Focus on Hydraulic Fracturing

We have been hydraulically fracturing, or fracking, wells to produce natural gas and crude oil for decades. Our Health, Safety and Environment (HSE) Policy and Code of Business Ethics and Conduct mandate that wherever we operate, we will conduct our business with respect and care for the local environment and systematically manage local, regional and global risks to drive sustainable business growth.

Our Hydraulic Fracturing Operations

Our global governance structures, supported by proprietary policies, standards, practices and guidelines, are subject to performance assurance audits at the business unit and corporate levels. Action plans to outline commitments and support process improvements have been part of our risk management process since 2009. This system allows us to effectively address the risks and opportunities related to our development operations, like hydraulic fracturing, through solutions that reduce emissions and land footprint, manage water sustainably and create value for our stakeholders.

Wells

We have completed over 2,200 unconventional wells and, after recent dispositions, are currently managing over 1,800 in our portfolio.
INTRODUCTION

Global Social and Environmental Risk Management Standards and Practices

<table>
<thead>
<tr>
<th>HSE Standard</th>
<th>Identify, assess and manage operational risks to the business, employees, contractors, stakeholders and environment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15 HSE elements</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Due Diligence Standard</th>
<th>Identify, understand, document and address potential risks and liabilities related to health, safety, environment and other social issues prior to binding business transactions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Due diligence risk assessment requirements</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Capital Projects Standard</th>
<th>Minimum, mandatory requirements for management of projects and unconventional programs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HSE risk assessment and risk register tracking</td>
</tr>
<tr>
<td></td>
<td>Climate change, social and stakeholder engagement, water and biodiversity assessments</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sustainable Development Practice</th>
<th>Identify social and environmental risks and mitigation actions to provide long-term strategic direction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Climate change, stakeholder engagement, water and biodiversity risk assessments</td>
</tr>
<tr>
<td></td>
<td>Company-wide roll-up of risks and mitigation actions</td>
</tr>
</tbody>
</table>

During drilling activities, one of the most important objectives is to protect groundwater. To isolate and protect freshwater zones throughout the life of the well, we design and construct wells with multiple layers of steel and cement. We have incorporated established industry and internal standards and practices into our Global Onshore Well Management Principles, which apply throughout the life cycle of a well, from discussions with local communities before drilling site selection to the permanent closure of a well, decommissioning and final reclamation or restoration of the land. These principles provide direction on how to economically construct and operate wells in a safe and environmentally responsible manner.

Well Management Standards

RISKS
Documented process to identify and assess risks; document results and action plans to well site personnel

REQUIREMENTS & STANDARDS
Documented regulatory requirements and standards of operations

WELL DESIGN ENVELOPE
Allowable pressures and temperatures, maximum flow/injection rates, anticipated flowing temperatures, monitoring and maintenance requirements, expected fluid compositions

EMERGENCY PREPAREDNESS
Well control and blowout response plan addressing lines of communication, roles and responsibilities, contact details, and location of contingency and backup blowout control and spill cleanup equipment

AUDITS
Inspection and testing of well control equipment, verification of competence and readiness of personnel, adequacy of the wellsite operations management, communication and emergency response systems
The ConocoPhillips Cementing Guideline provides direction based on industry best practices and American Petroleum Institute (API) cement testing methods.

### Cementing Guideline

<table>
<thead>
<tr>
<th>Zonal Isolation</th>
<th>Well Integrity</th>
<th>Completions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Careful consideration of annular clearance and casing centralization</td>
<td>Mechanical integrity tests to assess well integrity and seals</td>
<td>Fluid injection rates and pressures are monitored throughout the hydraulic fracturing process</td>
</tr>
<tr>
<td>Proper wellbore conditioning</td>
<td>Established operating pressure limits</td>
<td>Operations are immediately shut down in the event of unexpected pressure responses</td>
</tr>
<tr>
<td>Use of API cement blends proven to deliver long-term cement integrity</td>
<td>Monitor of casing strings</td>
<td>Data can be transmitted via satellite to remote operation centers for off-site monitoring</td>
</tr>
<tr>
<td>Verification of proper cement placement through cement bond logs, ultrasonic cement evaluation tools or wireline temperature surveys</td>
<td>Design based on regional variations (geology, surface features and seasonal climate) and technical/economic considerations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Entire system is pressure-tested prior to completions</td>
<td></td>
</tr>
</tbody>
</table>

Technology has evolved, and will continue to evolve, to make drilling and hydraulic fracturing safer. These advancements will reduce environmental and social risks while also making our operations more efficient. Accelerated adoption of new tools has played an important role in improving productivity and has enhanced our ability to drill and complete wells faster, better and at a lower cost.
Air Emissions

Emissions from natural gas and oil development, including hydraulic fracturing, can be associated with powering drill rigs and well pad facilities, vehicle emissions, venting or flaring from storage tanks, flaring of associated gas, and fugitive emissions.

We design infrastructure and operate in a manner that protects air quality and reduces emissions. During drilling and hydraulic fracturing, we use closed-loop or reduced emissions completion techniques, which capture the natural gas at the wellhead. Portable equipment and central gathering and distribution systems separate and collect the gas (mostly methane), solids (mainly proppant sand) and crude oil. This process enables us to significantly decrease venting and flaring. The U.S. Environmental Protection Agency (EPA) and the British Columbia Oil and Gas Commission in Canada have closed-loop completion regulations. Wherever technically and practically feasible, we use central gathering systems to direct natural gas to sales pipelines. These systems are used in the Eagle Ford region to decrease emissions by reducing venting and flaring. In the Permian Basin, we further reduce emissions by using a central distribution system for completions water transfer to well sites and for produced liquids (crude oil and produced water), significantly reducing the need for trucks.

We removed over 300 trucks per day from roads in the Permian by transporting produced water through pipelines. This reduced emissions and improved road safety.

Fugitive Emissions

Managing emissions, including methane, which is the primary component of natural gas, is one of our key priorities. Reducing emissions, even the small releases known as “fugitive emissions,” is a crucial aspect of our Global Onshore Well Management Principles and, where appropriate, we use technology to help. Sources of fugitive emissions include pneumatic devices, equipment leaks, liquids unloading, and storage tanks. While there are differing methods and many measurement points, estimates of pre-plant natural gas leakage rates vary widely, from 0.7-2.6 percent.

We estimate our emissions using regulatory approved methods that include engineering calculations and source-specific EPA, state agency or IPCC Tier 3 emission factors. In 2016, company-wide methane emissions from drilling, completion and production operations were 0.1 percent of our natural gas production.

We continue to take actions on a voluntary basis to reduce greenhouse gas (GHG) emissions where it makes environmental and economic sense. We are evaluating options for future targets and incentives that effectively progress environmental footprint reduction as a mindset of our operations.
Leak Detection and Repair

We have standard operating procedures to detect and repair leaks. Audio-visual-olfactory (AVO) inspections are routinely performed during operator rounds to identify any leaks or other issues. Leak detection and repair (LDAR) is a work practice used to identify and quickly repair leaking components, including valves, compressors, pumps, tanks and connectors, to reduce GHG emissions and increase efficiency.

Leak detection and repair is mandated by state or provincial regulations and agreements for our Bakken, Niobrara, some Eagle Ford facilities and Montney assets. Regulations provide specifics on applicable facilities, methods and reporting.

At many of our locations, especially high-producing well sites and stand-alone compressor stations, we instituted a periodic voluntary fugitive monitoring program using forward-looking infrared (FLIR) cameras to enhance our LDAR. FLIR cameras create real-time images of gases or liquids leaking from pipes, vessels, tanks and other types of process equipment. FLIR surveys are completed at new or modified well sites and subsequent monitoring surveys are conducted at least annually.
FLIR Leak Detection

FLIR cameras operated by authorized and trained staff

FLIR surveys start with an instrument check

Line supervisors are notified of anomalous leaks

Any leaks potentially exceeding regulatory or permit requirements are reported to managers

Hazards that pose an immediate safety, health or environmental risk are mitigated

Repairs and corrective actions for leaks requiring maintenance or engineering controls are scheduled as soon as practicable

Leaks and repairs are tracked in logs

We fix leaks as soon as it is feasible and many leaks are repaired either the same day or within a few days of being detected. If additional time is required, we follow standard maintenance processes by adding the required repairs to our maintenance tracking system. After repairs are completed, we inspect the leaks to ensure that the repairs are successful. We implement engineered solutions and/or operational changes if we identify developing trends of systemic hardware problems.

Flaring & Venting

Flaring is a regulated and permitted process that can be routine or non-routine. One of the primary uses of routine flaring is for safety, to control and reduce the emissions of volatile organic compounds from oil and condensate storage tanks. Routine flaring can also occur at remote well sites that lack sufficient pipeline infrastructure to capture gas for sale. Closed-loop completions, central gas gathering systems, vapor recovery units and blowcase installations have all significantly reduced routine flaring. Non-routine flaring is required to keep our operations safe; it burns off flammable gas released during over-pressuring of

REQUIRED LEAK DETECTION AND FLIR TRAINING

Emissions Leaks Survey Procedure course

Authorized Camera Technician (ACT) course

Thermal Optical Leak Inspection Level 1 Compliance Procedure course

Additional facility-specific training may include: Hazard Communication, Hot Work, HSE Orientation, Confined Space Entry and H₂S

Our Climate Change Position governs our activities.
equipment or other unplanned events. Flaring can also be used to safely relieve pressure before performing maintenance, which is a requirement for some equipment before isolation or breaking containment. Non-routine flaring is also decreased by improving uptime and operational excellence, a major focus for all our facilities.

The adoption of closed-loop completions has reduced emissions associated with venting. Oil and condensate storage tanks and the unloading of liquids remain regulated and permitted as venting sources. The installation of blowcases, which direct condensate to sales pipelines, vapor recovery units on storage tanks, and the optimization of liquids unloading has helped reduce venting emissions.

Emission Reduction

To prioritize emission reduction projects across the company, we utilize our Marginal Abatement Cost Curve (MACC). The tool evaluates projects by calculating the costs and/or benefits of the project (capital cost, increased or decreased operating costs, and potential increased revenue) and dividing it by the GHG emissions that can be reduced — yielding a "breakeven cost of carbon" in $/Tonne CO2e. For example, a project that installs a compressor to move previously flared gas into a sales pipeline will have an upfront cost, increased expenses to operate and maintain, and increased revenue from natural gas sales. Depending on the volume and natural gas price, this could lead to either a positive or negative breakeven cost of carbon associated with executing the project. Projects across the company are compared on a $/Tonne CO2e basis, further evaluated with full economic analysis, and prioritized by the Executive Leadership Team.

Projects

<table>
<thead>
<tr>
<th>Region</th>
<th>Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permian</td>
<td>Replace/retrofit pneumatic devices</td>
</tr>
<tr>
<td></td>
<td>Install vapor recovery units</td>
</tr>
<tr>
<td></td>
<td>Electrification at some facilities</td>
</tr>
<tr>
<td>Eagle Ford</td>
<td>Replace/retrofit pneumatic devices</td>
</tr>
<tr>
<td></td>
<td>Install blowcases to reduce emission from tanks</td>
</tr>
<tr>
<td></td>
<td>Electrification at some central facilities</td>
</tr>
<tr>
<td></td>
<td>Optimize liquids unloading</td>
</tr>
<tr>
<td>Bakken</td>
<td>Replace/retrofit pneumatic devices</td>
</tr>
<tr>
<td></td>
<td>Optimize liquids unloading</td>
</tr>
<tr>
<td>Niobara</td>
<td>Replace/retrofit pneumatic devices</td>
</tr>
<tr>
<td></td>
<td>Install vapor recovery units</td>
</tr>
<tr>
<td>Montney</td>
<td>Install vapor recovery units</td>
</tr>
<tr>
<td></td>
<td>Eliminate flare system through use of a vent scrubber</td>
</tr>
<tr>
<td></td>
<td>Install electric chemical pumps in place of pneumatic</td>
</tr>
<tr>
<td></td>
<td>Future design: Use of instrument air systems to eliminate vented methane from well pad controllers and actuators</td>
</tr>
</tbody>
</table>
We optimize technology to improve efficiency, reduce costs and reduce emissions. For example, high-bleed pneumatic devices have been identified as one of the largest sources of emissions. These devices use pressurized natural gas to control production process variables, such as gas flow rate or pressure, and are typically used at remote well site storage facilities, compressor stations, and pipelines where electricity is not readily available. They release or “bleed” natural gas to the atmosphere as part of normal operations. While regulations now restrict the use of high-bleed pneumatic devices on new installations, we voluntarily replaced over 98 percent of our existing high-bleed installations across our operations with no- or low-emission controllers.

We have used alternative fuel sources such as compressed natural gas and liquefied natural gas (CNG/LNG), field natural gas and co-op electrical to power drilling and completion engines, reducing both air emissions and traffic. In the Permian Basin, we entered into agreements with natural gas midstream companies to buy our natural gas, process it and sell it back to us. We use this gas to generate power at remote off-grid production facilities, reducing the need for diesel-driven generators. Our operations near the Little Missouri State Park in the Bakken rely on power from a local utility rather than generating power with diesel-driven generators to reduce noise, emissions, and cost.

Technology, Innovation and Collaboration

### Improving Emissions Management Performance

- Assess viability and economics of promising technologies, such as real-time chemical gas cloud imaging
- Ongoing industry collaboration with the American Petroleum Institute (API) to design a voluntary emissions reduction program for: 1) equipment monitoring and repair; 2) manual liquids unloading; and 3) pneumatic controllers
- Multi-stakeholder collaboration with the Petroleum Technology Alliance Canada (PTAC), technology providers, government and eNGOs to pilot new LDAR technologies
- Multi-stakeholder collaboration with communities, government, eNGOs and industry to develop new methane regulations for Alberta, Canada
- Industry and government collaboration in methane working group in British Columbia, Canada

The use of microprocessors and electronic controllers increase reliability, efficiency and reduce the need for travel to well sites, further lowering air emissions.

Technology, innovation and adoption of a data-driven approach has improved our drilling efficiency and performance over the last five years. The average drilling time for horizontal wells in our Lower 48 operations decreased between 50 and 70 percent. At the same time, we have increased the typical lateral length from 4,000–5,000 feet to 8,000–10,000 feet in some locations. Faster drilling translates into significantly reduced drill rig emissions as well as cost and energy savings for each well completed.

As technology for emissions management evolves, we are piloting promising new technologies and collaborating to find solutions to improve performance.

---

Air emissions are regulated by the United States Environmental Protection Agency (U.S. EPA) and by the British Columbia (BC) Ministry of Environment. Facilities that emit 25,000 tonnes or more of carbon dioxide equivalent (CO$_2$e) per year in the U.S. Lower 48 and 10,000 tonnes or more in British Columbia adhere to mandatory reporting requirements.
All exploration and production operations, including hydraulic fracturing, can alter the landscape with the construction of roads, well pads, compressor stations and storage facilities. However, thanks to technology and innovation in horizontal drilling, completions techniques and well pad design, we have been able to significantly reduce our infrastructure footprint. Drilling one 10,000-foot lateral can be more efficient than drilling two that are 5,000 feet long. This strategy reduces the need for additional well pads and facilities while boosting flow rates and the amount of resource we expect to recover.

**Protection of Species Habitat and Reducing Infrastructure Footprint**

- Increasing the typical lateral length of our wells from 4,000–5,000’ to 8,000–10,000’ can reduce footprint by up to 50%
- Routinely placing four to six wells on multi-well pads (sometimes as many as eight to 12 wells) can reduce footprint by up to 70%
- Utilizing central facilities can reduce well pad size and infrastructure
- Using hydraulic fracturing technology on existing vertical wells can increase production with 75% less infrastructure footprint

**Protecting Habitat**

To protect sensitive species, we have cumulatively enrolled over 286,000 acres in voluntary conservation agreements that protect the Lesser Prairie Chicken in Oklahoma, New Mexico and Texas and the Dune Sagebrush Lizard in New Mexico and Texas. These formal agreements with the U.S. Fish & Wildlife Service and/or other federal or state agencies address the conservation needs of species before they become listed as endangered or threatened. Our conservation agreements typically require that new well locations and surface infrastructure avoid species habitats or sensitive areas within habitats. We have used directional drilling to avoid designated habitat areas, protect the integrity of conservation areas, and reduce habitat fragmentation. We also implement conservation measures, such as reducing our operational footprint and habitat restoration, by maintaining an active habitat restoration program.
Strategic Partnerships

Over a five-year period, we provided $1 million to the Intermountain West Joint Venture to support the implementation of the Sage Grouse Initiative, an effort by regulators, NGOs and industry to create intact native rangelands for the species. Sage Grouse, which are found in several U.S. states and Canadian provinces where there are fracking operations, have been in decline due to habitat fragmentation. The Sage Grouse Initiative worked across the entire Sage Grouse range to conserve habitats capable of sustaining bird populations through sustainable ranching. The initiative, led by USDA’s Natural Resources Conservation Service, provided win-win solutions for ranchers, sage grouse and 350 other wildlife species. Initiative members invested $424.5 million and conserved 4.4 million acres on more than 1,100 participating ranches in 11 western states.

We are currently in a multi-year, landscape-scale assessment project for funding a conservation plan for grasslands across the U.S. Great Plains administered through the Prairie Potholes Joint Venture. The goal is to coordinate and catalyze organizations and joint ventures already working on local or regional projects to share knowledge and science that can help improve ecosystem understanding and assess conservation programs that sustain populations of grassland birds. The desired outcome is a set of recommendations for a grasslands conservation framework across the Great Plains that could attract scaled up support and multi-donor funding. This project fits well with the collaboration we have had with the U.S. Fish & Wildlife Service in bird joint ventures for over 25 years.

Through our Water & Biodiversity Stewardship program, we help advance the conservation of migratory birds through work with the Smithsonian Conservation Biology Institute’s Migratory Bird Center. Through this partnership, we gain a better understanding of habitats throughout their migration cycle, and how we can take a coordinated approach for more effective conservation. The center conducts both long-term and applied research.

Working with the National Fish and Wildlife Foundation, we fund the ConocoPhillips SPIRIT of Conservation & Innovation Program to support projects focused on the restoration of ecosystems and habitats, particularly those focused on high-priority North American migratory species.

We partner with Ducks Unlimited to restore Gulf Coast wetlands — important wintering habitats for waterfowl. By identifying effective coastal restoration and mitigation projects and working closely with diverse stakeholders, we support a variety of efforts, including freshwater introduction and marsh-terracing projects, shoreline stabilization, coastal ridge restoration, and hydrologic improvements.

Habitat Conservation

Lesser Prairie Chicken
Voluntary conservation agreement
Over 106,000 acres in Texas
Over 85,000 acres in New Mexico

Dune Sagebrush Lizard
Voluntary conservation agreement
Over 95,000 acres in Texas
Over 85,000 acres in New Mexico

Sage Grouse
Voluntary conservation partnership
4.4 million acres in western U.S., Canada

Managing water is an important element of drilling, completions and production operations, starting with sourcing water needed for drilling and hydraulic fracturing and ending with produced water recycling or disposal.

Typically, water is only used during the initial drilling and completions phase of the lifetime of a well. While some water is required during drilling, the majority is used for fracking. The amount used varies according to the geology, number of fracking stages, length of the well and the fracturing technique. Water volumes can range from approximately 100,000 to 650,000 barrels per well. After this initial use of water, wells produce oil, natural gas and produced water for decades.
Some wells can produce more water than oil or natural gas, but the relative volumes vary significantly with basin geology/hydrogeology. Similarly, produced water quality varies between and even within basins. In addition to high salinity, produced water can have high concentrations of iron, hardness and sometimes H₂S.

Water-to-Oil Ratios for Produced Water

Produced Water Salinity Comparison with Natural Waters
(Total Dissolved Solids (TDS), mg/L)
Transportation

Water for drilling and completions and produced water must be transported between well sites and water sources and storage, treatment or disposal facilities. Depending on existing infrastructure and volume of produced water, options for transporting water include trucking and temporary or permanent pipelines. Central water gathering and distribution systems can provide water sourcing and disposal alternatives for basins with large amounts of produced water. Our Permian Basin central distribution system, tailored to the region, offers flexibility for water disposal and reuse. It has reduced our surface footprint as well as emissions, dust, and road noise associated with truck transportation.

Completions and Produced Water Transport

<table>
<thead>
<tr>
<th>Region</th>
<th>Compleitions water</th>
<th>Produced water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permian</td>
<td>Central gathering and distribution pipeline system</td>
<td>Central gathering and distribution pipeline system</td>
</tr>
<tr>
<td>Eagle Ford</td>
<td>Flat-hose pipeline from temporary central storage</td>
<td>Trucked from well site storage tanks</td>
</tr>
<tr>
<td>Bakken</td>
<td>Flat-hose pipeline from temporary central storage or trucked</td>
<td>Trucked from well site storage tanks</td>
</tr>
<tr>
<td>Niobrara</td>
<td>Flat-hose pipeline from temporary central storage or trucked</td>
<td>Trucked from well site storage tanks</td>
</tr>
<tr>
<td>Montney</td>
<td>In planning and appraisal stage: Closed-loop system design with source water and produced water pipeline and water hub</td>
<td></td>
</tr>
</tbody>
</table>

Fracking Fluids

Service companies develop customized hydraulic fracturing fluids to more efficiently induce and maintain productive fractures. These frack fluids have unique characteristics, and the exact concentrations of some additives can be protected as proprietary information. Many states now have statutes or regulations that require public disclosure of the chemicals used in hydraulic fracturing utilizing FracFocus. In some states the identity of some chemicals and their exact concentrations may be protected by confidential business information considerations and not disclosed on FracFocus.

We work with our service companies to replace chemicals classified as toxic with more environmentally friendly chemicals whenever feasible. For example, together with our service providers for the U.S. Lower 48 business unit, we are committed to not use diesel fuel or BTEX (Benzene, Toluene, Ethylbenzene and Xylene) in fracking fluid. We also collaborate with drilling and completions service providers, most of whom offer options for dry fracking chemicals, to select the best option based on safety, performance and economic criteria.
Sourcing

Every basin has unique social, economic and environmental conditions. Before drilling we conduct risk assessments to better understand and manage local water risks. This provides information about water sources, quality and availability, other water users in the community, regulatory requirements, community concerns, options for disposal, regional droughts and local water stress.

We have conducted a number of pilot projects using non-freshwater sources, treated municipal wastewater, and recycled produced water to hydraulically fracture our wells. In the arid Permian Basin, we use non-freshwater for the majority of our drilling and hydraulic fracturing. In the Eagle Ford, we target water sources that are not used for municipal, domestic or agricultural purposes. Our 3-D water visualization tool provides a 3-D image of aquifers, water wells and natural gas and oil wells. We use the tool to demonstrate that we target deeper, more brackish water sources, which are not used by local landowners.

We may partner with local landowners who own water rights to build water infrastructure and water wells that provide improved access to water. Landowners then often request that we purchase water for drilling and completions directly from them, providing further local economic benefits.

Protection of Local Water Resources

Protection of local groundwater resources is important through every stage of development and production. Our Global Onshore Well Management Principles commit to protect groundwater and surface water by adhering to strict well-integrity procedures and safe water management practices. The principles provide direction on design, construction, fluid management and monitoring during drilling and fracking.

Our Guideline for Groundwater Baseline Assessment provides guidance on when and how voluntary baseline sampling should be conducted through a risk-based approach. In the Eagle Ford, we conducted voluntary groundwater chemistry and methane analysis on over 140 water wells. Methane, detected in three wells, was confirmed as biogenic in origin, produced by naturally occurring bacteria. In the Niobrara, where baseline groundwater sampling is a regulatory requirement, we sampled over 100 wells. Methane was detected in four wells and again confirmed to be biogenic.

Produced Water Recycling

The chemistry of produced water, particularly the high salinity, hardness and iron content, make treatment a requirement prior to reuse for hydraulic fracturing.
A careful assessment of environmental trade-offs and costs is necessary as it requires additional infrastructure, energy and chemical use, and creates waste. Treatment of produced water can pose challenges, but represents an important opportunity for technology and innovation.

In the water-stressed Permian Basin, supply, reuse, transportation, and disposal can average 20 percent of well completion costs and operating expenses. Since water-to-oil ratios are between 1:1 and 7:1, produced water is abundantly available. Given the limited surface and groundwater resources in the area and resulting well cost implications, there is both an environmental and economic incentive to utilize produced water whenever feasible.

We have recycled **42 MILLION** gallons of water in produced water reuse pilots in the Eagle Ford, Bakken, and Permian Basin.

### Produced Water Technology Pilot Projects

<table>
<thead>
<tr>
<th>Region</th>
<th>Treatment Technologies</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permian</td>
<td>Iron oxidation, coagulation and clarification, suspended solids filtration, ( \text{H}_2\text{S} ) oxidation/filtration and cyclonic deoiling</td>
<td>With increasing rig activity, produced water reuse will be best option, economically and environmentally, for full-cycle water management</td>
</tr>
<tr>
<td>Eagle Ford</td>
<td>Ion-exchange for chemical removal, membrane distillation of groundwater with high total dissolved solids and volume reduction using evaporator/crystallizer</td>
<td>Low produced water volumes limit recycling options</td>
</tr>
<tr>
<td>Bakken</td>
<td>Adapt treatment technology for high salinity produced water frack fluid compatibility and cold-weather operations</td>
<td>Low produced water volumes limit recycling options</td>
</tr>
<tr>
<td>Niobrara</td>
<td>State regulations currently limit produced water storage, which restricts reuse/recycle options</td>
<td></td>
</tr>
<tr>
<td>Montney</td>
<td>Deoiling, iron oxidation and removal, microbial inactivation, suspended solids filtration and produced water storage design</td>
<td>Results used as input for water hub design</td>
</tr>
</tbody>
</table>
Produced Water Storage and Disposal

Recycling produced water for hydraulic fracturing requires the storage of large volumes of water that can have elevated levels of total dissolved solids (TDS), a measure of salinity. We utilize an engineering guideline for selection, design and specifications for high TDS produced water storage alternatives. It includes an evaluation matrix to help select the best site-specific storage alternative. Either an above-ground storage tank or an engineered in-ground lined pond based on criteria including total volume, site layout, location with respect to floodplain or protected areas, depth to groundwater, distance to surface water, soil conditions and other environmental criteria.

Produced water that is not reused or recycled is disposed in salt-water disposal wells (SWD). Produced water disposal is managed through our HSE Waste Management Standard. The standard requires each operating area generating waste to prepare waste management plans, evaluate the suitability of waste disposal facilities and to contract only with approved facilities.

Seismicity

Some studies have linked increased seismicity rates to the disposal of produced water in SWD wells, while other studies have assessed the potential linkage between hydraulic fracturing and increased seismicity rates. We use a risk-based Global Induced Seismicity Guideline for the planning and operation of our new injection wells and for screening third-party injection operations, if circumstances warrant. The guideline helps characterize seismicity risks by assessing historical seismicity, identifying geological faults of concern, assessing actual or proposed injection operating conditions, and considering proximity to people and population centers. It also provides possible monitoring, management and response planning options if the assessed risk is elevated. We are working with our peers and academic researchers to better understand and document if, where and how fluid injection and hydraulic fracturing may contribute to the phenomenon of increased rates of seismicity over background trends.

Waste

In addition to produced water, our HSE Waste Management Standard also applies to waste streams such as drilling muds and cuttings. It is possible in some locations that wastes containing naturally occurring radioactive material (NORM) are encountered. Wastes containing NORM are classified as industrial waste in our Standard and managed according to applicable regulations.

Recycling of Oil-based Drill Cuttings

Collaboration with the Eagle Ford Reclamation Center, a supplier in Texas’ Eagle Ford region, started with pilot a program to recycle 100 percent of our oil-based cutting waste. Cuttings are now routinely taken from the rig to a nearby reclamation company instead of a disposal site, reducing the distance traveled by trucks by up to 60 percent. A thermal desorption process removes oil and water, creating reclaimed base oil and dry ash. The reclaimed oil is reused by the rig as fuel and the dry ash is sold for other uses. Simply put, the drilling waste is turned into useable products. The process is now used on all our rigs in the Eagle Ford. Reusing the reclaimed oil saves $6,000 to $10,000 per well, so this project helps the community by reducing traffic, the environment by reducing waste, and the economics of our development.

Our website offers more information about our approach to water management.
Our Global Water Sustainability Position provides direction for water management activities.
Our annual Sustainability Report includes water performance data.
We work with local communities to understand their concerns about hydraulic fracturing. These range from increased traffic, road safety, water use, light, noise, odor, to economic benefits for local communities. We engage with stakeholders and collaborate with other operators to proactively address community issues.

Our Corporate Health, Safety & Environment (HSE) Management System, Risk Matrix Standard and Sustainable Development Risk Management Practice combined with business unit local practices, direct how community concerns are addressed. This includes conducting risk assessments and tracking mitigation actions for significant and high risks using risk registers and company-wide action plans. Key risks are communicated to executive leadership and to the Public Policy Committee of the Board of Directors as outlined in our SD governance approach.

We tailor our stakeholder engagement to the local social, economic and environmental priorities of communities, since our operations can be miles away from or in close proximity to neighbors. As part of our routine permitting process in Niobrara, where wells can be located within city limits, we voluntary host open-house events to hear concerns and answer questions.

We then create a detailed list of local community concerns which is used to guide current and future planning of our operations.

In the Permian, our drill rig activity is focused on the northern Delaware Basin, where the closest neighbor is typically miles away and public concern is often about infrastructure. Roads are often not paved and can be flooded or washed out after a heavy rain event. Here, our focus on road safety for our employees and other operators and drivers includes funding road construction to minimize traffic on county roads. This also includes building an office near Carlsbad to reduce the number of miles our employees travel each year. Use of a central water gathering and distribution system for our drilling operations has virtually eliminated all water truck traffic. This infrastructure offers flexibility for water disposal or reuse which has reduced our surface footprint and eliminated emissions, dust, and road noise associated with truck transport. The produced water pipelines alone removed 300 trucks from area roads per day in 2016.

In the Eagle Ford, our newsletter provides information about our operations and the work we are doing in the community. We also engage with...
community leaders and elected and appointed officials through routine Citizens Advisory Committee meetings and Eagle Ford Leadership Roundtables. Both forums help us listen and respond to community concerns and share information about our operations. We plan to extend this practice to the Bakken region. Additionally, we conducted a journey management study of the Eagle Ford region, resulting in a guide that prioritizes routes based on factors such as the safety of the roads, time of day and length of travel. This research was shared with contractors, employees and county officials. A follow-up study in partnership with the Texas Department of Transportation and county officials focused on improving safety at intersections without traffic signals and recommended measures to enhance road safety.

Actively encouraging dialogue about local water use and engaging with local stakeholders allows us to understand concerns about the use and protection of local water resources. We utilize our 3-D water tool and presentation to help illustrate to local communities and regulators how the natural gas and oil industry uses data, science and engineering to protect groundwater and manage water use in the Eagle Ford. The presentation highlights the details of well construction and how aquifers are protected during drilling and production. The 3-D water tool provides a visualization of the subsurface offering a 3-D image that details the locations of aquifers, water wells and natural gas and oil wells.

Eagle Ford Traffic/Road Safety Campaigns

**STOP for School Buses**
campaign based on community feedback of increased traffic violations related to school buses. Generated safety brochures and presented key messaging with employees, contractors and community advocates.

**Slow Down Don’t Trash Our Town**
campaign encourages employees, contractors and the community to obey the posted speed limit and keep the roadside clean.

**Eagle Ford Journey Management Pre-Travel Checklist**
1) Job Safety Analysis
2) Journey Management/Risk Assessment
3) Journey-Specific Hazards
4) Directions/Verified Address

For every rig in service, we provide direct employment for an average of 10 field-based workers.
We follow the same community-based approach to international development. In western Canada, we consulted with local stakeholders, including two indigenous First Nations, about concerns related to water use for natural gas and oil gas production in the Montney area. Indigenous peoples’ traditional land use studies informed our development plans and ongoing workshops fostered additional awareness of priority concerns. Due to limited availability of local water resources and stakeholder concerns we designed a treatment process to reuse produced water. This will allow for reuse of up to 100 percent of our produced water.

**Economic Benefits**

One of the many benefits of our drilling, hydraulic fracturing and production activities is the economic benefit to communities in the areas we operate. Local jobs are created to support our fracking operations and we utilize local providers for a full range of services, including food service, construction, and transportation, which infuses millions of dollars into local economies. Additionally, we sometimes partner with local surface owners to build water management infrastructure which becomes an ongoing source of income.

** Suppliers**

Our suppliers play a significant role in our business activities at all stages of development, so how they manage their impacts on the environment and community is important to us and can impact our performance. About 80 percent of our total spend goes through our suppliers and about 50 percent of that is for well operations and oilfield services, which includes drilling and hydraulic fracturing operations.

We use a supplier registration, pre-qualification and compliance management system that includes data and information collection on vendor management practices for priority topics such as local communities, chemical use and frac fluid disclosure. We use specific questions in our bid template to identify providers that are closely aligned with our expectations on how to safely, responsibly and economically develop a well.

**Supplier questions include:**

- **What are your company’s management practices for minimizing impacts** on the surrounding community and/or natural environment?

- **What attributes of the services** to be supplied will enable ConocoPhillips to operate more sustainably (efficiently and with less environmental impact)?

- **What are your company’s management practices for employing environmentally friendly chemicals** in drilling, completion and cementing systems?
Suppliers also have the opportunity to share best practices about their traffic route optimization systems (including tracking methods) and stakeholder engagement approach to avoid high-traffic times or road sections. We also use this process to identify supplier alignment with our expectations for protecting the health and safety of our workers, contractors, local communities and the environment.

We worked with our larger suppliers to develop and implement key standardized environmental performance indicators (KPIs). These KPIs are meant to support our action plans and focus on opportunities for improving efficiency and reducing waste. They require key suppliers to report annual performance in several categories, including GHG emissions, amount of fresh water consumed, and weight of solid waste disposed. A yearly review with each supplier regarding their results will focus on year-over-year changes to performance, the drivers for positive change in performance such as technology or processes, and the current or potential application of those drivers to be used more broadly within our operations. We hope these KPIs will clarify performance expectations, track results, and identify continuous improvement opportunities and options.

Regular Supplier Sustainability Forums allow supplier representatives who support our Lower 48 business unit to share best practices and discuss challenges. In 2017, our forum focused on innovation, process optimization, energy efficiency, footprint reduction, water use, supplier diversity, and supply chain sustainability. We continue to develop our supplier engagement practices to improve our environmental, social, and economic performance.

All suppliers and contractors are expected to perform in accordance with our Code of Business Ethics and Conduct. Our Expectations of Suppliers and Commitment to Supplier Inclusion documents provide insight into our operating philosophies and expectations.

Our annual Sustainability Report includes information about our relationships with suppliers.