

Zero Harm

White Paper shows how advanced dry disconnect coupler and adaptor technologies help ease environmental concerns for shale oil and gas upstream and midstream industries

HISTORY notes that as far back as 1920 shale oil was being viewed as a potential major contributor to the North American energy-supply hierarchy. In fact, it was in that very year that the Mineral Leasing Act made fossil fuels and minerals located on public lands administered by the federal government “leasable,” that is, open to exploration and recovery.

However, it was not until the dawn of the 21st century that the petroleum industry became fully convinced of the role that North American shale oil deposits could have as a positive contributor to the US energy supply. The potential of shale oil is so great that some are saying that we are in the midst of a new “Black Gold Rush.”

This opinion is borne out by the fact that recent statistics have shown the United States is home to more than 2.1 trillion barrels of recoverable shale oil, or 82% of the world’s known shale oil deposits, with oil exploration companies expected to spend \$25 billion to drill an estimated 5,000 new wells in 2011 alone in the United States. This high volume of recoverable shale oil in basins throughout the United States and Canada is enough to ease reliance on foreign sources of energy and meet US energy demand for decades to come.

The rush to gather this newfound source of Black Gold has set off a spending frenzy among oil and gas companies. In fact, a recent estimate by the securities firm Raymond James says that these companies are on course to spend \$133 billion in 2011 on the shale oil processing, storage, and transportation infrastructures, with a projected 56% increase to \$206 billion in shale oil infrastructure spending in 2012.



OPW Drylok dry disconnects can meet the most stringent emission and safety limits.

This presents a tremendous growth opportunity for companies that supply equipment for use in shale oil exploration, drilling, production, storage, and transportation, with much of this equipment—especially that which is used in liquid-handling applications within the shale oil supply chain—already in existence. As with any industry, production operations, as well as the equipment used to optimize them, must meet the strict tenets of environmental regulation. This OPW Fluid Transfer Group White Paper will show how the advancements in liquid-handling dry-disconnect technology can play a key role in helping to ensure safe operations in shale oil liquid-handling applications, all while meeting a core mission of “Zero Harm” in safeguarding people and the environment.

Challenging environment

Locating and extracting shale oil from deep beneath the Earth’s surface involves a series of complex and challenging exploration and production processes. After the shale deposit and the suspected oil or natural gas is discovered, a vertical well is drilled that may extend as deep as 10,000 feet straight down. Upon reaching the level of the shale oil deposit, using advanced drilling techniques and specialized equipment, the well is then drilled horizontally, sometimes as far as two miles, until the shale oil or gas deposit play is accessed.

That’s where the process of hydraulic fracturing, or “fracking,” begins. In this process, as much as one million gallons of water, 20 tons of specialized sand, and a variety of completion fluids —commonly called a “slickwater” compound—are injected into the well at high pressures. This pressurized mixture speeds down to the shale oil deposit where it exits the wellbore through perforated sections. Once in the shale oil formation, the high-pressure mixture fractures the rock, allowing sand or ceramic pellets to be injected into the fissure to hold it open. This allows the shale oil and gas to flow, in most cases, under its own pressure into the wellbore and to the well’s surface. Depending on the length and richness of the shale oil deposit, there may be as many as 42 fracking episodes along the wellbore.





Drilling for natural gas has been underway for decades in Utah's Uinta Basin, where this rig is located. However, drilling of new wells is surging as exploration and production companies rush to develop shale oil fields across the United States and Canada. Recent surveys suggest that the United States is home to more than 2.1 trillion barrels of recoverable shale oil, or 82% of the world's known shale oil deposits.

The shale oil production process offers four distinct areas where liquid-handling dry disconnects are most commonly used:

1. Well Site Preparation.
2. Drilling.
3. Hydraulic Fracturing.
4. Completion.

Within these four basic stages of shale oil production, anywhere that pipe or hose needs to be used to transfer a liquid, dry disconnect couplers and adaptors are there. This includes the following vehicles, storage modes and associated equipment:

- Chemical Trucks
- Rail Tank Cars
- Transport Tankers
- Diesel Fuel Trucks
- Water and Wastewater Trucks
- Hot Oil Trucks
- Blending Equipment

- Aboveground Storage Tanks
- Totes
- Loading Rack Equipment

Throughout these stages of shale oil production, producers and their drilling partners are taking special precautions to prevent unnecessary contamination of the well site and, by extension, the environment. This is accomplished by minimizing liquid discharge across all aspects of the drilling site and wellhead, which is only possible through the use of fittings and hoses all along the supply chain—from transport vehicles to storage tanks to chemical totes to blending equipment—that are as liquid-tight as possible.

Shale-safe system

For many years, "quick connect" technology was the coupling product of choice, used primarily in low-pressure liquid-transfer applications. Today, dry-disconnect couplers and adaptors are the technology of choice where safeguarding people and the environment are paramount concerns.

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Oilfield report . . .

Dry-disconnect couplings are hose-connection devices that provide an automatic mechanism to seal off both the hose and the fixed pipe end when the hose is disconnected. These couplings are used in any liquid-transfer application where loss of fluid upon disconnection cannot be tolerated because of environmental regulations, worker safety considerations, the high value of the fluid, or where cleanliness is a concern.

Although dry-disconnect products are not necessarily newcomers to the connection business, the demand for these products has continued to rise sharply as environmental consciousness and compliance have become more prevalent. Operators today are placing a heightened focus on reducing liquid discharge at hose connection points, particularly at drilling sites. Additionally, the engineering, design, and materials of construction found in dry-disconnects have become more and more advanced, offering the optimum connect/disconnect solution at a reasonable price

point. Traditional quick connects, although still a highly accepted and viable connection product for non-hazardous liquid applications, can be hard to handle with connections oftentimes difficult to complete and hard to verify. Some styles are not very ergonomic, which can lead to physical strain for the operator.

Fortunately for the shale oil exploration and production companies and their on-site employees, dry-disconnect products are in abundant supply and meet the strict operational parameters and environmental regulations of complex, harsh production process applications found in shale oil and gas production, completion, and transport. The goal of any dry disconnect technology is to optimize human and environmental protection. Manufacturers of dry-disconnect products strive for maximum efficiency while simultaneously doing everything possible



OPW Kamvalok dry disconnect uses a poppet-action design.

to eliminate the potential for human error. Efficient and safe connection devices, dry-disconnects deliver substantial benefits to today's operators, including a clean well-site environment that reduces regulator scrutiny, liquid-damage fees, fines, and unfavorable publicity, while optimizing productivity, personal safety, and environmental protection.

There are several levels of dry disconnects for consideration, each offering unique benefits depending on the type of liquids being handled or the level of protection required.

One of the most notable dry disconnect products is the Kamvalok-style dry-disconnect that uses a unique poppet action design. The flow shut-off mechanism resembles a butterfly valve that results in a very low-flow restriction. This design enhances flow while reducing the risk of internal gunk-ups that can lead to connection malfunctions. A foolproof safety interlock prevents accidental opening, and a sealing arrangement results in a drip-free dry disconnect. Connections and disconnections are accomplished by simply closing and opening two cam arms, which lock into the machined groove around the circumference of the mating adaptor. This fitting is designed to automatically shut off in the event of accidental disconnection.

Drylok-style dry-disconnects represent the driest disconnect of the technologies offered by the OPW Fluid Transfer Group, allowing less than 1-cc of fluid loss from a three-inch coupler. Typically, Drylok-style devices meet today's stringent emission and worker safety requirements set by EPA, OSHA, and others.

These devices cannot be uncoupled while the valve is open. They are ideal for high-pressure line applications because they can be opened and closed against 150-psi maximum head pressure. In addition to high pressures, they are easy to use because of the simple lever action that connects valve to coupler and opens and closes the flow. The product's 360-degree

Why are dry-disconnect couplers better than quick disconnects?

VARIOUS styles of couplers and hose/pipe fittings are used in and around shale oil plays every day. However, the chance for a leak increases if using quick disconnect technology versus a dry-disconnect coupler.

The basic quick-disconnect technology is not always able to offer total product containment, which is a major concern for site personnel and the environment when handling hazardous liquids. Traditional quick disconnects can be hard to handle, with connections oftentimes difficult to complete and hard to verify.

The goal of any dry-disconnect technology, such as the OPW Drylok dry-disconnect coupler, is to optimize environmental protection, while allowing operators to perform safer, cleaner and faster connections and disconnections throughout the supply chain. OPW Drylok couplers are very easy to use and are operated in the following manner:

1. Push coupler onto adaptor by first engaging lower jaw of coupler under lip of adaptor and tilting the coupler upward to engage top jaw.
2. Turn handle counter-clockwise until lock engages. Coupler and adaptor are locked together but valve is closed.
3. Press button on coupler down and turn handle counter-clockwise until it locks. Valve is now open and product will flow.
4. To disconnect—press button on coupler and rotate handle clockwise until it locks. Valve is now closed.
5. Press button on coupler down and turn handle clockwise to the "in-line" position. Press tab on opposite side of coupler to release the upper jaw and move coupler away. ■

orientation ensures proper seating and alignment, and with no clamps, clips, loops, or tabs, the potential for human error is vastly reduced.

Enhanced dry-disconnect designs with a poppet in the adaptor also ensure that the liquid flow will automatically cease in the event of an accidental disconnection of the coupler and adaptor, with automatic closure guaranteed from both the coupler and adaptor directions. When used in conjunction with a vapor-recovery system, this creates total closed-loop loading capability, which protects service personnel, property, and the environment from exposure to hazardous liquids, vapors, and volatile organic compounds (VOC).

Dry-disconnect devices that offer a double ball-valve system feature an unrestricted flow path and double shut-off capability that can handle pressures to 25 bar (363 psi) and temperatures up to 464°F (240°C). The dry-disconnect can also be equipped with safety interlocks that allow the valves to open and close only with a deliberate action, which prevents accidental opening of the valve.

Dry-disconnect fittings are available in a wide variety of materials of construction, from stainless steel to Hastelloy C bodies with seals of TFM or PFA, which allows the site operator to choose the type of dry disconnect that best serves his many unique shale oil production applications. In most cases, the replacement of transfer seals can be completed without the need for special tools.

The obvious goal of any shale oil exploration and production operation is to remove as much of this new-age “Black Gold” from deep beneath the Earth’s surface as quickly, safely, and economically as possible. With increased attention being paid to environmental protection, however, the most important priority is to complete the process in a manner that is also environmentally friendly. When dealing with a process that involves a wide array of fuels, chemicals, millions of gallons of water, and potentially contaminated waste liquids that is often easier said than done.

That’s why the shale oil producers who take care to make their environmental footprint as unobtrusive and clean as possible are taking a

fresh look at coupling technology, particularly advanced dry-disconnect systems. These devices improve the safety of workers, who experience greater peace of mind and protection when handling and transferring potentially hazardous materials. This technology also proves to regulators that the operator is taking the utmost care possible and is serious about ensuring a “Zero Harm” production site.

This White Paper was published by the OPW Fluid Transfer Group, part of Dover Corporation, and is comprised of the following operating companies (OPW Engineered Systems, Midland Manufacturing, Civacon, Knappco, Sure Seal and Hiltap Fittings) each dedicated to designing, manufacturing and distributing proven solutions that assist in the safe handling and transporting of hazardous and non-hazardous bulk products. For more information on the OPW Fluid Transfer Group and its member companies, please visit www.opwshaleoil.com.

Frac-sand dry bulk trailer hardware now available from Sure Seal

Sure Seal Inc, a division of OPW Fluid Transfer Group, now offers the industry a full line of dry bulk trailer components that have been designed to deliver optimized performance on frac-sand trailers. The package includes field-proven products such as the LM Series manhole cover, swing check valves, series 2000 pressure relief vents, butterfly valves, aeration systems, hopper tees, and quick release couplers.

Frac sand is a key ingredient in the hydraulic fracturing (or “fracking”) process that is one of the key stages in producing shale oil and gas. In the fracking process, frac sand is part of a slurry mixture that is pressurized and pumped down a wellbore.

The frac sand makes it possible for the fissures within the fractured shale deposit to remain open so that the gas and oil that are contained in them can freely flow to the surface, where it is collected. Typically, three different types of frac sand—which are categorized by their particle size—can be used in the fracking process.

The frac sand is first carried from the sandpit via railcar to a transloading station where it is transferred to semi trailers. These trailers haul the frac sand to the shale-oil production site, where it is transferred via hose to a “sand chief” that will eventually deliver the sand to the wellbore during the fracking process.

The performance of the following Sure Seal products helps ensure that the transfer of the frac sand from truck to sand chief is completed as efficiently as possible:

- **Hopper Tees** — designed with a low profile configuration to provide greater ground clearance for tough applications, while also allowing for optimum unloading times and easy maintenance.



- **LM Series Manholes** — designed to handle working pressures up to 30 psi.

- **Aeration Systems** — allow more air to get through the hopper wall, resulting in 20% to 50% faster product-unloading times.

- **Butterfly Valves** — machined from 17-4 stainless steel to eliminate twisting of the stem and give direct disc control of full or partial product flow.

- **Swing Check Valves** — Spherical design, aluminum construction provide increased airflow for faster unloading times while improving reliability.

- **Pressure Relief Valves** — Two-inch valves allow for increased standard features at a lower cost.

- **Quick Release Couplers** — oil-impregnated bronze bushings eliminate coupler freeze-up.

For more information on Sure Seal products used on frac sand trailers, go to www.opwshaleoil.com.