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before the

Committee on Science, Space and Technology

United States House of Representatives

Hearing: Review of Hydraulic Fracturing Technology and Practices

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Mr. Chairman, and members of the committee,

Thank you for this opportunity to provide an industry perspective on the exciting, technology driven opportunity of hydraulic fracturing. Today I hope to share with you some perspectives on both the technology as a whole and on the proposed EPA draft plan to study the potential impacts of hydraulic fracturing on drinking water resources.

Apache considers hydraulic fracturing (HF) one of the most enabling technologies in the oil and gas business. It is a technique that continues to evolve; and it benefits from constant innovation as companies explore new applications every day. Literally the future of the world energy supply is being re-written as economically recoverable oil and gas supplies increase at dramatic rates thanks to advances in hydraulic fracturing. With so much potential it is essential that we, as a nation, investigate and rationally understand the risks associated with hydraulic fracturing techniques by employing high quality science and rigorous scientific review to validate our conclusions. The public may not want to engage in the analytical techniques required for understanding scientific tests, but it has every right to believe that regulators, the scientific community and industry will collaborate to investigate and ensure public safety, and especially to preserve precious resources such as groundwater and clean air.

Given the rapid expansion of the technique, many are uncomfortable and even afraid of the changes it brings. To complicate matters, public understanding is not advanced by emotionally charged distortions and confrontational media. It appears that many are content to criticize techniques they barely begin to understand, and jump to conclusions without also acknowledging that innovation is likely to overcome obstacles as they are properly understood. The Society of Petroleum Engineers has estimated that there have been over two million fracture stimulation jobs done worldwide – more than one million in the United States alone in the last 60 years; there is no doubt the technique has improved considerably in the past five years. Science is about testing ideas and solving problems. The oil and gas business has a long tradition of technical innovation based on applied science and engineering that has created enormous wealth for this country and allowed Americans to enjoy high standards of living with relatively low-cost energy.

Apache's hydraulic fracturing operations

Most focus on hydraulic fracturing in shale gas plays. Apache believes hydraulic fracturing will unlock vast amounts of hydrocarbons in both existing conventional and new unconventional reservoirs. While Apache does not currently operate in the Marcellus shale play, it is both a major player and a significant innovator elsewhere. We have a leading acreage position in the Horn River Basin shale gas play in British Columbia, Canada. Apache is the second-largest hydrocarbon producer in the Permian Basin of West Texas and New Mexico, where we are applying high-volume horizontal hydraulic fracturing techniques to increase oil production from a very large inventory of drilling targets in fields that have been producing for 60 years or more. In the Anadarko basin of western Oklahoma and the Texas Panhandle, we have achieved great success in advancing the Granite Wash play, producing high flow rates of natural gas and condensate from a laterally extensive tight sandstone reservoir that was originally developed using fraced vertical wells beginning in the 1970s. We recently announced we have extended this concept to another reservoir, the Hogshooter formation, where two hydraulically fractured wells have provided initial flow rates in excess of 2,000 barrels of oil and 3 million cubic feet (MMcf) of gas per day. Hydraulic fracturing is revitalizing production in the North American Oil Patch, and we are convinced it will rapidly expand internationally. Apache is actively engaged in hydraulic fracturing tests in unconventional reservoirs or resource plays in Argentina and we expect to go forward with tests in the Western Desert of Egypt. We recognize that our competitors also have global ambitions to expand the use of the technology.

Hydraulic fracturing is a major transformative technology that expands and leverages long-proven drilling standards and techniques in order to massively increase the energy available to the growing population of the planet. The question before you and the industry is not whether it should be continued. Developing this expected flood of supply will require continued innovation to reduce cost and increase efficiency, aligned with efforts to improve environmental protection. Sustainable performance requires us to consider how we can reduce the footprint of our operations, best provide the water required and protect local aquifers with responsible practices, and carefully select and use the necessary chemicals. Ultimately we all benefit from doing this correctly.

Managing risks and operating in a safe and responsible manner

Apache takes great care to protect drinking water and manage risks associated with drilling and production everywhere it operates. It surprises many that some places have little or no effective regulation governing the standards of common water supply wells. We are not aware, however, of any jurisdiction around the globe where drilling practices and well-design standards do not explicitly address protection of potable aquifers. Wells are drilled, fresh water is isolated behind steel and cement barriers, and the barriers are tested before hydraulic fracturing operations begin. Performance testing includes pressure tests of each cemented section and full wellbore pressure tests before hydraulic fracturing competitions begin. It is increasingly common for months to pass between the time drilling operations cease and a well is completed using hydraulic fracturing. Detailed continuous pressure monitoring is standard with hydraulic fracturing operations, and sometimes we employ micro-seismic

monitoring techniques to help define the shape and the lateral and vertical extent of the fractures and injected fluids.

Apache operates in states and provinces where we are permitted to re-inject 100 percent of flow-back and produced water into deep underground reservoirs completely isolated from freshwater aquifers. In Oklahoma and Texas, we normally make-up our frac fluids by mixing fresh water produced from shallow groundwater sources and surface sources that are purchased from land owners. Recently, we have learned a great deal from our Canadian operations about using relatively high saline water instead of fresh water, contrary to the general practices and expectations of the industry. In the Horn River Basin, working with our partner EnCana, we have developed a system for extracting water from a saline aquifer in the Debolt formation and treating it in a built for purpose plant to eliminate H_2S. The water is piped to our well pad where we add a minimum of chemicals to create an effective frac fluid. After fracing we then re-inject the flow-back and produced water into the Debolt formation in a closed-loop system. This water source provides many operational advantages, and compliments efficiencies provided by innovative high-density well pads that allow a minimum surface footprint. We intend to continue to innovate to protect a pristine environment using a minimum of surface water and disposing of none into waterways.

High-flow-rate brackish or salt water aquifer systems are not present everywhere. In the Permian Basin, Apache believes the brackish Santa Rosa groundwater system can be adapted for a similar purpose as the Debolt in parts of the Horn River Basin. We are currently investigating tests of our concept for frac systems in oil reservoirs using recycled brackish water as a base fluid. This has many environmental advantages, and well as practical reservoir management efficiencies, but it is especially good because if we are successful, we will minimize our need for fresh water. This is a clear example where technology enables our business and we aggressively explore what is possible in order to succeed. So do many others, and we all benefit.

In addition to our general practice of water re-injection, we have developed a program that tests the chemical composition of our make-up water, whole frac fluid, flow-back and produced water at representative wells. We test this water even though it gets re-injected into deep reservoirs and would never be used for drinking. Information from these tests helps us communicate with our service companies to reduce or improve the chemical formulations in our operations.

In addition we have undertaken many performance-based comparisons to aid in our selection of chemical additives. Basically, no one wants to pay for chemicals they don't need, and we have found that we can often replace non-biodegradable biocides with much less intrusive chemicals or even with ultraviolet light in some circumstances. We frequently eliminate clay control additives without detrimental reactions.

Beyond our direct operational choices, Apache has made a real effort help the industry reach consensus regarding disclosure of the composition of hydraulic fracturing fluids; we have committed to post the composition of every U.S. frac job operated by Apache on the FracFocus hydraulic fracturing chemical

registry. The www.fracfocus.org website is a joint project of the Ground Water Protection Council and the Interstate Oil and Gas Compact Commission.

The EPA Draft Plan

Apache Corporation would be pleased if the U.S. scientific community were to conduct robust scientific investigations that better establish the risks of hydraulic fracturing on drinking water resources. Based on existing knowledge and practical experience we believe these risks are minimal and manageable; we have faith that if a problem is identified, industry will be able to innovate and resolve it. Society benefits from high-quality research that advances knowledge and ultimately makes us more comfortable with the difficult choices we face. Alarmist sensationalism, especially when it purports to be science, is destructive, and this topic has enjoyed more that it's fair share of that already.

The success of any scientific evaluation can usually be predicted by the quality and commitment of the team assembled to do the work, the clarity and focus of the investigation to prioritize testing what is important, and the availability of the necessary tools and resources to get the job done. Good oversight and guidance also helps. Based on those criteria it is frankly difficult to expect much of value from this study. It aspires to do too much with too little, in too short a time frame. It has no direction of priorities based on testing existing knowledge. If this committee believes that the topic merits investigation, then Apache supports making adequate funds and oversight available to achieve a well-defined goal.

One fundamental problem underlying this study is an unresolved conflict: Is it intended to be a study of risks of hydraulic fracturing in the Marcellus shale basin or fracturing throughout the United States? Issues related to surface water discharge and use of publically operated treatment works (POTW) appear to be limited to the Marcellus, yet the study tends to consider these major national issues, deserving the highest priority.

Water resource management, at the scale required for hydraulic fracturing, normally is the prerogative of states and local governments, and there is substantial variation across geology and jurisdiction about the net effect of water demand for any given water resource. States are equipped with the skills required to manage water resources and there is no need for this study to include the topic. Any evaluation of the water resources required for hydraulic fracturing needs to be made in the context of other major demands on water.

Lifecycle analysis of hydraulic fracturing techniques, in terms of impact on water and air emissions, may deserve critical investigation, but in this study it contributes little to the essential question proposed by Congress. Likewise the proposed focus on repetitive toxicology studies seems a misplaced priority at this level of funding. Existing information should be mined and leveraged and focused studies undertaken to test the conclusions.

The national interest may be well served by changing the tone of the study. Instead of casting a wide and shallow net hoping to catch something quickly, focus on developing more insightful fishing techniques. It would be helpful for EPA to collaborate with industry to identify and prioritize the chemical additives of greatest concern based on regionally specific information and analysis about the

ultimate presence of these chemicals in produced waters and the actual risks to the public. There are likely to be different answers for different formations, and this aspect of study would help all parties focus on the development of alternative additives and practices to best protect the environment.

I would like to end on a very personal note. In my journey to understand the real issues of hydraulic fracturing, I have met and discussed technical material with a great many talented people including some exceptional scientists in industry, the EPA, national labs, universities and committed environmentalists. I consider it a privilege to have served as a technical theme lead for an EPA hydraulic fracturing workshop. It is true that there is simmering distrust between scientists with different perspectives, but that is probably healthy at some level. Government science sometimes seems to encourage and expose our worst tendencies, especially when non-scientific issues may be the root cause of polarization. Ultimately science is objective. Sometimes it takes a while to realize that truth. Hydraulic fracturing is far too important to be dismissed for the wrong reasons.