Statement of the
American Exploration & Production Council,
American Petroleum Institute,
Independent Petroleum Association of America,
International Association of Drilling Contractors
Petroleum Equipment Suppliers Association,
and US Oil & Gas Association
for the

House Natural Resources Subcommittee on Energy and Mineral Resources Hearing on Shale Gas Development

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The American Exploration & Production Council ("AXPC"), the American Petroleum Institute ("API"), the International Association of Drilling Contractors ("IADC"), the Independent Petroleum Association of America ("IPAA"), the Petroleum Equipment Suppliers Association ("PESA") and the US Oil & Gas Association ("USOGA") (collectively the "Associations") (collectively the "Associations") appreciate the opportunity to present the views of the U.S. oil and natural gas industry on shale gas potential and issues related to shale gas development.

AXPC is a national trade association representing 25 of the largest U.S. independent natural gas and crude oil exploration and production companies. AXPC members are leaders in developing and applying technology necessary to find and produce secure supplies of oil and gas throughout North America and around the world. API is a

nationwide trade association representing over 400 member companies involved in all aspects of the oil and gas industry in the United States, including exploration and production of oil and gas resources. IPAA represents thousands of independent oil and natural gas producers across the country. IPAA's members develop 90% of domestic oil and gas wells. IADC represents virtually the entire worldwide drilling industry, both onshore and offshore, including those companies operating drilling rigs in the Marcellus Shale formation. PESA comprises equipment manufacturers, wellsite service companies and supply companies serving the drilling and production segments of the petroleum industry. USOGA's members represent all segments of the oil and gas industry, including major oil and gas companies and independent oil and gas producers as well as others. These Associations work to secure reliable access to the nation's valuable hydrocarbon resources in order that they may be developed, produced and supplied in an environmentally responsible manner. We are dedicated to improving the compatibility of our activities with the environment, while developing these energy resources in an economically sound manner – ultimately helping this nation strive toward energy independence.

Energy Vital to U.S. Economic Recovery

Shale gas development must be viewed in the context of current U.S. energy needs and the leading roles of oil and natural gas in meeting those needs.

Energy is vital to all Americans. We need to meet our energy challenges if we are to keep our country on the road to economic recovery. Energy means jobs, economic

growth, and global competitiveness. It means ensuring energy security today and for decades to come. All respected energy studies agree that we need more of *all* sources of domestic energy. Transitions to new energy sources don't happen overnight. What we need is a multi-pronged approach that includes more renewable energy like solar and wind and increased energy efficiency. But our strategy must also include oil and natural gas, which will continue to be our leading energy sources.

A recent study by ICF International underscores how energy development impacts jobs and the economy. The study found that development of much-needed oil and natural gas resources that have been kept off-limits by Congress for decades could create more than 160,000 new jobs by 2030. Those new jobs would be in addition to the 6 million jobs the U.S. oil and natural gas industry already supports – 1.8 million people directly employed by the industry and more than 4 million supported by the industry. Moreover, the average salary of exploration and production jobs is more than twice the national average.

Increased oil and natural gas development not only creates more jobs and provides more energy; it also generates significant revenues for federal, state and local governments. The study shows that developing the oil and natural gas resources that have been kept off-limits could generate more than $1.7 trillion in revenues that would help support vital programs and reduce pressure on American taxpayers.

Also, consider how petroleum byproducts help shape the lives of Americans and will continue to do so for years to come. There are hundreds of examples of how consumers

rely on petroleum byproducts in their everyday lives – everything from aspirins and antiseptics to food preservatives and fertilizers.

Future Role of Natural Gas

Although the share of non-fossil fuels is growing rapidly, natural gas, as well as oil, will continue to play leading roles through 2030. The U.S. Department of Energy's Energy Information Administration (EIA) estimates that natural gas and oil will continue to meet more than half of the nation's energy consumption in 2030. EIA also estimates that just 7 percent of the nation's energy needs were supplied by renewable energy – including ethanol, hydropower, and biomass -- in 2007, with its share expected to grow rapidly. Despite the rapid growth and because it is starting from such a small base, EIA estimates that renewable energy will supply 13 percent of the nation's energy needs by 2030. Thus, even if we were to double our reliance on renewable energy as the President has advocated, we would still rely on natural gas and oil as our leading energy sources in 2030.

Natural gas is a clean burning fuel and it can be used to meet a variety of U.S. energy needs from heating homes to generating electricity to powering vehicles to creating the basic materials for fertilizers. Demand for natural gas in recent years has been driven by its clean-burning nature, making it an ideal means of reducing greenhouse gas emissions. It is one of the few lower-emission power generation sources available.

One important but frequently overlooked fact is that natural gas and oil are crucial to developing renewable energy sources. Not too many people understand that when you talk about relying more on wind turbines, it's not possible to do that without natural gas. With all the discussion about wind as a source of power for electricity, it is important to remember that electricity production in the U.S. is predicated on reliability, affordability and security. Because large amounts of electricity cannot be stored and because the availability of wind power is highly variable, standby capability for electricity generation will be required in the foreseeable future for any wind-dependent sector of the nation's power grid. Natural gas provides the cleanest burning fuel for that standby generating capacity. Furthermore, you need natural gas to manufacture components like wind turbine pylons and solar arrays, as well as thin-film technology used in lightweight plastics that improve vehicle energy efficiency. Natural gas is also used in the manufacture of solar films to generate emissions-free electricity. And it is the primary component of the fertilizer used to grow crops that become biofuels like ethanol.

Shale Gas Potential

Shale gas is natural gas from shale formations. Older shale gas wells were drilled vertically, while more recent wells primarily utilize horizontal drilling techniques; both techniques require stimulation treatments to be commercially viable. Only shale formations with certain characteristics will produce gas. Shale gas is present across much of the lower-48 states. Each shale gas basin has unique characteristics and each offers its own exploration and production challenges.

In its latest *International Energy Outlook*, EIA estimated that unconventional gas production from both tight sand and shale formations could increase from 47 percent of the U.S. total in 2006 to 56 percent in 2030.

The DOE's Office of Fossil Energy and National Energy Technology Laboratory addressed shale gas potential in its April 2009 report, *Modern Shale Gas Development in the United States: A Primer.* DOE reported: "The United States has abundant natural gas resources. The Energy Information Administration estimates that the U.S. has more than 1,744 trillion cubic feet (tcf) of technically recoverable natural gas, including 211 tcf of proved reserves (the discovered, economically recoverable fraction of the original gas-in-place). Technically recoverable unconventional gas (shale gas, tight sands, and coalbed methane) accounts for 60% of the onshore recoverable resource."

DOE goes on to state: "At the U.S. production rates for 2007, about 19.3 tcf, the current recoverable resource estimate provides enough natural gas to supply the U.S. for the next 90 years. Separate estimates of the shale gas resource extend this supply to 116 years."

DOE further states: "Analysts have estimated that by 2011 most new reserves growth (50% to 60% or approximately 3 bcf/day) will come from unconventional shale gas reservoirs. The total recoverable gas resources in four new shale gas plays (the Haynesville, Fayetteville, Marcellus, and Woodford) may be over 550 tcf. Total annual production volumes of 3 to 4 tcf may be sustainable for decades. This potential for

production in the known onshore shale basins, coupled with other unconventional gas plays, is predicted to contribute significantly to the U.S.'s domestic energy outlook." Additional data were provided in a November 2008 study by The INGAA Foundation, Inc., *Availability, Economics and Production Potential of North American Unconventional Natural Gas Supplies*, which evaluated the potential of North American unconventional natural gas sources, including shale gas. The study's conclusions included the following:

- "Total natural gas resources in North America exceed 2,300 trillion cubic feet (tcf). Shale resources alone within the assessment total over 500 tcf of recoverable natural gas. To put this in perspective, annual U.S. and Canada gas production in 2007 was approximately 25 tcf. For the lower-48, tight gas is assessed at 174 tcf, coal-bed methane at 65 tcf, and shale gas at 385 tcf. …
- "Lower-48 natural gas production is forecast to increase from 19 tcf per year in 2007 to 23 tcf per year in 2020. During this period, the percentage of lower-48 unconventional natural gas will grow from 48% to 69% of total lower-48 production. …
- "To achieve the gas production forecast presented here, it will be necessary to drill an average of approximately 25,000 unconventional gas wells per year through 2020. That equates to 300,000 wells, representing a drilling and completion cost outlay of $560 billion. To achieve the forecast results, industry must have land access for drilling, a reasonable permitting process, and adequate prices and demand for natural gas."

Hydraulic fracturing is vital for more natural gas production

While the United States contains a great deal of natural gas, most cannot be produced without hydraulic fracturing technology. Hydraulic fracturing is a technology that has been available for more than 50 years and has been used in nearly 1 million wells in the United States. Experience shows it to be both safe and effective.

U.S. Energy Information Administration Acting Administrator Howard K. Gruenspecht has said: "There's no question that the gas growth we see in the U.S. from tight sands and shale depends on hydraulic fracturing. If that's taken off the table, the impact would be profound."

Well-construction practices and state and federal regulation have effectively protected underground water sources from impacts related to drilling and production activities, including hydraulic fracturing. Wells are carefully constructed using steel pipe cemented to the surrounding rock to ensure isolation and protection of any subsurface drinking water sources.

Application of hydraulic fracturing to increase recovery is estimated to account for 30 percent of recoverable oil and gas reserves in the U.S. 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. The National Petroleum Council has estimated that 60 to 80 percent of all wells drilled in the United States in the next ten years will require fracturing in order to remain profitable.

Hydraulic fracturing entails the use of high pressure pumps to force fluid down the well and into 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.

The process 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 order to be effective, the fracture must be kept open when the pressure is relaxed. This is accomplished by introducing a proppant (usually sand) that is conveyed into the fracture by the viscous fluid. 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. 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 flow of oil and gas reserves, which would defeat the purpose of the fracturing job. 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—in all oil and gas wells, not just those that are hydraulically fractured— 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.

Overall, the fluids used in the process are typically a mixture, with as much as 99 percent consisting of commonly used material such water and sand. The chemicals and additives that make up the rest are well diluted. There are a number of constituents that may be added to fracturing fluids to perform a variety of functions depending on the characteristics of the formation being fractured. These constituents are intended to help ensure the effectiveness of the fracturing operations.

Hydraulic fracturing does not pose a threat to drinking water supplies

Despite allegations to the contrary, there is no confirmed evidence that hydraulic fracturing has resulted in the contamination of drinking water supplies. The U.S. Environmental Protection Agency (EPA) and state regulators have studied the potential impacts of hydraulic fracturing on underground drinking water sources and have found no confirmed evidence of any contamination of drinking water wells in connection with hydraulic fracturing operations despite the fact that many thousands of hydraulic fracturing operations have been undertaken over more than 50 years.

One such study was conducted by the Ground Water Protection Council (GWPC), an organization of federal and state regulators and others concerned with groundwater quality, which surveyed state agencies responsible for oil and gas production in 1998. GWPC found no evidence of any contamination of drinking water supplies or increased risk to human health due to the hydraulic fracturing of coal-bed methane (CBM) wells even though the responding agencies indicated that over 10,000 CBM wells had been completed in their respective states. See *Survey Results on Inventory and Extent of Hydraulic Fracturing in Coal-bed Methane Wells in Producing States*, GWPC (December 15, 1998). Similar to the GWPC effort, the Interstate Oil and Gas Compact Commission conducted its own survey of member states in 2002 and again found no evidence of contamination of drinking water supplies as a result of hydraulic fracturing operations. See "*States Experience With Hydraulic Fracturing: A Survey of the Interstate Oil and Gas Compact Commission*," IOGCC (July 2002).

In addition, EPA completed a study of the potential impacts of hydraulic fracturing of CBM wells on drinking water supplies; the agency has, in fact, characterized this study as the most extensive review of the potential impacts of hydraulic fracturing on public health ever undertaken. See *Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coal-bed Methane Reservoirs, EPA Office of Water* (June 2004). As part of the study, EPA reviewed information about alleged incidents of drinking water well contamination believed by the affected parties to be associated with hydraulic fracturing or other CBM development activities. Based on its review, EPA found that, although thousands of CBM wells are fractured annually, there were "no

confirmed cases that are linked to fracturing fluid injection into CBM wells or subsequent underground movement of fracturing fluids."

As a result of this study, EPA concluded that hydraulic fracturing of CBM wells poses little or no threat to underground sources of drinking water. EPA also concluded that any risks to such drinking water sources associated with other types of formations – such as shales – would likely be even less given that coal-beds tend to be shallower than other formations and that hydraulic fracturing of formations such as shales would generally take place at greater depths and would therefore be even further removed from drinking water sources than fracturing operations in coal-beds.

Individual state reviews have produced similar findings. For example, the Colorado Oil and Gas Conservation Commission concluded: "Thousands of these and other types of stimulations (like hydraulic fracturing) are performed each year in Colorado with no adverse impact to groundwater or the surface environment." The New York Department of Environmental Conservation recently noted there was "no record of any documented instance of groundwater contamination caused by hydraulic fracturing for gas well development in New York, despite the use of this technology in thousands of wells across the state during the past 50 or more years."

In short, every study that has examined the potential impacts of hydraulic fracturing operations on drinking water wells has concluded that there is simply no persuasive

evidence that any of the many thousands of hydraulic fracturing operations that have been conducted throughout the country have contaminated drinking water supplies.

The lack of any demonstrated impact on drinking water from hydraulic fracturing is not at all surprising in light of the nature of hydraulic fracturing activities and numerous factors that weigh against any significant migration of fracturing fluids toward drinking water wells. In fact, employing well-accepted drilling techniques that have been used for many years, the majority of hydraulic fracturing activities take place at depths far below any groundwater sources that could reasonably be considered drinking water sources.

At the same time, companies engaged in drilling and completing oil and gas wells use various acknowledged well construction practices such as zonal isolation techniques that help to ensure that fluids in the well bore will not come in contact with groundwater at shallow depths that may serve as a source of water for drinking water wells. For example, the casing program for each well typically is designed, installed and maintained to prevent any migration of oil, gas or water from one formation to another that may result in the degradation of groundwater. Surface casing is generally run to a depth below all known drinking water aquifers and the surface casing must be set in or through an impervious formation. Surface casing is usually cemented from the bottom of the casing to the surface. Thus, the very nature of the typical oil and gas well construction process itself suggests that hydraulic fracturing would virtually never pose any threat to drinking water sources. These design and construction practices are closely regulated by state oil and gas conservation agencies with regulations tailored to geology, reservoirs

and subsurface conditions, to ensure that ground and surface waters are not contaminated by oil and natural gas production activities.

Moreover, a number of other factors contribute to the lack of impacts from hydraulic fracturing. For example, after the fluids enter the formation being fractured, they become substantially diluted. In addition, once fracturing operations are completed, the well operator begins to pump out groundwater as well as oil or gas, removing as much as 82 percent of the fracturing fluids in the process. As long as oil or gas continues to be pumped out of the well – a period that could extend 30 years or more – any remaining fluids within the capture zone of the well will generally be drawn toward the oil or gas well by the pumping and are unlikely to migrate away from the vicinity of the well.

As the EPA study found, the fluids that remain in the formation may be affected by several other factors: some chemicals may be naturally broken down or biodegraded; some chemicals may be adsorbed onto the rock formation, meaning that the chemicals will not be pulled back in the direction of the well by pumping but also will not migrate away from the well; and some fluids may become trapped in the rock formation and will not migrate in the direction of drinking water wells. The nature of the surrounding formations also may serve to further confine the fracturing fluids to the formation in which they were initially placed. As the EPA study recognizes, in some cases formations of shale or other relatively impermeable rock may form barriers to any migration of fracturing fluids from deep formations where fracturing usually takes place to shallow formations that may serve as drinking water sources.

In light of these various factors and the distance that typically separates an oil or gas well and any drinking water well, it is quite unlikely that any fracturing fluids would even approach a drinking water well or a surface aquifer as a result of subsurface migration.

Horizontal drilling is another key technology in shale gas development

Another important technology that has increased shale gas production has been the use of cost-effective horizontal drilling. This technology, together with hydraulic fracturing and protective environmental practices, has enabled shale gas development to expand into previously inaccessible areas. Currently, drilling and completion of shale gas wells involves both vertical and horizontal wells, both of which have casing and cement installed to safeguard fresh and treatable aquifers. Horizontal well completions are being increasingly implemented by shale gas operators to maximize recovery of gas and optimize well economics.

Horizontal drilling allows more exposure to a formation than does a vertical well, which provides important advantages. According to the U.S. Department of Energy's *Modern Shale Gas Development in the United States: A Primer* (April 2009), "Six to eight horizontal wells drilled from only one well pad can access the same reservoir volume as sixteen vertical wells."

Conclusion: Shale gas development needs to be encouraged

Shale gas is an increasingly important factor in meeting U.S. energy and economic needs in the years ahead. Any effective energy policy must encourage development of shale gas and not erect barriers to its production and use. The need to accelerate shale gas development is one more important reason to provide access to domestic natural gas resources. Moreover, hydraulic fracturing continues to be an essential technology in developing shale gas and has been effectively regulated at the state and local levels. Additional federal regulation is not necessary and could needlessly complicate and delay shale gas development.

On May 28, the Ground Water Protection Council released its study, *State Oil and Natural Gas Regulations Designed To Protect Water Resources*. This study confirms that regulation of oil and gas field activities, including hydraulic fracturing, is best accomplished at the state level where regional and local conditions are best understood and where state regulators are on hand to conduct inspections and oversee specific operations like well construction and testing and plugging, as well as hydraulic fracturing. Hydraulic fracturing is a tried-and-true, more than half-century-old technology, increasingly essential for producing the nation's natural gas.

The bottom line is clear: We need a comprehensive, multi-pronged approach to our nation's energy challenges and increased development of shale gas must be a major component of that approach. The Associations and the people of America's oil and natural gas industry want to work with your Subcommittee and others in Congress to help encourage shale gas development today and in the years ahead.