

The phenol phenomenon

PRODUCT TRANSFER SI Group has realised improved transfer safety and containment of extremely hazardous, highly viscous material after installing Drylok dry disconnect couplers from OPW Engineered Systems, as *Dave Morrow** explains

In any type of manufacturing operation where numerous and varied components come together to create a finished product, there is one basic rule: there are some components you just don't take any chances with. One of these is the organic compound commonly known as phenol. At room temperature it is a white, crystalline solid, but when heated to 130°F (54°C) and higher it becomes a highly viscous liquid that is used in the production of alkylated phenols, among other things. These compounds are then used in a variety of rubber, industrial resin, adhesive resin, fuel and lubricants, and plastic additives production applications.

In its liquid form, phenol is classified as a Division 6.1 toxic material. It is highly poisonous and can cause severe burns, while its vapours are corrosive to the eyes, skin and respiratory tract. Phenol may cause second- and third-degree burns. Inhalation of phenol vapours can cause fluid to collect in the lungs, resulting in a condition known as oedema. Prolonged exposure to phenol can have harmful effects on the central nervous system and heart, resulting in dysrhythmia, seizures and even coma.

These extreme characteristics help explain why the US Occupational Safety and Health Administration (OSHA) has established a permissible exposure limit (PEL) to the skin for phenol of 5 parts per million (ppm) over an eight-hour work period. Additionally, the Centers for Disease Control and Prevention's National Institute of Occupational Safety and Health (NIOSH) has determined that phenol is immediately dangerous to life or health when exposure reaches 250 ppm.

Handle with care

Phenol is, then, dangerous stuff. Nevertheless, it is vital in many industrial processes and, for instance, is the lifeblood of the SI Group, Inc of Schenectady, New York, which is one of the world's leading developers and manufacturers of phenolic resins, alkylphenolic resins and alkylated phenols. The SI Group has operating facilities on six continents and works closely with clients that are situated in more than 90 countries around the globe. One of the SI Group's operating facilities in the US, SI Group Manufacturing, is located in Freeport, Texas, about 60 miles (95 km) due south of Houston on the Gulf Coast. SI Group Manufacturing receives a steady supply of liquid phenol via pipeline, railcar and, on rare occasions, tank truck.

"We are a leading producer of alkyl phenols



Paris Watson upgraded his plant with OPW Drylok dry disconnect couplers for phenol handling

and our products serve a vital role in a variety of markets, from surfactants to lubricants, engineered plastics, and paint and fuel additives," explains Doug Wright, manager of quality assurance for SI Group Manufacturing's Texas-based operations. "Phenol is one of our raw materials, and one of the key building blocks. We react it with other materials to create these alkylated phenols. We make 17 to 20 unique products or grades of phenols, and we're a 24/7 operation that has to maintain pace to keep up with business."

All of this means that Wright and his staff are constantly performing a balancing act: on the one hand, producing phenol-based products at a rate that satisfies the production schedule and end-users; while on the other, doing it in a safety-first way that does not endanger plant personnel or the environment through accidental releases. If the raw phenol were able to be delivered to the plant solely through a pipeline, Wright's concerns would be greatly reduced, but that mode of transfer is not always the first choice of phenol shippers, or even available to them.

"Our preference is to get the phenol by pipeline, which we do when we can because it takes all of the human touch out of it," Wright says. "When we can't, rail is our next preference. Truck unloading is the least preferred method because it's a smaller volume, plus the safety mechanisms are not as redundant."

Safety considerations

When delivered by rail tank car, phenol is typically unloaded from the top of the car. In

terms of safety, Wright prefers top unloading, which uses the pressure created by a transfer pump and eductor tube to force the phenol from the railcar.

"The suppliers of the phenol have their railcars configured in a certain way because of the toxic nature of the material," Wright says. "If phenol were unloaded from the bottom of the railcar, it would require the technician to get under the car to make connections and that would make them more vulnerable if there was a leak because the path of egress is more difficult. The ability of the technician to get out of harm's way is easier with top unloading."

Another danger with bottom unloading is that if an unloading line fails, the effects of gravity will allow whatever amount of phenol remains in the railcar to escape until the tank car's valves can be completely closed. By comparison, if there is any type of line failure in a top-unloading operation, the flow of phenol can be interrupted by simply turning off power to the pump.

Another thing that Wright is constantly aware of is that many of the top-unloading phenol railcars that arrive at SI Group Manufacturing are equipped with a pressure-assisted unloading system. In these types of systems, the introduction of pressurised nitrogen is used to maximise the flow rate. When the unloading is completed a closed vapour-balance operation is performed to equalise the pressure inside the railcar. Even then, however, there is still a limited amount of pressure inside the railcar, creating the opportunity for a pressure blowback or blip when the fittings are released, meaning that

any residual phenol in the railcar may be released onto the technician or the ground, putting them at risk and necessitating a cleanup procedure.

The containment plan

The combination of phenol's hazardous characteristics and the potential for product releases when unloading railcars means that the fittings and disconnects used in the handling of phenol must be highly reliable and capable of total product containment. Since 2007, SI Group Manufacturing has relied on Drylok™ dry-disconnect couplers from OPW Engineered Systems for its phenol handling applications.

"We've had the Dryloks on our phenol vapour and liquid lines since 2007 because we were looking for something that would give us as close to total containment of the phenol as possible," says Paris Watson, maintenance technician at SI Group Manufacturing. "With the toxicity of phenol you can't have any spills, so we had to make certain that we didn't lose anything. To do that, we had to get the best disconnect that we could get – and that's the Drylok."

The Drylok meets the needs of SI Group Manufacturing, and handlers of toxic or hazardous materials worldwide, because its design – which meets or exceeds the emission and worker-safety requirements set by the US Environmental Protection Agency, OSHA and other regulatory bodies – features an interlocking handle that averts accidental spills by preventing uncoupling while the valve is open. The Drylok is also ideal for high-pressure applications since it can be opened and closed against 150-psi maximum head pressures, while its easy-flow interior optimises the flow rate in high-pressure or high-viscosity applications. The Drylok also improves uptime since all repairs can be performed without the coupler being removed from the piping, and all primary seals are standard O-rings for easy replacement.

Most important, the unit's flat face minimises fluid loss, which further reduces exposure risk during operation. The 3-inch Drylok allows less than 1 cc of fluid loss, making it the driest disconnect in the industry, according to OPW Engineered Systems.

"The Dryloks have worked very well," says Wright. "Even on the pressure-assisted railcars they close off any remaining pressure, so there's less of a concern that something can be sprayed back at you. With the nature of this material and the dangers associated with it, we've trained all of our employees on what precautions to take. They know that if they even get a drop of this material on them they need to get in a safety shower as soon as possible; they have a high level of awareness of the dangers of phenol. With that said, we don't want any leaks of this material at all and having the Dryloks adds a level of security for our technicians. With the Dryloks, it's a much cleaner operation. They take some of the worry out of doing the job – and remove some of the fear as well."

Iron out the kinks

SI Group Manufacturing worked out some initial kinks with the Dryloks by heat-tracing and insulating the supply lines, which keeps the phenol in a liquid state and keeps it from plugging the lines, and using PTFE (polytetrafluoroethylene) encapsulated O-rings. According to Watson, since 2009 the Dryloks have performed without incident.

"OPW was great throughout the process," he says. "We talked with them, walked through it, discussed the problem and came out with a solution that has worked. With equipment like this it can take a bit to get it figured out and get used to it in the specific application, but once we got everything straightened out, the Dryloks have done a great job in this phenol application."

"We have a lot of respect for that material and we want to minimise the direct contact our personnel has with it as much as possible," adds Wright. "We require them to wear a full PPE when handling it and the Dryloks offer another reliable level of safety. They give a second layer of protection and added peace of mind when handling this extremely dangerous material."

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Eliminating the phenol fear factor

The Drylok™ dry-disconnect coupling from OPW Engineered Systems has been designed to provide unprecedented safety and product containment in the transfer of hazardous liquids, making it the driest disconnect coupling currently available. This design also makes its operation easy and foolproof.

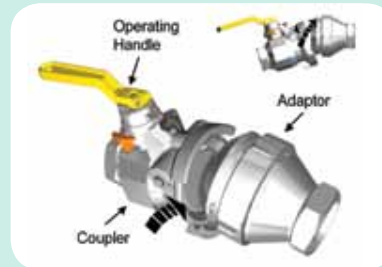


Figure1

Push coupler onto adaptor by engaging lower jaw of coupler under lip of adaptor and tilting the coupler upward to engage top jaw.



Figure2

Turn handle counter-clockwise until lock engages. Coupler and adaptor are now locked together, but valve remains closed.

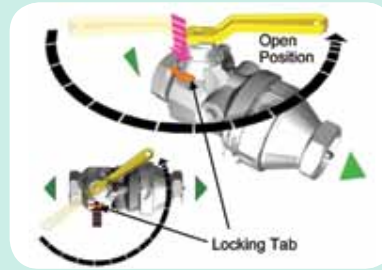


Figure3

Press button on coupler and turn handle counter-clockwise until it locks. Valve is now open and will allow product to flow.

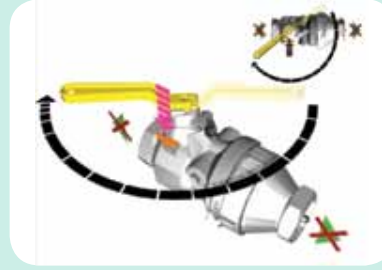


Figure4

To disconnect, press button on coupler and rotate handle clockwise until it locks. Valve is now closed.

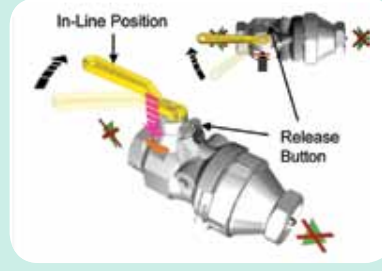


Figure5

Press button on coupler and turn handle clockwise to the 'in line' position. Press tab on opposite side of coupler to release the upper jaw and move the coupler away from the adaptor.