# IMPROVING CRUDE OIL TANK BOTTOM
## Cleaning Operations with Grinders

One of the most important issues influencing the profitability of industrial and manufacturing operations is maximizing equipment uptime to maintain a consistent throughput of production. This is clearly a priority in all aspects of the oil and gas industry, which relies heavily on the movement of fluids in closed systems, where production can be slowed or brought to a standstill because of a clogged valve or pump.

Crude oil refineries are especially at risk because of the high-solids content of slurries moving through these operations, particularly relating to storage tank bottom cleaning at refineries. Pumps, centrifuges and liquid-solid separators, critical to keeping production moving in these operations, are subjected to extremely demanding industrial conditions, being under a constant onslaught of hydrocarbons like paraffins and asphaltenes, and inorganic solids like rock, sand, rust and heavy metal oxides. Consequently, this equipment can experience high incidences of interruption and repairs, impacting production throughput and operational costs.

Increasingly, refineries are now relying on powerful in-line dual-shafted grinders to protect their costly downstream processing equipment. These grinders are powerful enough to grind down rocks, wood debris and paraffin sludge, to ensure pumps do not clog, and that liquid-solid separators and centrifuges receive properly-sized content for separation, enabling them to operate at optimum throughput without interruption.

### Crude Oil Tank Bottom Sludge

One of the more challenging issues for refineries is the development of methods to minimize the cost for removing and disposing of crude oil sludge in storage tank bottoms.

Crude oil sludge from storage tanks is a multiphase water/oil/solid composite, composed primarily of heavy hydrocarbon deposits, paraffin and asphaltene, and possessing a semisolid physical state. It is produced under normal storage conditions by the gradual sedimentation of heavy oil components, varying in consistency, density, thickness and composition across the whole tank bottom. Inorganic solids in the crude oil, such as clay, silica, calcite and corrosion-produced residues contribute

to this process, bringing more hardness and higher density to the deposit. The accumulating sediment compacts, resulting in a thick layer of sludge, which is difficult to remove. The sludge can accumulate to many feet in depth and up to 100,000 barrels in volume, which causes a gradual reduction in the tanks' storage capacity, and uncertainty of available volume. Refineries have inspection policies to verify the integrity of tank seals, flooring and roofs. To perform these periodic maintenance and inspection programs, the sludge must be removed.

### Traditional Sludge Removal Techniques

Tank cleaning, in the traditional sense, has involved opening or cutting a centrifuge to reduce the volume of sludge waste, and subsequently transported to an off-site location. This process is increasingly coming under scrutiny for both inefficiencies as well as environmental concerns. Frequent throughput interruptions, in part caused by malfunctions with shaker screening systems, add time into an already lengthy method. Because it is a process open to the environment, sludge spills do occur, as well as allowing volatile hydrocarbons to evaporate, raising issues with plant emissions, which, in some states has caused the process to be restricted.

### Closed-Loop Tank Bottom Cleaning

In response to the concerns with traditional methods, the petroleum industry has developed better, safer, quicker, and less expensive methods for doing tank cleaning, and where tank bottom hydrocarbons can be recovered and recycled back to

the refining process. These systems are overwhelmingly closed-loop processes, where, once removed, the hydrocarbons are recovered via enclosed external systems, such as centrifuges and liquid-solid separators.

Within closed-loop system for cleaning crude oil tanks, everything exits the tank via pumping, and is then passed through a centrifuge or liquid/solids separator, before it is pumped back into another tank. The pumping takes place at high pressure, often in the range of 1,500 psi (103 bar) and the sludge passes through a relatively small passageways. The passageways are susceptible to blockages from the hard, friable, abrasive and debris laded crude sludge. Once the system becomes plugged or a pump is damaged the resulting the shutdown of operations becomes a very costly problem.

## Dual-Shafted Grinders in Closed-Loop Systems

To prevent pump clogs as well as protect other equipment in the closed-loop systems tank bottom cleaning contractors are installing in-line dual-shafted grinders before the pumps. The powerful slow-speed, high-torque grinders that can handle up to 6,860 gpm and easily shred the toughest hydrocarbons, rust, rocks, and other debris commonly found in the tank sludge.


The grinders also serve a second purpose in closed loop systems. Centrifuges are used frequently in these closed-loop systems for dewatering. Randomly too big and too small particles inhibit centrifuge performance. By grinding the sludge, it is preconditioning the materials to a more consistent particle size prior to entering the centrifuge. The more consistent the particle size, the faster the sludge can be processed through the centrifuge, reducing the overall time required for tank cleaning and hydrocarbon recovery.

Achieving maximum equipment uptime, environmental compliance and ultimately profitability in tank bottom cleaning operations is not without its pitfalls. Closed-loop operations utilizing dual shafted grinders are one tool to move operators closer to those goals.

*JWC Environmental (JWC), a Sulzer Brand, is a world leader in solids reduction, removal systems and product destruction for municipal and industrial applications. JWC Monster Industrial shredders and grinders are uniquely designed to cut through the toughest solids and bring them down to size. Monster Industrial products are working every day, protecting equipment and destroying debris. They are found in applications like recycling, waste-to-energy, commercial facility sewage, food and beverage processing, agriculture, and oil and gas. Founded in 1973, the company has built and shipped more than 40,000 Monster grinders, shredders and screens to customers worldwide. More information on JWC Environmental is available at www.jwce.com*

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