Question 32: Have you developed processes to successfully extract the emulsion layer from the desalter, so the emulsion can be treated separately? Please describe your chemical treatment programs and equipment that have been implemented successfully to treat this extracted emulsion.

MICHAEL KIMBRELL (Becht Engineering)

Emulsion extraction headers, sometimes called cuff headers, have been an option and have been installed in desalters for decades. The removal of the emulsion layer solves one problem and creates another as this emulsion layer can be very difficult to treat. Heavy oil fractions contribute to emulsion formation and these hydrocarbons sometimes contain the organometallic compounds that contain nickel and vanadium. An early patent on how to take advantage of removing the emulsion layer used the fact that it would lower the metals content in the residue fraction as a selling point. That application used the emulsion as fuel in a cement kiln as one was located near the site.

Treating the emulsion external to the desalter has typically required long residence times and chemical addition. Each emulsion needs to be individually tested to determine the most effective chemistry. In some cases, filtration of the emulsion to remove the solids will result in a clean oil and a clean water phase. The oleic phase can be recycled while the aqueous phase is treated in the wastewater treatment plant.

These emulsions can be extremely difficult to break. The entrained brine contains hydrolysable salts so that any further processing will generate HCl that will need to be managed. This is particularly true if this emulsion is reprocessed through a Delayed Coker. The ammonia that is naturally generated within the Coker will form salts with the HCl that can be extremely corrosive.

BRANDON PAYNE (SUEZ Water Technologies & Solutions)

Emulsion extraction from crude oil desalting vessels is a non-standard operational technique that is limited to a small percentage of the vessels currently in service. It is a characteristic in the certain desalter vessel designs, but this mechanical feature is seldom utilized in typical unit operations on vessels equipped with this extraction capability. Appropriately designed desalters with a robust chemical treatment program should not require emulsion extraction as a routine operational practice. It should be employed in isolated instances where crude quality has significantly varied beyond design criteria.

During these infrequent instances, the extracted emulsion can be sent to holding tank, preferably cone bottom with heat and recirculation capability. The emulsion can be treated with chemical to facilitate emulsion resolution. Water and solids should be drained to wastewater treatment system for further clarification and solids harvesting. Resultant oil can be metered, at a controlled rate into the raw crude

charge line. Typical injection rates are 0.01% to 0.5% of crude charge. Locating the holding tank near the desalters will provide greater visibility to inventory control and re-processing rates. Simply removing the emulsion layer to the slop oil system without a robust emulsion resolution protocol in place could result in a more significant emulsion issue with the larger volumes in the facility's slop oil tankage.

Elaborate extraction and separation systems designed for routine emulsion withdrawal pose the obvious question of whether capital is more efficiently allocated to upgrading existing desalters. Asset operators can utilize the services of chemical treatment consultants that have desalter design and manufacturing capabilities and can assist customers with capital estimates to explore logical mitigation approaches and their potential financial impacts. Elaborate emulsion extraction systems with hydrocyclones, centrifuge, or others can be examined for frequent use. However, as stated earlier, routine use of an emulsion extraction and separation process generally indicate in inappropriate desalter design or chemical treatment program for crude dehydration and desalting.

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CHRIS CLAESEN (NALCO)

Our approach is to avoid emulsion build up in the desalter by applying the appropriate demulsifiers and demulsifier dosages. If an emulsion is growing despite high demulsifier dosages the demulsifier program, feed composition and desalter operation need to be reviewed. If an emulsion is drained from the desalter for some reason, it can be treated in a tank with the same demulsifiers that give good performance in the desalter although dosages will be higher.

SAM LORDO (Consultant)

The typically used equipment to effectively withdraw an emulsion from a desalter is a cuff/rag draw header located in the desalter near the oil/water interface. The withdrawn emulsion can be then treated separately with demulsifier chemicals designed for emulsions that are high in water and solids. This rag draw is typically sent to a separate heated tank.

Types of chemical programs used typically are acidic in nature, so materials of constructions should be considered carefully. In addition, this tank should be designed for ongoing solids removal.

RAÚL ROMERO (NALCO)

High solid in crude feed is a common area of concern in nowadays operations. Desalter is one of the first equipment impacted by a high solid load. Working on preventing spikes of solids in the crude feed is the first step in managing this issue, by implementing a correct mixing and dehydration procedure on crude tank. A suitable desalter chemical treatment is key to help mitigate formation of stable rag layer concentrated in solids. Many desalters designs include a “Cuff Header” located at the design interphase position, fitted with external valves to remove stable high solid layer once formed. It helps a lot on quickly removing stable emulsion but need to be externally treated. Centrifuge application can be considered to “break solid recycle” through slop systems.

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