Department of Energy
Washington, DC 20585

February 28,2011

Mr. Edward Hanlon
Designated Federal Officer (DFO)
SAB Staff Office
US Environmental Protection Agency
Mailcode 1400R
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Dear Mr. Edward:

DOE appreciates the opportunity to provide our comments on the EPA 2010 Hydraulic Fracturing Study, and the dedication in which EPA's Scientific Advisory Board has provided to this effort. We reached out to the organizations within DOE that have interest in or conduct research on issues associated with hydraulic fracturing, combining comments from our national laboratories and various programs at headquarters.

Below are some highlights of DOE's general observations on the study plan:

- The purpose of the study, as stated in the executive summary, is to outline a process to "provide policymakers at all levels with sound scientific knowledge that can be used in decision making processes." The plan itself, however, is more of a fact-finding exercise rather than research in solution based-strategies. As such, the study will identify potential issues, but it is likely that additional research will subsequently be required to inform decision-makers on addressing those issues.

- Given that the retrospective case study methodology will selectively focus on cases for which there have been negative outcomes reported, there is concern that the study may not adequately represent the overall risk presented by hydraulic fracturing. EPA may want to consider including some retrospective case studies that focus on effective hydraulic fracturing practices.

- Analyzing the efficacy of existing Federal and state laws and regulations for conventional oil and gas operations as it applies to hydraulic fracturing, along with new frac-specific regulations, is not covered in the study plan. This would be pertinent to a sound scientific investigation of mitigating potential impacts of hydraulic fracturing on drinking water.

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- The list of finalists for the prospective case studies should be included in the study plan just as it was included for the retrospective case studies. DOE welcomes EPA to consider including the DOE/NETL project in Green County, PA as one of the finalists for the prospective case studies.

The complete DOE comments are recorded in the spreadsheet attached to this letter.

Sincerely,

Christopher A. Smith
Deputy Assistant Secretary
Office of Oil and Natural Gas

Attachment

Department or Agency: **U.S. Dept of Energy**

Comment Number	Page number	Section number	Comment	Proposed alternative text or additional information:
1	44	7.1	The finalists for the prospective case studies to be conducted in the study should be confirmed in the plan just as the retrospective case studies finalists. DOE welcomes EPA to consider including the DOE/NETL project in Green County, PA as one of the finalists for the prospective case studies.	
2	46	7.3	If initial or final results from the prospective case studies can be completed by the 2012 deadline, then it should be included with the 2012 results from the retrospective case studies to give a more comprehensive analysis of potential impacts from hydraulic fracturing on drinking water resources.	
3	na	na	General Comment: We commend EPA for including an assessment of the potential for drinking water contamination from improper casing/cementing and investigating long-term inspection of said following multiple frac jobs. These are inherently O&G operations not specific to HF but do represent clear potential pathways for contamination.	

4	29	6.3.1.1	"Therefore, on-going mechanical integrity testing of the well is recommended, and many states require that wells be periodically tested (GWPC, 2009)." How need to be looked at more closely.	Given that test methods are limited at best (e.g. if a cement bond log shows a good bond, it does not mean the cement is still or ever was an effective barrier to fluid movement), it might be best to simply note that additional studies need to be done to develop reliable test methods to ensure cement (or whatever other product) is an effective barrier to fluid movement up the wellbore behind the casing. Note that the MMS has a large number of wells with sustained casing pressure that has resulted from failed cement jobs; many (and likely most) of these wells had good cement bond logs.

5	29	6.3.1.2	Models can also be used during the fracturing process to make real-time adjustments to the fracture design (Armstrong et al., 1995). Additionally, microseismic monitors and tiltmeters may be used during fracturing to plot the positions of the fractures (Warpinski et al., 2001; Cipolla and Wright, 2000), although this is done primarily when a new area is being developed or new techniques are being used (API, 2009). Microseismic monitoring is utilized in about three percent of fracturing jobs (Zoback et al., 23 2010).	It is my understanding from conversations some service companies that significantly more than 3% of frac jobs are mapped with microseismic techniques. Pinnacle does more of these than anyone else, and an article published by K. Fisher last summer discussed using extensive microseismic data to show that the tops of Marcellus and Barnett shale hydraulic fractures did not approach within several thousand feet of the deepest freshwater aquifers. This reference should at least be included in the research plan. (Fisher, Kevin, 2010, Data confirm safety of well fracturing, The American Oil and Gas Reporter, July 2010, www.aogr.com)
6	30	6.3.1.3	"-or cement around a wellbore fails under the pressures exerted during hydraulic fracturing, these potential contaminants could migrate into drinking water supplies."	Makes no distinction between cementing vertical vs. horizontal wells. Cementing the horizontal portion of a well is primarily to ensure zone isolation for the hydraulic fracture making it more cost effective. Hence failure has no real effect on vertical isolation. The importance of only the vertical section needs to be addressed here.
7	32 and 33	6.3.6.1	• Assessing the integrity of wells with respect to casing and cement placement using available logging tools and pressure tests prior to hydraulic fracturing; • Repeating mechanical integrity assessments on wells following hydraulic fracturing treatments to evaluate changes related to the high pressures used in the fracturing;	Ref. limitations of current tool technologies above. Need to rethink this section. It might be better to ensure proper development of the barrier during cement placement - perhaps similar to the MMS's TA&R Program's Project #539, "Eliminating Annular Flow after Cementing in Offshore Gulf of Mexico". The potential of this technique was not realized and could be considered a possible candidate for EPA consideration for additional research (see: http://www.boemre.gov/tarprojects/539.htm). Such a study will likely lead to a "best practices" approach providing best available assurance of isolation of downhole fluid migration.
8			Review rest of references to "cementing" to ensure they agree with corrections/ additions above.	
9	29	6.3.1.2	As noted on page 29; Microseismic monitoring is utilized in about three percent of fracturing jobs (Zoback et al., This is an area potentially for advanced research and investigation of BMPs/state regulations in order to assess the risk potential. 23 20ID).	

10	102-104	Appendix F	On stray gas issues related to Marcellus shale production, it is important to look at the potential for gas entry into the well annulus of an uncased borehole with a string of production tubing hanging from the surface casing to the kickoff point for the lateral. This form of well completion saves money by only cementing the production casing in place within the lateral, but leaves all of the formations above the Marcellus open to the annular space in the vertical part of the borehole. Gas released from overlying shales, coal seams, etc. can build up in this space, which is typically unvented. If the surface casing cement contains microannular cracks, which can happen if they don't let it cure properly, the gas in the annulus can migrate behind the surface casing and potentially get into an aquifer. This is what may have happened in situations like at Dimock, PA. Chasing down stray gas is a complicated and notoriously difficult task, but understanding the details of well construction is important. One of the outcomes of such a study should be recommended well construction techniques to avoid the problem in the future (i.e. full casing and full cementing, not cutting corners).	
11	117	Appendix G	EPA will use the data collected from field samples to identify and evaluate potential indicators of hydraulic fracturing fluid migration into drinking water supplies. For example, flowback and produced water have higher ionic strengths (due to large concentrations of potassium and chloride) compared to surface waters and shallow ground water and may also have different isotopic compositions of strontium and radium. Although potassium and chloride are often used as indicators of flowback or produced water, they are not considered definitive. However, if the isotopic composition of the flowback or produced water differs significantly from those of nearby drinking water resources, then isotopic ratios could be sensitive indicators of contamination. Recent research by Peterman et al. (2010) lends support for incorporating such analyses into this study. Additionally, DOE NETL is working to determine if stable isotopes can be used to identify Marcellus flowback and produced water when commingled with surface waters or shallow ground water. EPA also plans to use this technique to evaluate contamination scenarios in the retrospective case studies and will coordinate with DOE on this aspect of the research.	In addition to trying to find isotopes that might indicate the presence of frac fluid in an aquifer, DOE NETL suggests researching a field experiment to allow a conservative tracer to be placed as a tag into the hydraulic fracture fluid (such as sulfur hexafloride, tritium, or others). Monitoring groundwater, surface water and soil gases above the lateral for the tracer chemical before, during and after the hydrofrac will provide an indication of fracture fluid movement. Other federal agencies like The USGS Office of Ground Water is known for their expertise with groundwater tracer tests. The final part of the experiment would be to drill a vertical borehole down to the fracture zone, sampling formation water along the way and analyzing for the tracer. This will provide definitive results on the movement of these fluids underground, especially when tied in with microseismic data. Stable isotope studies on frac fluids positively identified by detection of the tracer may lead to a method of fingerprinting hydraulic fracturing fluid, which can be applied to retrospective sites elsewhere.
12	viii	Exec Summ	How recent will the reported incidents be? The older the incident, the more challenging the investigative work will be.	

13	18		This should also include some mention of fate and effects, such as the third bullet in the box just below this one. A chemical in full strength may be toxic, but when diluted or combined with other substances may be less toxic. For example, if a tank of concentrated acid falls onto a gravel road, it will react with the gravel and be fully or partially neutralized before the acid reaches a stream or soaks into the ground.	
14	18		This box should include some questions that talk about how flowback and produced water actually come into contact with drinking water. What are the pathways the releases would follow to get to drinking water sources?	
15	18		Effectiveness of treatment and disposal are not necessarily important unless the wastewater has an opportunity to come into contact with drinking water.	
16	19	6.1.1	This is not a good estimate -- it assumes that all fraced wells are horizontal wells. There is no evidence to support how many of the fracced wells are high-volume horizontal shale gas wells, and how many are low-volume vertical wells in other formations	
17	19	6.1.1	Estimates prepared for the Marcellus and Fayetteville shales suggest that even in a hypothetical high drilling (and fracing) year, the total volume of water required for natural gas development is just a fraction of one percent of the water withdrawals in the states in which those shales are located. (Veil 2011 -- presentation made at Produced Water Society Seminar on Jan 18, 2011)	
18	97	table D2	There are no shale gas wastewater data in this reference. The study plan noted earlier that it limited the scope to shale gas wastewater. This reference may not be relevant for the purposed of this table.	
19	29	6.3.1.2	Tiltmeter data is a proxy for deformation, and difficult to invert to plot the positions of the fractures within the formation	
20	34	6.3.6.2	Characterization data on natural pathways is needed to assess the role these pathways play in possible contamination, yet this data may not exist due to the common assumption that natural barriers in the rock strata act as seals. How will adequate characterization data (natural faults and fractures) be obtained?	
21	119	Appendix H	There is no mention of process coupling in the models, i.e. fully coupled THMC models.	
22	7	3	Change AEO 2011 references from will to would; also, the AEO 2011 is neither a forecast nor a prediction. Rather, it is a scenario developed by the Energy Information Administration (EIA).	"… in 2009, and would constitute 45 per cent of the U.S. gas supply in 2035 (DOE 2010b) if current trends and policies persist."

23	26; 39; 42	6.2.5.2; 6.4.5.2; 6.5.3.1	In analyzing existing data and conducting retrospective case studies, what might be the criteria EPA is planning to use for data inclusion? For example, would data/samples from the company and the residents be included, and would an older sample be accepted assuming it's in "reasonable" condition? Obviously, which data are included and which aren't has a large impact on potential linkages between drinking water contamination/health effects and chemical mixes/flow back as well as produced water/waste treatment and disposal.	
24	30	6.3.2	These are very significant statements in the Section titled "How Effective are Well Construction Practices at Containing Gases and Fluids Before, During, and After Fracturing?" As such, the study may want to look at current EPA, DOE, and other federal R&D efforts in these areas and potentially add areas of focus not yet well understood.	
25	30	6.3.2	Just to amplify and expand upon the prior comment regarding this section, a major technical challenge appears to be whether or not current science & technology can enable industry and regulators alike to irrefutably 'fingerprint' the footprint of gas and chemical migration from a given wellbore / operation - in other words, tracing back from contaminated groundwater or surface water, or other potentially harmful environmental impacts from gas / chemical migration, to the precise source at which the chemicals / hydrocarbons breached containment (e.g., characterization of contaminant fate and transport in the subsurface). Perhaps this section could be tweaked / expanded to reflect this major opportunity area as recent gas migration cases have arisen but have seemingly been unable to identify the precise source of contamination as some regulatory actions have been questioned by industry and oil and gas regulators (e.g., TX Railroad Commission), etc.	

26	35	6.4.1	Although a brief reference is made to the DOE National Energy Technology Laboratory (NETL) being available, potentially, to provide useful tools and insights for "planning and managing water from hydraulic fracturing operations," this might be an opportunity to add additional narrative text spelling out some of the initial collaborative arrangements established between EPA and DOE from the formal meeting at EPA Headquarters - hosted by Deputy Administrator Bob Perciasepe - on 12/16/10. For example, the role DOE-NETL may be playing in helping EPA interpret recent survey results / feedback from the nine (9) hydraulic fracturing service firms queried in 2010; providing technical results and other information from ongoing NETL R&D potentially applicable to the EPA Hydraulic Fracturing Study; etc.	
27	45	7.2	Regarding case study selection criteria, please make more explicit the criteria used - and limitations faced - in coming up with the current set of candidates. Ideally, EPA would consider retrospective cases that resulted in some sort of environmental incident yet hasn't been studied at length (or at all). EPA should avoid repeating prior studies. Analyzing sites with documented incidents possibly related to fracing that haven't been thoroughly studied previously may produce new and important findings. Ideally, the findings from these case studies and the EPA study as a whole will help to advance sustainable and environmentally protective hydraulic fracturing practices. Lastly, given the relatively few number of case studies, EPA needs to manage the subsequent communication of findings from these investigations as they most certainly do not constitute a representative sample of shale gas operations nationwide and therefore should not be construed as such.	
28	53	10	It is not clear how the information requested from the nine (9) service companies will be used, including how it might inform the case studies (retrospective, prospective) and future activities at hundreds of thousands of well sites in the future. I think it will be important to inform the public as to how general or specific the state of affairs being observed through the lens of the data provided by the 9 companies - with respect to each of the requested areas (fluid cracking fluid formulation, management practices, health and environmental impacts, etc.) - may ultimately be. The plan should also describe more clearly how the data will or will not be useful for specific case studies or sites.	