



## REFINERY GRADE HYDROGEN PEROXIDE ELIMINATES HAZARDOUS HYDROGEN SULFIDE GAS RELEASES DURING COKER UNIT OPERATIONS

### Project Scope

A gulf coast refinery was experiencing unacceptable hydrogen sulfide (H<sub>2</sub>S) releases into occupied work areas in the Coker unit during cutting & quenching operations. Refinery Coker units are used to process residual oil or 'heavy ends'. A part of the coking process requires quenching the hot coke with water, resulting in latent hydrogen sulfide being transferred to the water stream and stripping into the vapor phase creating potential exposure risks to operations personnel. In order to protect workers, hydrogen sulfides in the process water stream must be eliminated.

In late 2016, USP Technologies (USP), leaders in peroxygen-based technologies for industrial water and wastewater treatment applications, was contacted by the refinery in search of a viable solution for its H<sub>2</sub>S issues. USP recommended a full-service chemical treatment program which included 27% refinery grade hydrogen peroxide, chemical storage, a dosing equipment system, inventory analysis, logistics management, safety training and ongoing field and technical support.

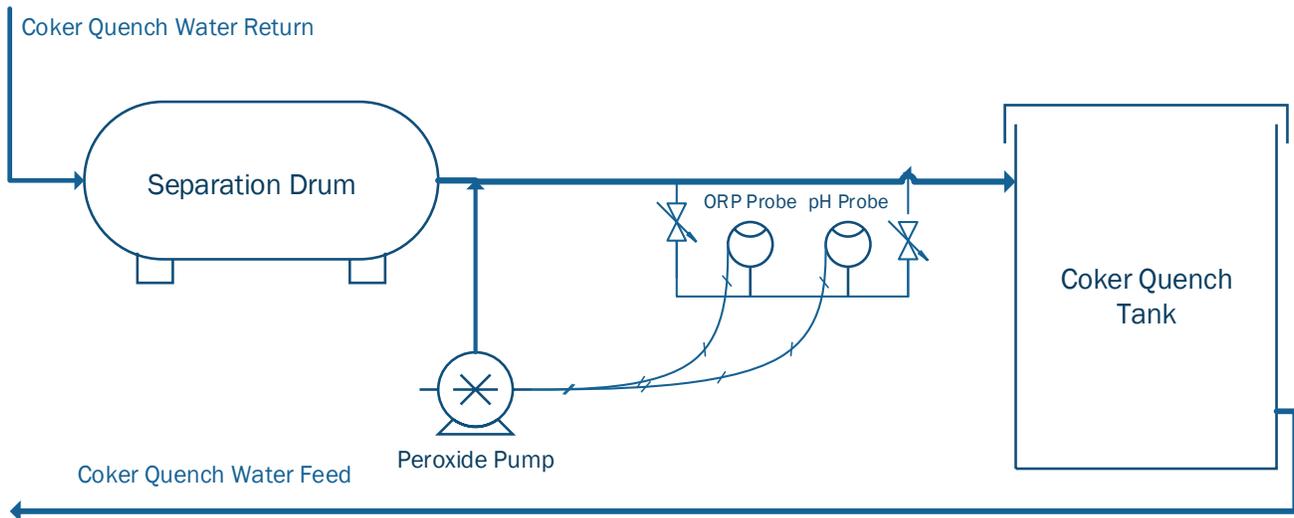
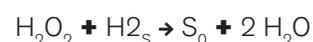


Figure 1. Closed loop Coker process flow diagram

### Full-Service Hydrogen Peroxide Treatment Program

The refinery recycles coker quench water in a closed loop, where any chemical used for treatment cannot negatively impact the coking process. Under near neutral pH conditions,

the theoretical weight ratio of H<sub>2</sub>O<sub>2</sub>:H<sub>2</sub>S is 1:1, and proceeds according to the following reaction:



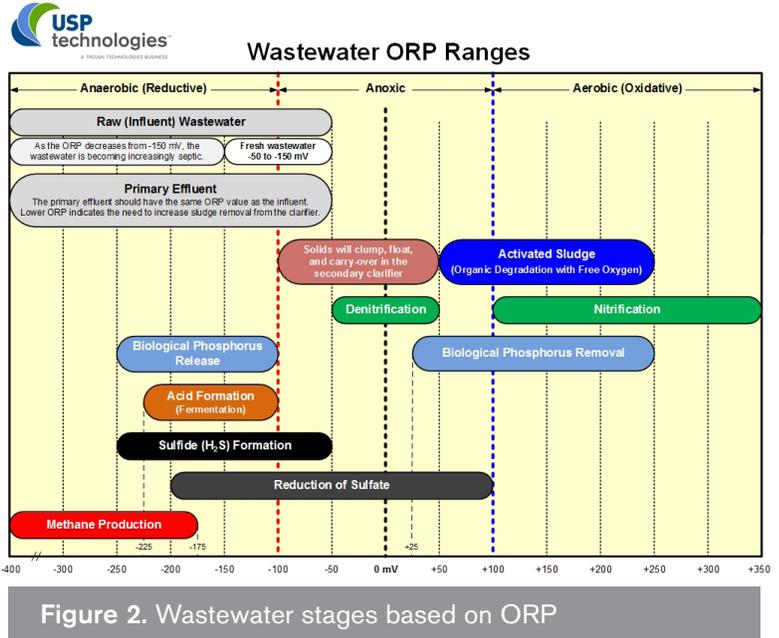
Since the products of the above reaction are water and inactive elemental sulfur, the chemistry does not negatively impact the batch coking process.

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The program employed by USP included a Class 1, Div II automated hydrogen peroxide feed system coupled with a double-walled bulk storage tank. Remote dosing adjustments and inventory management are critical to the continual operation of the H<sub>2</sub>S treatment program in the Coker unit. Ongoing water quality monitoring and appropriate dosing adjustments are all handled by USP's team. USP's data collection includes Coker quench water sulfides, ORP, pH and residual peroxide, which verifies the effectiveness of treatment. Extensive liquid sampling and test work at the beginning of the project allowed USP to determine the range of positive ORP values that were required to maintain non-detectable liquid H<sub>2</sub>S levels in the coker quench water. Maintaining positive ORP in the coker quench water system also helps suppress further biological production of H<sub>2</sub>S by sulfate reducing bacteria, represented in Figure 2. USP has employed an inline ORP setup, shown in Figure 1, which will control the hydrogen peroxide feed based on real time water quality.

## Effective Program Results

USP's program addressed the refinery's main concern of worker safety for operators during unheading of their Coker drums. Additionally, the technology eliminated the tote handling of amine based scavengers (e.g. MDEA) previously used to scavenge the hydrogen sulfide. During the first three quarters of operation there was a realized savings of \$100,000 for the year. As the program is continually optimized, 2018 program spend is estimated to annually save the refinery ~ \$300,000. This ongoing hydrogen peroxide treatment program effectively allows operators to work safely within the Coker unit, as very limited H<sub>2</sub>S "hits" have been recorded since start-up. H<sub>2</sub>S hits occur when atmospheric H<sub>2</sub>S is present at hazardous levels. The lower limit of 5 ppm and upper limit of 10 ppm requires workers to evacuate the contaminated area and seek shelter in a clean environment. The prior hydrogen sulfide scavenging program experienced frequent H<sub>2</sub>S "hits" many times well above 30 ppm on a daily basis.



## About USP Technologies

USP Technologies' ongoing mission is to help customers meet their water quality objectives by providing eco-efficient solutions that reduce and recover cost, energy, resources and space. Through a collaborative method of working closely with customers to solve problems, we are dedicated to developing innovative, sustainable and cost-effective solutions that successfully meet the highest standards of environmental stewardship. Our consultative approach includes application assessment, technology selection and field implementation of a custom engineered treatment solution. Our turn-key programs seamlessly integrate storage and dosing equipment systems, chemical supply, inventory and logistics management, and ongoing field and technical support. USP Technologies has been serving the water, wastewater and remediation markets for more than 20 years and has offices and field service locations throughout North America. We are the largest direct supplier of peroxygen-based technologies for environmental service applications and we manage hundreds of successful full-service chemical programs that treat over 1.0 billion gallons of water per day.

## Getting Started

We look forward to supporting your treatment needs, whatever the scale of your requirements. To obtain a streamlined treatment solution tailored to your specific project, give us a call at (877) 346-4262.

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