 2035. Shale gas alone now accounts for one-third of total domestic gas reserves.[8]

Hydraulic fracturing technology substantially assists in the viable development of these unconventional natural gas resources. Given its critical technical importance, hydraulic fracturing is certainly expected to become an even increasingly important part of energy production in the United States and the jobs and other economic benefits that result from that energy production. Application of hydraulic fracturing to increase recovery is estimated to account for 30% of recoverable oil and gas reserves in the United States and has been responsible for the addition of more than 7 billion barrels of oil and 600 trillion cubic feet of natural gas to meet the nation's energy needs. Hydraulic fracturing is needed to make many wells productive. Recent estimates are that 95 percent of all wells are hydraulically fractured, particularly in unconventional formations,[9] and the National Petroleum Council has estimated that 60% to 80% of all wells drilled in the United States in the next ten years will require fracturing. As one expert has stated, as much as 95 percent of the oil and gas wells in the world are now dependent on hydraulic fracturing because the easily reached petroleum reserves have been used up.[10]

In sum, natural gas will play a crucial role as the United States pursues improvements in air quality and a national climate change strategy. In addition, an abundance of domestic natural gas will help mitigate electricity price increases while increasing energy independence. As many studies have demonstrated, natural gas production also provides critically needed jobs and revenue to workers, landowners, local communities and state and local governments. Realizing these benefits depends on our ability to access unconventional natural gas reserves and hydraulic fracturing technology is a vital component of that process.

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[6] *EIA 2010*, at 4. As EIA explains, "[e]lectricity prices tend to reflect trends in fuel prices—particularly natural gas prices, because natural-gas-fired plants often are the marginal generators." *Id.*

[7] *EIA 2010,* at 4.

[8] Press Release, Potential Gas Committee, *Potential Gas Committee Reports Unprecedented Increase In Magnitude of U.S. Natural Gas Resource Base* (June 18, 2009).

[9] IHS Global Insight, *Measuring the Economic and Energy Impacts of Proposals to Regulate Hydraulic Fracturing* (2009), *available at* http://www.api.org/policy/exploration/hydraulicfracturing/upload/IHG_GI_Hydraulic_Fracturing_Exec_Summary.pdf ("*Impacts of Proposals to Regulate Hydraulic Fracturing*").

[10] *See* David A. Hill, *Expert: 95 Percent of Oil, Gas Wells Are Fractured*, Colorado Energy News, Dec. 7, 2009, *available at* http://coloradoenergynews.com/2009/12/ expert-95-percent-of-oil-gas-wells-are-fractured/.

B. Hydraulic Fracturing is a Safe and Well-Understood Process

EPA's Scoping Materials identify a number of possible research categories related to the hydraulic fracturing lifecycle and potential relationships to drinking water resources.[11] However, given the industry's long experience with hydraulic fracturing technology, many, if not most of these issues, have already been substantially investigated and are indeed well understood. This understanding reflects the fact that hydraulic fracturing techniques are safe and well-understood processes subject to comprehensive regulatory requirements at the state and local governmental levels. In fact, the commercial use of the hydraulic fracturing process to stimulate production from oil and gas wells dates back to the 1940s.[12] In the ensuing 60-plus years, hundreds of thousands of oil and natural gas wells in the United States have been hydraulically fractured. Throughout the course of these activities, the industry has amassed a great wealth of experience with hydraulic fracturing techniques in a wide range of geological formations.

Hydraulic fracturing (or "fracing") is a technique involving the pumping of fracturing fluids into a reservoir at high enough pressures to create a crack or fracture in the reservoir. The fracture allows the increased flow of hydrocarbons out of the formation. The intent is to pump viscous fluids into the well bore at pressures sufficient to create cracks or fissures in the rock formation containing the oil or gas in order to improve the flow characteristics of the formation. The entire process may take anywhere from 15 minutes to several hours.

Most significantly, fracing projects typically take place in formations at significant depths below ground surface and distant from drinking water sources. The process of fracing a well is preceded by careful planning of a particular hydraulic fracturing job in order to maximize the effectiveness of the operation in increasing the flow of oil or gas to the well bore. The field operations are initiated when fluids are forced into the well at a rate that causes the pressure in the well bore to exceed the breakdown pressure of the formation. When this pressure is exceeded, a fracture opens and the injected fluid begins moving outward, away from the well. In most formations, the fluid pressure opens a single fracture that propagates away from the well as two wings that extend in opposite directions.

In order to be effective, the fracture must be kept open when the pressure is relaxed. This is accomplished by introducing a proppant that is conveyed into the fracture by the viscous fluid. The makeup of a fracturing fluid system to be used in a particular well depends mostly on the nature of the formation, so the specific components of a fluid system may vary from field to field, reservoir to reservoir and even well to well. However, water typically makes up 95% of the aqueous phase of the fracturing fluid system. Proppants, another significant ingredient, are normally in the form of sand. Because water alone is not the most effective carrier of the sand into the well bore and the fractures, the water must be made more viscous or gel-like. The most common material used for this purpose is guar, a material which is derived

[11] *Scoping Materials*, at 3.

[12] *See* Ground Water Protection Council, *et al.*, *State Oil and Natural Gas Regulations Designed to Protect Water Resources* at 21 (May, 2007) ("*State Oil and Gas Regulations*"), *available at* http://www.gwpc.org/e-library/documents/general/State%20Oil%20and%20Gas%20Regulations%20Designed%20to%20Protect%20Water%20Resources.pdf.

from guar beans and is also used as a gelling agent in common foods. In addition, materials are added to the water to keep it from developing impurities that will affect its ability to gel and to ensure its compatibility with the receiving formation fluids. The fluid system also will contain nitrogen gas, used to foam the mixture for better transport down the well.

Once the proppant is in place, the fluid is meant to break back down to its more liquid, less viscous state, after which it flows more freely. An enzyme is used to help break the fluid back down from its gelled state to a more liquid state once the fracture is created and the sand is in place. The pumping is then stopped and fluids flow back to the well bore while the proppants remain in place; through this process, much of the fluid that was initially pumped down the well bore to create the fractures is subsequently removed. If the fluids were allowed to stay in the reservoir, they would themselves become impediments to the freer flow of oil and gas reserves, which would of course defeat the entire purpose of the fracturing job in the first place. As fluids are removed, the oil or gas begins to move through the fractures to the well bore and the oil or gas flows out of the well bore to processing facilities. Throughout this process, well casing (including both surface casing and production casing) and cement prevents the fluids and other materials in the well bore from escaping into shallow formations that may include drinking water aquifers or other formations that have not been targeted for production.

III. HESI Strongly Supports EPA's Commitment to a Transparent Study Process With Extensive Stakeholder Involvement

HESI strongly supports the inclusion of stakeholders at all stages of the proposed study, including those identified by EPA's initial framework for stakeholder involvement.[13] In light of 60-plus years of expertise with hydraulic fracturing technology, industry stakeholder participation is a particularly vital component of any study. Consideration of existing regulatory programs is also an important part of this process and stakeholder involvement should include consultation with other federal and state, and interstate agencies. Accordingly, any study should provide ample opportunity for input from key stakeholders.

While EPA has asserted that stakeholder involvement is relevant at certain phases of the proposed study,[14] HESI believes that a credible study will involve stakeholders throughout the process, at every stage. In addition, a stakeholder communications plan should ensure ample opportunity for public participation and comment at each stage. As observed by the National Research Council ("NRC"), "[p]ublic participation should be fully incorporated into environmental assessment and decision-making processes, and it should be recognized by government agencies and other organizers of the processes as a requisite of effective action, not merely a formal procedural requirement."[15] Increased public participation also improves the overall quality of the scientific process. As the NRC has stated:

> [I]integrating science and public participation through processes that iterate between analysis and broadly based deliberation . . . promotes the quality, accountability, and legitimacy of environmental assessments and decisions. In contrast, processes

[13] *Scoping Materials*, at 9-10.
[14] *Scoping Materials*, at 9.
[15] National Research Council, *Public Participation in Environmental Assessment and Decision Making*, 226 (2008).

> that treat analysis and deliberation in isolation from each other impede both analysis and deliberation.

EPA has endorsed the NRC approach[16] and HESI believes that any hydraulic fracturing study process should include robust stakeholder participation in accordance with these principles.

Consistent with this view, HESI believes that it is important to note that there was only a limited amount of time to comment initially on EPA's proposed Scoping Materials. This document presents a detailed set of issues and research questions that EPA is proposing as appropriate subjects for inclusion in the study. Through the Scoping Materials, the Agency is proposing to conduct a study that is very broad in scope and that, as discussed further below, appears to significantly exceed the scope of the study requested by Congress. As a result, EPA's Scoping Materials raise serious issues regarding the Agency's approach to this very important study. However, given the limited time frame that was allowed for comment on these proposed materials, HESI urges the Agency to provide additional, timely opportunities in the future to comment on the implementation of the study design and to allow for effective interchange on key technical points addressed in the proposed study. The Scoping Materials state that stakeholder involvement will be relevant at a number of other stages of the study design process, including defining the scope of the study, prioritizing research objectives and reviewing the study design itself, and HESI urges the Agency to provide essential public input at these critical points as well as other important stages of this project

IV. The Proposed Scope of the Study Is Overbroad

As EPA itself notes in the Scoping Materials, Congress directed the Agency to undertake a study on "the relationship between hydraulic fracturing and drinking water." Given this congressional direction, it seems quite evident that Congress expected EPA to focus its study specifically and quite directly on the potential impacts of hydraulic fracturing operations on drinking water sources. This focus is quite understandable in light of the fact that the principal allegations that have been made in the past about hydraulic fracturing relate to claims of contamination of drinking water supplies. EPA has stated that the purpose of the Scoping Materials is "to describe the initial steps in fracing a study consistent with this Congressional mandate."

However, the Scoping Materials propose to implement a study that is not consistent with this "Congressional mandate" and that, in fact, goes well beyond its scope in several key respects. First, the Scoping Materials identify numerous issues and potential research questions that generally have no connection with the potential impacts of hydraulic fracturing on drinking water. This overly broad focus is evident throughout the document. For example, EPA states that the "primary objective of the study is to evaluate the potential for HF activities to impact surface and/or underground sources of drinking water and impose public health or *environmental risks*."[17] EPA goes on to say that in the initial scoping of the study "potential impacts on other water resource functions, such as supporting aquatic ecosystems and recreational activities, will also be considered."[18] These changes suggest a study far broader than

[16] *Scoping Materials*, at 9.
[17] *Scoping Materials* at 2 (emphasis added).
[18] *Id.*

originally authorized or intended by Congress – for example, the health of aquatic ecosystems and the use of water for recreational purposes have nothing whatsoever to do with the use of water for human consumption. In fact, the congressional mandate to study the relationship between hydraulic fracturing and drinking water clearly indicates that the focus of the study should be on human health, not on potential environmental impacts.

The overbreadth of EPA's proposed study scope is likewise evident in the Agency's discussion of potential exposure pathways. While HESI fully supports the need to consider exposure issues, the Scoping Materials identify a variety of exposure pathways that are entirely unrelated to drinking water, such as dermal exposure through air, food and environmental exposures.[19] Analysis of these exposure pathways will not contribute to an understanding of the relationship between hydraulic fracturing and drinking water.

Other examples of issues and research questions identified in the Scoping Materials that go beyond the scope of the study mandated by Congress include the following:

- The potential for livestock, crops and wildlife to be impacted;
- Information concerning the spread of invasive species;
- Appropriate biological endpoints that could be used to evaluate ecological risks;
- Task and analytical methods needed to characterize emissions from hydraulic fracturing operations;
- Data and information needed to optimize BMPs for vapor emissions during hydraulic fracturing operations;
- Social/behavioral science research approaches to generate increased awareness of potential benefits and risks of HF;
- Life cycle assessment to identify relationships between energy, water, the chemicals used in HF, the surrounding environment, and the safe guards for public health; and
- Environmental justice issues associated with hydraulic fracturing.

In addition to addressing factors beyond those related to drinking water, the Scoping Materials also identify issues for review that, in fact, are not even related to hydraulic fracturing at all. For example, the Scoping Materials make numerous references to issues relating to produced water. However, as typically used in the industry the term "produced water" refers to water that is naturally found in the formation from which oil and gas is being produced and that is produced through the wellbore along with oil or natural gas. Produced water includes very little, if any, frac fluid and the handling and disposal of produced water from a well site would occur regardless of whether the well had been hydraulically fractured. Accordingly, issues related to the handling and disposal of produced water are beyond the scope of a study that is meant to address hydraulic fracturing.

[19] *Id.* at 6.

Finally, the Scoping Materials include references to a number of other issues that are not related to hydraulic fracturing. For example, EPA has identified as a potential research question whether site preparation and well construction activities have the potential to impact water resources. However, site preparation activities such as grading and well construction activities take place regardless of whether a well is being hydraulically fractured and possible impacts from these activities are not relevant to assessing the potential impacts of hydraulic fracturing operations themselves. Moreover, EPA's approach for compiling background data and information should consider that hydraulic fracturing additives are in other various types of products, and, consequently, there are many other environmental sources of such compounds.

HESI believes that the focus on the relationship between hydraulic fracturing and drinking water specified by Congress is entirely appropriate for several reasons. First, as noted above, the principal allegations regarding hydraulic fracturing relate to claims of contamination of drinking water supplies. Other potential exposure pathways – such as through food, air or soils – would likely be insignificant even if they were ever completed. Devoting resources to examining these exposure pathways would not address the central issue identified by Congress and would inevitably delay the completion of the Agency's investigation of the drinking water pathway that is of primary interest to Congress and others. Accordingly, EPA should reassess the proposed scope of its study.

V. EPA Should Consider Prior Studies and Investigations Regarding Hydraulic Fracturing

In undertaking the proposed study, the Scoping Materials suggest that EPA will compile "background data and information to inform the EPA study." In this connection, EPA states that it is aware of information on hydraulic fracturing from numerous sources but states that there is a "limited body of peer-reviewed literature on the relationship between hydraulic fracturing and drinking water." HESI respectfully disagrees with this point – rather, HESI believes that there is indeed a significant amount of existing literature and other information that is highly relevant to the issues EPA has been directed by Congress to study. In fact, as noted in these reports hydraulic fracturing has been thoroughly studied and carefully reviewed by numerous key governmental and regulatory officials in the past. These studies repeatedly confirm that there is no risk to drinking water aquifers due to hydraulic fracturing activities.

In particular, EPA itself produced one of the most detailed peer-reviewed studies of hydraulic fracturing ever undertaken. In 2004 EPA issued a report concerning the potential impacts of hydraulic fracturing of CBM wells on drinking water supplies in an effort to determine whether hydraulic fracturing posed any risk.[20] EPA has characterized this study as the most extensive review of the potential impacts of hydraulic fracturing on public health ever undertaken. In focusing on hydraulic fracturing of CBM wells, EPA recognized that it was addressing a "worst case" scenario given that coalbeds tend to be shallower than other types of unconventional gas formations such as shales and tight sands, and that the findings of this study would certainly be applicable to these other geological formations.[21] This study was based on a comprehensive protocol that included an extensive effort to collect information regarding the

[20] *2004 EPA Study*.
[21] *Id.* at ES-7.

hydraulic fracturing process from literature searches and field visits and to review both empirical and theoretical data regarding hydraulic fracturing and the movement of fracturing fluids in the subsurface. The study was also peer-reviewed in accordance with EPA's standard peer review guidelines.

EPA states in the Scoping Materials that in analyzing and interpreting existing data such as the prior EPA study, it should consider the fact that geology is site specific and studies done in one area of the country may not be applicable in another area. However, the 2004 EPA was not focused on one area of the county, but rather examined conditions in coalbed methane reservoirs across the nation. Moreover, in deciding to focus its study on CBM wells, EPA recognized that such wells generally represent a "worst case" with respect to potential impacts on shallow drinking water aquifers because coalbeds tend to be shallower than other types of formations such as shales from which oil and gas is produced and therefore are often found in closer proximity to drinking water aquifers. Accordingly, HESI believes that the peer-reviewed 2004 EPA study is credible and of high quality and is, in fact, particularly relevant to the Agency's new proposed study.

HESI further believes that there are several other credible studies that should likewise be taken into account in implementing this new study design. For example, additional studies have recently been undertaken in connection with a further examination of hydraulic fracturing practices in the Marcellus Shale region in the northeastern U.S. In addressing this issue in its draft "Supplemental Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program: Well Permit Issuance for Horizontal Drilling and High-Volume Hydraulic Fracturing to Develop the Marcellus Shale and Other Low Permeability Gas Reservoirs" ("draft SGEIS"), the NYDEC also came to the conclusion that hydraulic fracturing does not pose any risk to drinking water supplies.[22] As part of its preparation of the draft SGEIS, NYDEC had a further review of this issue undertaken by ICF – a highly-regarded scientific firm – that focused specifically on the risks to drinking water aquifers posed by subsurface migration of frac fluids from the Marcellus Shale.

In addition, HESI has recently had its own consultant, Gradient, undertake a study of hydraulic fracturing in connection with New York's draft SGEIS. Like ICF, Gradient examined the potential for subsurface migration of frac fluids from the Marcellus Shale to shallow drinking water aquifers. Gradient also examined the potential for contamination of drinking water sources as a result of surface spills of frac fluids. HESI believes that the analysis and conclusions in these studies are generally applicable to a wide variety of shale formations in many areas of the country. Accordingly, in conducting its own study, EPA should further review and carefully consider these and other studies regarding hydraulic fracturing.

Moreover, state regulators have investigated various allegations of contamination of drinking water wells due to hydraulic fracturing operations. These investigations have included inquiries into specific allegations of well contamination such as the investigations by the Alabama Department of Environmental Management and the Alabama Oil and Gas Board concerning the McMillian well and the investigations by the Colorado Oil and Gas Conservation Commission concerning the Amos well. In addition to these specific investigations, state

[22] *See* draft SGEIS at 6-37.

regulators have also conducted more general inquiries concerning allegations of drinking water contamination through entities such as the GWPC and the IOGCC. EPA should likewise take the results of these investigations into account in conducting its study. Any additional field studies to be undertaken by EPA should be representative of the appropriate range of hydraulic fracturing conditions, not just biased to certain hydrogeologic settings.

VI. EPA Should Take Into Account Existing Regulatory Programs and Practices

In undertaking its study, EPA also should take account the results and requirements of existing regulatory programs that are in place with respect to hydraulic fracturing. States have overseen hydraulic fracturing operations for many years as part of their programs for regulating oil and gas exploration and production. State regulations "typically include a prohibition against causing harm to the environment" which is "at the heart of the regulatory process" and employ regulations, rules, and Best Management Practices ("BMPs") to accomplish that goal.[23] As recently documented in an extensive report prepared for the DOE by the GWPC, "state oil and gas regulations are adequately designed to directly protect water resources through the application of specific programmatic elements such as permitting, well construction, well plugging and temporary abandonment requirements."[24]

As the GWPC has noted, "*[a]ll* oil and gas producing states have regulations which are designed to provide protection for water resources."[25] These state programs typically include a variety of well construction provisions that are intended to protect surface and subsurface water resources from contamination, including requirements for casing and cementing, while permitting requirements allow state regulators to review proposed drilling plans and ensure that water resources will be appropriately protected. State regulators can and often do impose conditions on drilling and related operations in order to take account any special environmental or other circumstances with respect to a particular project. These state regulatory programs have been very effective in protecting drinking water sources and should be properly considered in making any assessment of risks to drinking water that are associated with hydraulic fracturing operations.

Likewise, EPA should consider standard industry well construction practices that are used to achieve "zonal isolation" and protect any valuable groundwater resources from contamination. These practices are based on years of experience and closely adhere to applicable state regulatory requirements and recognized industry guidelines established by the key trade organizations including the American Petroleum Institute ("API").

Consistent with this view, EPA should consider recent enhancements to industry standards for hydraulic fracturing operations that will further ensure that the possibility of hydraulic fracturing operations resulting in contamination of drinking water supplies is remote. For example, just recently in October 2009 API issued Guidance Document HF-1, Hydraulic Fracturing Operations – Well Construction and Integrity Guidelines, which is the result of a significant amount of attention brought to adopt key guidelines for well construction. This document provides key guidance and highlights industry-recommended practices for well

[23] *State Oil and Gas Regulations*, at 6.
[24] *Id.* at 7.
[25] *Id*. at 37.

construction to ensure the integrity of wells that will be hydraulically fractured. The guidance is intended to apply both to vertical and horizontal wells used to develop oil and gas resources.

As part of these industry guidelines, API has adopted other appropriate industry standards relating to the casing and cementing of wells to be hydraulically fractured. These guidelines contain detailed guidance concerning the selection of cement and cementing practices as well as logging and other diagnostic procedures to ensure the integrity of the cement job.[26] These industry standards will help further ensure that zonal isolation is established and maintained on all wells in order to protect drinking water aquifers during hydraulic fracturing activities.

Consideration of these state regulatory programs and industry practices is essential because they are critical factors in determining whether there is any completed exposure pathway between formations in which hydraulic fracturing occurs and shallow aquifers that are typically used for drinking water. As the GWPC has recently noted in its extensive study of state oil and gas regulatory programs and the extent to which they protect water resources:

> Casing strings are an important element of well completion with respect to the protection of ground water resources as they provide for the isolation of fresh water zones and ground water from the inside of the well. Casing is also used to transmit flowback fluids from well treatment. In this regard, surface casing is the first line of defense and production casing provides a second layer of protection for ground water. As important as casing is, however, it is the cementation of the casing that adds the most value to the process of ground water protection. Proper sealing of annular spaces with cement creates a hydraulic barrier to both vertical and horizontal fluid migration.

State Oil and Gas Regulations, at 21. Accordingly, any proper assessment of exposure pathways involving drinking water must begin with a review of these existing regulatory programs and well construction practices.

VII. The Study Must Be Conducted in a Transparent, Scientific Manner

As directed by Congress, EPA's study must rely "on the best available science" and "be conducted through a transparent, peer-reviewed process."[27] HESI fully supports these principles. Adhering to a rigorous approach will promote proper study design, accurate results that consider all available scientific information, and increased public confidence in the study process. Based on these principles, the proposed study should:

- Incorporate Recognized Risk Assessment Principles: Consistent with well-recognized risk assessment principles, measuring risk to human health or the environment depends on both the hazards associated with the substances

[26] *Id*. at 9-10.
[27] *Scoping Materials*, at 2.

involved as well as potential exposure pathways.[28] For example, prior studies regarding hydraulic fracturing and its potential impacts on drinking water have found that because exposure pathways are essentially incomplete, any risk to USDWs from hydraulic fracturing activities is minimal. This dual focus on both potential hazards and exposure pathways is a recognized scientific principle and a crucial component of risk assessment, and should be fully incorporated into any study of hydraulic fracturing. EPA has acknowledged the necessity of examining exposure pathways themselves in the Scoping Materials, noting that "[i]dentification of health risks . . . related to HF requires an understanding of potential exposure pathways and receptors." While HESI has concerns about the specific exposure pathways identified by EPA for potential inclusion in the study, HESI certainly agrees with the fundamental need to consider exposure, but only to concentrations of HF constituents in drinking water, if any.

- Adhere to Scientific Method Assuring Transparency, Validity, and Accuracy: President Obama has directed federal agencies to incorporate well-established scientific processes, transparency, and peer review into scientific and technological processes.[29] EPA Administrator Lisa Jackson affirmed the importance of transparency in remarks to Congress by observing that "the methodologies and guidelines that EPA uses for scientific analyses should be shared fully with the public."[30] HESI supports this principle, and recommends that any study of hydraulic fracturing contain programmatic elements to assure transparency at every stage.

- Adhere to Applicable Quality Assurance Standards: Recognized quality assurance principles help to assure the integrity and success of scientific research projects, and should be incorporated into any study of hydraulic fracturing. In particular, any study of hydraulic fracturing should be undertaken in accordance with applicable Agency quality assurance guidance, including EPA's *Guidance for Quality Assurance Plans*.[31]

- Assure Robust Peer Review Consistent with EPA Guidance: Peer review is an integral component of scientific research. As recognized by EPA, peer review is most effective when incorporated at the outset, including up-front planning and study design stages.[32] Accordingly, any study of hydraulic fracturing should incorporate a peer review process consistent with existing Agency guidance.

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[28] EPA recognizes these principles in various risk assessment frameworks, *available at* http://epa.gov/riskassessment/basicinformation.htm#arisk

[29] Presidential Memorandum for the Heads of Executive Departments and Agencies on the Subject of Scientific Integrity, (Mar. 9, 2009), *available at* http://www.whitehouse.gov/the_press_office/Memorandum-for-the-Heads-of-Executive-Departments-and-Agencies-3-9-09/.

[30] Lisa P. Jackson, Administrator, U.S. Environmental Protection Agency, *Testimony before the U.S. Senate Environment and Public Works Committee*, June 9, 200,) *available at* http://www.epa.gov/ocir/hearings/testimony/111_2009_2010/2009_0608_lpj.pdf.

[31] U.S. Environmental Protection Agency, *Guidance for Quality Assurance Plans*, EPA QA/G-5 (Dec. 2002), *available at* http://www.epa.gov/QUALITY/qs-docs/g5-final.pdf.

[32] U.S. Environmental Protection Agency, *Peer Review Handbook 11-12*, (3rd ed., May, 2006).

VIII. Conclusion

HESI appreciates the opportunity to submit these comments on EPA's proposed approach to the design of this study. HESI supports EPA's goal of conducting the proposed study in a transparent, scientific manner. By incorporating rigorous risk assessment, transparency, quality assurance, and peer review principles, EPA will ensure that the proposed study reaches valid scientific conclusions. In addition, the proposed study should involve stakeholders at all stages. Robust stakeholder involvement will enhance the study's legitimacy while adding valuable technical and regulatory expertise. Moreover, given the extensive volume of existing hydraulic fracturing research and technical expertise, the proposed study should build on existing scientific and technical literature, including but not limited to EPA's own extensive, peer-reviewed study of hydraulic fracturing of CBM wells and its potential impacts on USDWs. By making use of existing studies and other information, EPA will be able to focus its efforts on any issues that may not have been previously reviewed while conserving valuable public and private resources. Likewise, EPA's approach to the study should begin with a careful review of the well-documented state oil and gas regulatory programs and existing industry well construction practices that effectively eliminate any plausible pathway for fracturing fluid migration between producing formations and shallow drinking water aquifers.

At the same time, HESI strongly urges EPA to reconsider the proposed scope of the study. HESI believes that the initial scope of the study as set forth in the Scoping Materials goes well beyond the congressional mandate to examine the potential relationships between hydraulic fracturing and drinking water. By properly focusing the study, EPA will conserve resources and permit completion of the study in a timely manner while addressing the principal allegations regarding hydraulic fracturing and complying with the directive from Congress.

HESI looks forward to working with EPA on the continued design, execution, and review of this study. If you have any questions regarding these comments, please do not hesitate to contact Stuart H. Kemp, Senior Counsel for Halliburton, at (713) 839-4539.

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Attachments