# Cleaning of the sulfur recovery unit is essential to efficiency

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The Sulfur Recovery Unit (SRU) is an extremely important component in many industrial settings including oil refining and gas processing plants. Hydrogen sulfide ($H_2S$) is a by-product of high-sulfur crude oil and natural gas processing, and is a very toxic gas at high concentrations. Because hydrogen sulfide is defined as both an environmental and industrial pollutant, plants are required to recover between 95 and 99.9 percent of total sulfur that arrives at the SRU. The SRU converts hydrogen sulfide to nontoxic elemental sulfur. Without the SRU, the toxicological and environmental consequences of $H_2S$ would be harsh and severe, including acid rain and ground level sulfur dioxide contamination. Because the stakes are so high for refineries and other plants that must manage $H_2S$, the SRU must be well maintained, reliable, and able to meet the required recovery efficiency for the long term.

The proper performance of SRUs within a process can affect the cost of the final product, or even the production rate. Unfortunately, SRUs are prone to fouling. The nature of the fouling depends on the fluids flowing within and over the tubes; and the reduction in heat transfer that results almost invariably has an impact on product cost. To reduce this impact, SRU performance should be intelligently monitored and the SRU cleaned at intervals based on optimal economic criteria.

## Sulfur Recovery Unit fouling and its effects

Just as heat exchangers and condensers are prone to fouling, so, too, are Sulfur Recovery Units. In most cases, it is unlikely that fouling is exclusively due to a single mechanism, but in many situations, one mechanism will be dominant. Fouling tends to increase over time, with the trajectory being very site specific. Fouling has an economic impact, and determining when to clean often requires striking a balance between maximizing the quantity of finished product from the process and its cost. The sulfur buildup that accumulates in the tubes of SRUs can be hard and chalky, and it is not uncommon for tubes to be wholly obstructed.

SRUs are a part of a process and when fouling occurs, the temperature of the heating fluid must rise if the same amount of heat is to be transferred through the tubes. This temperature rise must be associated either with an increase in the total energy input to the process or a reduction in production rate, both of which represent a cost incurred due to fouling. Clearly, in order to make intelligent economic decisions, these costs must be quantified at a series of points in time and, preferably, in relation to the fouling resistance as well.

## Methods for cleaning the Sulfur Recovery Unit

Options for cleaning SRUs include:

- TruFit® tube cleaners
- Liquid nitrogen
- HydroDrill™

Improving the performance of fouled SRUs requires that the tubes be cleaned periodically. Each time the tube deposits are removed, the tube surfaces are returned almost to bare metal, providing the tube itself a new life cycle.

## TruFit® mechanical tube cleaning

The most frequently chosen and fastest method to address light to moderate SRU fouling is TruFit mechanical tube cleaning. The TruFit system is an offline method in which the mechanical tube cleaner is propelled through the tube with low-pressure water, flushing the debris out of the tube, leaving the tube free and clear of fouling. Fig. 1 shows a mechanical tube cleaner in action. For off-line mechanical cleaning, it is essential to select the appropriate cleaner. The TruFit cleaner manufactured by Conco has proven to be the most effective.

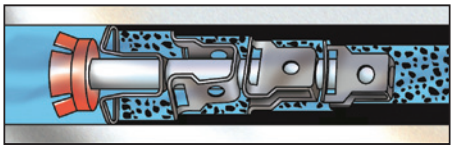

**Fig. 1: TruFit® mechanical tube cleaner.**

## HydroDrill™

Sulfur Recovery Units with more moderate to heavy fouling have been successfully cleaned with the Conco HydroDrill system. The HydroDrill uses a brush or drill bit mounted to the tip of a rotating extension or Kelly Rod, and as the rod rotates, the unit pumps water through the rod to the weep holes, flushing away hardened deposits as they are loosened. Fig. 2 illustrates the action of the HydroDrill.

HydroDrill cleaning is safe for all tube materials. Drill bits are sized to be 0.005 inches below the minimum tube I.D., and they feature long shanks to ensure that the axis of the bit and the axis of the tube are in complete alignment.

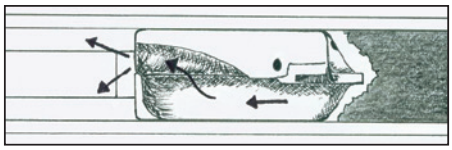

**Fig. 2: HydroDrill™ cleaning with rotating brush or drill bit.**

The bits are designed with carbide tips on the leading edge only and with rounded corners to ensure that no sharp edges directly impact the tube wall. The small onsite footprint of the cleaning system (50 to 100 sq. ft.) makes it an attractive and workable solution.

## Nitrolance™ liquid nitrogen cleaning

When SRU fouling is heavy to severe, and tubes are filled and obstructed with deposition, Nitrolance liquid nitrogen cleaning can be used to restore flow. Using the power of liquid nitrogen, a super-cooled cryogenic jet emerges from the Nitrolance nozzle, filling and expanding the cracks and crevices of the deposit, and causing rapid breakup of all debris within the tube. Fig. 3 demonstrates the mechanics of the Nitrolance nozzle.

Liquid nitrogen cleaning is safe and ideally suited for the most challenging fouling scenarios, yielding quicker turnarounds for critical path components. And because liquid nitrogen readily dissipates, only the removed deposit is left behind, saving the plant thousands of dollars in cleanup costs. The residual sulfur deposition can be vacuumed away, leaving the SRU in as-new condition.

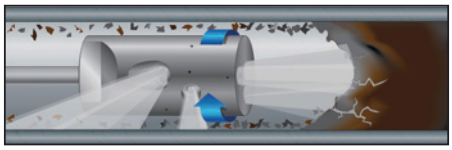

**Fig. 3: Nitrolance™ liquid nitrogen cleaning.**

## Maintenance for life

There has never been a better time to consider maintenance options for the Sulfur Recovery Unit. These units are prone to fouling, but with routine assessments and periodic cleaning interventions, the SRU can maintain its reliability and efficiency for the long-term. There is a cleaning protocol for every fouling scenario, and all are safe and effective.

*For more information, visit www.conco.net or contact Tim Meyer at tmeyer@conco.net.* ❑