Our Mission
Anadarko Petroleum Corporation’s mission is to deliver a competitive and sustainable rate of return to shareholders by exploring for, acquiring and developing oil and natural gas resources vital to the world’s health and welfare. As of year-end 2015, the company had approximately 2.06 billion barrels-equivalent of proved reserves, making it one of the world’s largest independent oil and natural gas exploration and production companies.

Questions & Answers Regarding Hydraulic Fracturing (Fracking) and Associated Activities
Anadarko is committed to safety and transparency as we produce oil and natural gas resources that are essential to the modern world. In doing so, we are committed to protecting the environment, safeguarding water supplies, preserving wildlife and habitat, and supporting the communities where we live and operate.

The advent of shale and other tight-sands opportunities has created a new energy future with greater abundance, energy security and economic activity. Achieving these benefits requires the combination of the proven technologies of horizontal drilling and hydraulic fracturing, or fracking as it is more commonly known. The confluence of these technologies is largely responsible for North America’s rapidly expanding supply of oil and cleaner-burning natural gas, which is significantly enhancing America’s energy security.

Shales and Tight-Sand Formations
Although, for many years, scientists have known about oil and natural gas trapped in shale formations, it wasn’t until the time-tested technologies of horizontal drilling and fracking were combined that these vast energy resources could be commercially developed, completely altering America’s supply outlook and self sufficiency.

Did You Know?
Horizontal wells can produce up to 10 times more oil and natural gas than traditional vertical wells.
One of the key advancements in technology was the application of **horizontal drilling**, a method of drilling thousands of feet vertically then turning the drill bit to drill another several thousand feet horizontally along hydrocarbon-bearing zones. This practice enables the wellbore to contact a larger cross section of the targeted rock (shale) formation, increasing productivity rates. Horizontal drilling also carries environmental benefits on the surface because it reduces the amount of surface space required, enabling companies to drill numerous wells from a single pad. Doing so also enables producers to consolidate gathering equipment and infrastructure such as roads and pipelines, which reduces truck traffic and associated emissions.

Another key advancement is in the application of hydraulic fracturing to horizontal wells. While fracking has been safely used for more than six decades, it was traditionally used in vertical wells that accessed only a small portion of the producing rock formation. Historically, each well typically had one hydraulic fracture placed in the reservoir, but with today’s technology, multi-stage fracturing in horizontal wellbores enables producers to access significantly larger producing zones, maximizing the amount of oil and natural gas resources being recovered and minimizing the amount of surface space required.

**What Does Fracking Look Like?**

This photo captures a portion of one of Anadarko’s Stim Centers in Colorado’s Wattenberg field, a centrally located hydraulic fracturing facility that remotely serves wells up to a mile away. This photo portrays a temporary water pipeline for our water-on-demand system, and both municipal effluent (red tanks) and recycled flowback water (purple tanks) for use in the fracking process.

The sand towers in the distance hold the proppant (sand), which will be injected with water to create microscopic pathways that allow natural gas and oil to be produced. Additionally, Anadarko is using dual-fuel pressure trucks that minimize the need for diesel-powered engines by utilizing locally produced natural gas from the Wattenberg field, significantly reducing emissions from fracking operations.

**Can the Horizontal Drilling Process Impact Fresh Water Aquifers?**

A five-year study conducted by the Environmental Protection Agency, a draft of which was published in June 2015, cited no widespread impacts on drinking water resources in the United States from fracking. Fresh groundwater sources in the U.S. typically reside between 100 and 500 feet (30 and 150 metres) beneath the ground, although depths can vary according to local geology. We determine the depth of fresh water sources in areas where we are planning to drill and then tailor our well design to protect them. We prioritize meeting and/or surpassing industry and regulatory standards to protect groundwater by setting in place multiple layers of steel pipe (casing) and cement in concentric rings that seal off the wellbore from the freshwater zone. Once these multiple layers of protection are in place, we pressure test them to ensure integrity and use specialized imaging technology to ensure a proper seal before continuing the next phase of drilling operations.
Before drilling commences in our operating areas throughout the U.S., we contract an independent consultant and laboratory to sample and analyze domestic fresh water sources, including water wells, springs and streams at our expense within a prescribed distance as determined by the relevant state agencies. The results are verified and summarized by the consultant and shared with the landowner and regulators. Where feasible, we utilize a “closed loop” drilling process, whereby cuttings are separated from recirculated mud, which is then trucked or piped directly to new drilling locations, minimizing the need to acquire water from other sources and eliminating the need for a reserve pit. Because we have largely eliminated reserve pits to capture rock bits created by the drilling process, we collect them in steel containers until they can be properly disposed. The rock bits are typically approved for burial onsite, transported to a permitted and approved landfill, or beneficially used as a cover layer over other landfill materials.

How Much Water Does Anadarko Use to Hydraulically Fracture a Typical Well?
Typically, it takes between 3 and 5 million gallons (11 and 19 thousand cubic meters) of water to hydraulically fracture a horizontal well. The amount of water used to complete a well varies based on the rock formation, depth and other geologic characteristics and is relatively small compared to other uses such as agriculture and electric-power generation. As the graphic below illustrates, water consumed during fracking is also significantly less than some municipal and recreational uses of water. In Colorado where Anadarko’s premier onshore asset, the DJ Basin, is located, hydraulic fracturing consumes only about 0.1 percent of the state’s total water use.

Where Do You Get Your Water?
We utilize a number of water sources for hydraulic fracturing, and all of these sources are permitted and regulated. We prefer to recycle and reuse water from ongoing operations when possible. Generally, our fresh water sources for operations are negotiated with the owners of private water wells or municipal water sources, and we also lease or purchase municipal wastewater effluent to supplement the recycling efforts of our own produced water. At some locations, we also utilize brackish (non-fresh or salty) water. During the permitting process, most states require an analysis of how water withdrawals from watersheds may affect associated hydrology and ecosystems. Data collected from these studies dictate daily withdrawal limits that are continuously monitored and strictly enforced. We have installed water-on-demand systems to facilitate our operations in Colorado, Pennsylvania and Texas. These comprehensive networks of pipelines conserve water and dramatically reduce associated truck traffic. Additional water-on-demand systems will be installed as practical.
What’s in Your Fracture Fluids?

More than 99 percent of a typical fracture fluid consists of water and sand. Less than 1 percent of the typical fracture treatment comprises between three and 12 additive chemicals. The specific chemical and amount required depends on the characteristics of the water and the shale or tight-sands formation being fractured.

Anadarko supports the public sharing of information regarding the ingredients used in hydraulic fracturing. We were instrumental in the creation of the Ground Water Protection Council’s hydraulic fracturing disclosure registry, which makes this information available to anyone at any time at www.fracfocus.org. Anadarko is currently the most active participant with data uploaded for more than 6,000 operated wells. Anadarko reports amounts, names and characteristics of chemical additives as appropriate for each state in which we operate.

Additionally, in 2012 Anadarko created a Hydraulic Fracturing Committee to review and analyze fluid content used in the company’s fracking applications and continuously review opportunities to utilize greener solutions. The Committee’s charter is available on our website at www.anadarko.com/fracking.

Anadarko has a strict policy against using diesel fuel in hydraulic fracturing fluids that has been communicated to the company’s contract service providers. In addition, Anadarko does not permit its vendors to inject diesel fuels as the term is defined in EPA’s “Permitting Guidance for Oil and Gas Hydraulic Fracturing Activities Using Diesel Fuels: Underground Injection Control Program Guidance #84” dated February 2014 (EPA-816-R-14-001). In addition, with the guidance of the company’s Hydraulic Fracturing Committee and in cooperation with its service providers, Anadarko is continuously working to reduce the toxicity of all fracking fluids, including reducing and/or eliminating BTEX as an ingredient or sub ingredient.

As required by law, we also keep Safety Data Sheets (SDS), which are prepared and provided by the chemical manufacturer to describe the additives used in the fracking process in detail at each well location. More information is available at www.anadarko.com/safety, and questions regarding the content of the SDS should be directed to the appropriate service provider.

Who Regulates Hydraulic Fracturing?

Hydraulic fracturing is extensively regulated at multiple levels of authority. Various state, county, township and city agencies, as well as federal agencies including the Bureau of Land Management, U.S. Department of Transportation, OSHA and the EPA are responsible for certain aspects of the process.

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**Key Federal Regulations Governing Shale Development Include:**

- Clean Water Act
- Clean Air Act
- Safe Drinking Water Act
- National Environmental Policy Act
- Resource Conservation and Recovery Act
- Emergency Planning and Community Right to Know Act
- Endangered Species Act
- Occupational Safety and Health Act

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**Key State Regulations Governing Shale Development Include:**

- Review and Approval of Permits
- Well Design, Location and Spacing
- Drilling Operations
- Water Management and Disposal
- Air Emissions
- Wildlife Impacts
- Surface Disturbance
- Worker Health and Safety
- Inspection and Enforcement of Day-to-Day Oil and Gas Operations
How Do You Handle Flowback Water from Fracking?
Most of the water used in hydraulic fracturing remains in the targeted rock formation, while approximately 10 percent to 30 percent of the water returns to the surface during a process known as “flowback.” We re-use almost all of the water produced during our operations on subsequent hydraulic fracturing activities, significantly reducing freshwater consumption and need for disposal. Any flowback water that is not recycled is disposed of in accordance with the appropriate regulations.

In 2015, Anadarko partnered with Energy Water Solutions, the Texas Railroad Commission, Texas A&M AgriLife Research and Gibson Energy for the Produced Water Irrigation Project. The project evaluated using recycled produced water from oil and natural gas activity in the Delaware Basin to irrigate a cotton crop in nearby Pecos, Texas. The full report is available at www.anadarko.com/fracking.

How Do You Prevent Spills?
Preventing all releases is a priority throughout our operations, and Anadarko has taken numerous proactive measures to ensure that the risk of spills is minimized. These measures include physical barriers, such as using engineered secondary containment devices and liners, and improving the work practices of our employees and contractors through continuous training and discussion. We also work with regulators to implement best management practices (BMPs) to protect streams and other bodies of water. In addition to complying with regulatory requirements, we have developed Spill Prevention Guidelines that focus on reducing the potential for spills by enhancing awareness during all operational activities. Daily awareness discussions are held on all job locations and site supervisor approval is required prior to fluid transfer operations, even during fresh-water transfers. Our EyesOn program ensures that all fluid transfers on Anadarko locations are monitored by an Anadarko employee or a designated contractor.

When spills do occur, we have an aggressive reporting and remediation policy that requires all spills, regardless of volume or substance, to be promptly reported to Anadarko’s Health, Safety, and Environment (HSE) department. The HSE staff abides by the appropriate spill reporting requirements and mitigation procedures based on the material, the volume and any potential risks to health or the environment. Emergency response procedures are in place and universal throughout our operations. Anadarko’s Emergency Response System was developed in concert with the National Incident Management System (NIMS) as developed by the Department of Homeland Security. We regularly conduct drills with local first responders to ensure roles and responsibilities are clearly understood by our personnel, contractors, local community response teams and responding agencies.

How Do You Protect and Monitor Air Quality?
Anadarko is at the forefront of reducing emissions related to operations, as we recognize the importance of clean air and take appropriate action in all of our operations to reduce emissions. Our HSE teams have acquired and utilize numerous infrared imaging cameras to detect leaks and fugitive emissions from tank batteries, pipelines and other infrastructure in our areas of operations so that they can be safely and quickly repaired. We also undertake numerous innovative actions such as pipeline construction, equipment consolidation efforts, and scheduling arrangements that reduce the need for trucks, which significantly reduce associated emissions and local traffic.

Anadarko also benefits from the guidance of its GHG and Air-Quality Committee whose charter is available at our website, www.anadarko.com/crleadership. Furthermore, Anadarko has partnered with the Environmental Defense Fund (EDF) and industry peers to support multiple studies conducted by the University of Texas and Colorado State University to quantify methane emissions from natural gas production and processing. One production study on the completions phase found that methane emissions from the well completion process are 97 percent lower than previously estimated by the EPA. Anadarko also partnered with the EDF on the development of air regulations in Colorado to detect and address methane leaks.
Does Hydraulic Fracturing Cause Earthquakes?
Induced seismicity is commonly defined as earthquakes that are caused by a variety of human activities.

Experts and regulators appear to agree that hydraulic fracturing, or fracking as it is more commonly referred to, is not a significant source of concern for induced seismicity for several reasons including:
• during the hydraulic fracturing process, only a limited volume of water is pumped into the formation for each stage of treatment; and
• each pumping stage is a one-time event lasting 2-4 hours. The micro-seismic events that are generated from the fracturing process are so small that, to be detected, requires sophisticated instruments that either have to be deployed in adjacent wells or on a very tight surface grid around the stimulated well.

Along with the oil and natural gas that are produced, potentially large amounts of natural saline brine water (formation water) may also be produced. The brine water must be separated from the oil and natural gas and, in some cases where recycling is not feasible, re-injected back into the Earth through the use of underground injection wells permitted in compliance with federal and state regulations. Such wells are common in oil and natural gas producing areas around the globe.

The relatively recent increase in seismic events in some isolated regions of the United States, including southern Kansas, Oklahoma and northern Texas, have led to numerous studies and increased deployment of seismic monitoring stations across the region. These stations increase data sampling and better enable independent researchers, regulatory bodies and industry partners in their ongoing efforts to study the possible correlation between wastewater disposal and increased seismic activity under unique geological conditions.

Though we do not have operations in the areas mentioned above, we have implemented comprehensive strategies in our major operations areas, to reduce the need for wastewater injection. These efforts include recycling programs in Colorado, Pennsylvania and Texas.