MISSION-CRITICAL HIGHLY SPECIALIZED

Few jobs require such attention to safety and minute detail, such tightly integrated teamwork and as high a level of trust in one's team members as those performed by the Catalyst Services Division of JV Industrial Companies, Ltd. (JVIC). Team members often must demonstrate ultimate trust by placing their lives in the hands of their colleagues as they work in hazardous environments with highly volatile substances.

Going down the critical path

Zachry acquired JVIC in late 2012, bringing along the highly specialized capabilities of Catalyst Services. This group changes out catalysts from reactors in refineries, petrochemical plants, ammonia units and coal facilities. Catalysts are substances that initiate, or accelerate, the chemical reactions that convert liquids or gases into other products without undergoing changes themselves.

This process of converting one product into another, and often several others, is at the heart of the business of refineries and chemical plants. While some reactors have the means to regenerate catalysts in the system, all catalysts eventually become spent and need to be removed and replaced.

"A lot of times, this can be done when the plant is either down or running. Regardless, it is a critical-path activity and our customers place a high value on our ability to remove and replace catalysts quickly, effectively and safely, and to get it done right the first time," explained JVIC Vice President of Business Operations, Catalyst Division, **Rodgers Thibodaux**.

The decommissioned USS Lexington serves as a training site by providing areas that simulate the confined spaces of reactor vessels as well as elevated areas that are ideal for practicing high-angle rescues. Photo/Alissa Hollimon

> ***"What makes it so specialized, and the required training so intense, is when the work is done in confined spaces and in an IDLH (immediately dangerous to life and health) atmosphere. — Training Manager Ed Lowrie"***

Housekeeping for reactors

Depending upon the type of reactor, Catalyst Services will remove spent catalyst from the reactor beds by vacuuming it from the top, dumping it or fish-taping it from the bottom. The catalyst itself can be anything from a fine powder to beads as large as two inches in diameter. Spent catalyst can also pick up heavy metals like silver, nickel and even platinum. That increases its value to customers, who send the catalyst away to be regenerated and/or to recover the metal from it.

Once the bulk of the catalyst is removed from the system, technicians are sent inside the confined space of the reactor to complete the final removal of the material and to clean and prepare the system for inspection. When it has passed inspection, the reactor is reloaded with new catalyst.

"The work itself is routine and involves a lot of vacuuming and shoveling," said Training Manager **Ed Lowrie**. "What makes it so specialized, and the required training so intense, is when the work is done in confined spaces and in an IDLH (immediately dangerous to life and health) atmosphere."

Degrees of danger

According to Thibodaux, about half of the work done by the division takes place in the open air and the other half in an IDLH nitrogen atmosphere.

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Teamwork, precision define Catalyst Services

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"Some of the open-air work we do is on tubular reactors in chemical plants. Here, the team will work on tube sheets that can be anywhere from 10 to 30 feet in diameter and might contain as many as 25,000 tubes. It typically takes about a minute per tube to empty catalyst, depending on the length of the tube, so it's very labor-intensive," he said. "Of course, with any reactor, you may have issues pertaining to high temperatures and sometimes airborne exposure to hazardous catalyst dust, but these concerns are mitigated and addressed properly."

The most hazardous, and therefore, most specialized work of Catalyst Services occurs when catalyst change-outs take place inside a vessel where there is an inert atmosphere, which means the amount of oxygen present is insufficient to sustain life.

Thibodaux described this process. "Under certain circumstances, some catalysts can become pyrophoric, meaning they don't require an ignition source, but will spontaneously combust when exposed to oxygen. In these instances, refineries will shut down a reactor for the catalyst replacement and purge that vessel with nitrogen to prevent the likelihood of a fire occurring or catalyst heating up. Once that is done, we will send a technician into the vessel to remove the catalyst."

Sophisticated equipment, skilled personnel

The process of entering and operating in an inert environment requires highly sophisticated breathing equipment and training. In terms of preparation, equipment and execution, the process could be likened to spacewalking for astronauts.

A typical inert crew comprises a project manager; superintendent; console operator; top supervisor; top safety; in-vessel technician; and a standby technician. All have well-defined roles, which they must perform with pinpoint accuracy and 100 percent reliability.

The top safety and in-vessel technician are the only team members who enter the vessel, or work in the so-called "hot zone," and each must wear a specialized breathing apparatus. It includes a lock-on helmet with an umbilical line that can be as long as 300 feet. The line is attached to the life support trailer, where the console operator monitors and controls the elaborate air delivery system.

"The helmet is a derivative of a NASA high-altitude pilot's helmet," explained Lowrie. "It allows no air to get inside other than that delivered via the umbilical line. It's also impossible for the wearer to remove the helmet himself. This is a safety precaution to prevent it being removed as a panic reflex. Breathing nitrogen would result in asphyxiation and, because it is nitrogen, there would be no possibility for resuscitation."

Since human lives hang in the balance, there is a lot of redundancy built into the breathing system. Each helmet is equipped with three air supplies and a fourth is on standby in the unlikely event that the first three are interrupted. Meanwhile, back at the trailer, the console operator's job is to continuously monitor the atmospheric conditions in the vessel, looking for oxygen concentration, levels of flammable or explosive gases and any toxic gases that may be present.

Intensive training, successful execution

"In-vessel technician training is the first of the specialty training we do and, though it pertains specifically to the technician and the top safety, the entire inert crew must undergo this two-day training course," said Lowrie. "Also, because we work in an inert environment, the customer's plant rescue service won't make entry into the vessel, so our team is responsible for providing first-line rescue and everyone must, therefore, complete a three-day rescue training course."

To simulate the confined spaces of reactor vessels and accommodate high-angle rescue training, teams train on one of three decommissioned naval vessels: the USS Lexington in Corpus Christi, Texas; the Battleship Texas in Houston, Texas; and the USS Kidd in Baton Rouge, La.

Catalyst Services requires that console operators and top supervisors be able to perform each other's roles when needed. This specialist training is combined into a single, two-day course that is 80 percent theory and 20 percent practical training.

"Our type of work is highly specialized, so all employees are properly and thoroughly trained to perform the functions required of them. Everyone also gets additional catalyst-specific training and all Occupational Safety and Health Administration (OSHA) required training, as well as any special site training that our customers require of them," added Thibodaux. •

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(l-r) Top Supervisor Joe Corrao and In-Vessel Technician Bryan McNair during a recent catalyst change-out at a facility in the Texas Panhandle. Photos/Site

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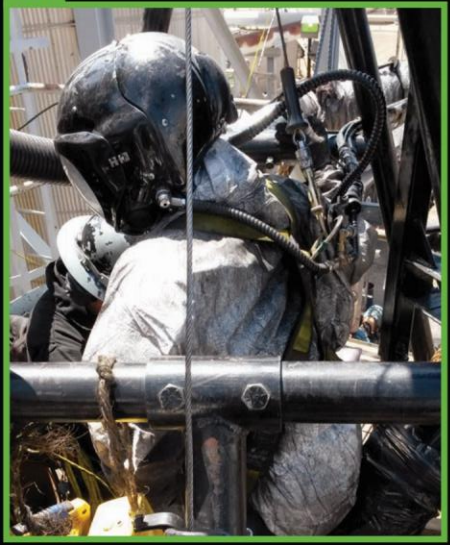

2-5: Step-by-step photos of McNair as he descends into a reactor vessel at the facility wearing a specialized breathing apparatus that includes a lock-on helmet with an umbilical line.

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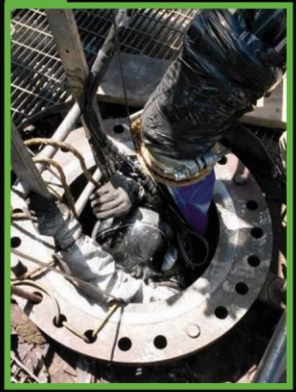

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