

LCO Wash Enhancement During FCCU Shutdown

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A little about us...

- Originating from the San Francisco Bay area circa 1970, Delta Tech service has been on the forefront of Unit Decontamination, and full service Chemical Cleaning for almost five decades.
- Now our service lines have expanded to include temporary equipment rental (drain systems), Decontamination consultation, Proprietary chemistry sales.
- However, our specialization is, and has been the complete decontamination of units, planning and logistical support for strategic methods for DE inventorying and cleaning up the most large scale and intricate projects.



Delta Tech Service

- Delta Tech Service is a full suite Chemical Cleaning and Decontamination provider with a specialization in providing complete Turnaround Decontamination and rental equipment solutions.
- As service providers and *partners* with customer facilities across the United States and abroad, for over 40+ years Delta Tech has learned to adapt to and mitigate the many challenges that can arise in full unit decontamination.

Delta Tech Service

- It is typical or, has been typical in the past that a Decontamination Contractor would plan a Decontamination for a particular unit and show up the day that feed is pulled, and be ready to inject chemistry per the approved plan.
- Our perspective has evolved over many years, from this, to incorporate the difficulties faced by the customer, the opportunities for improvements in efficiency, safety, and overall completion time to unit shutdown, and cleanup.



Delta Tech Service

- By forming this partnership with our customers, we are able to incorporate these challenges, and hurdles to the scope of the plan, and engineer a tailored solution that meets the design criteria.
- It is from this experienced and time tested perspective that this case investigation has been performed and presented today.

The Case

- A 'Gulf States' Refinery, with an operational crude oil refining capacity of ~280,000 B/pd.
- This refinery was to have an planned outage and turn-around of its ~75,000 B/pd FCCU, and awarded the decontamination to Delta Tech Service.
- Scope: Full unit shutdown ahead of an extensive mechanical turnaround, including entry and hot-work on all major vessels, in the fractionator, pump arounds and gas plant.
- Schedule critical path: Main Fractionator

Case for Presentation

- Dependent on operational conditions and equipment design, Petro Coke combined with entrained heavy hydrocarbon deposits (fractionator bottoms) can contribute to buildup in fractionator and downstream feed/effluent exchanger fouling.
- In handling heavy residual materials during FCCU Shutdown, care must be taken to control temperature parameters in shutdown in order to properly evacuate the material, and or properly dilute/cut residual materials with lighter hydrocarbon stock.

The Case

- Delta Tech Proposed and planned a full-unit decontamination, working very closely with refinery planning personnel to most strategically utilize the available resources by focusing on the known areas that were difficult to decontaminate on past projects. This involved switching to a relatively newer terpene based decontamination chemistry, Delta Tech's own DT-1000.
- This unit had known EXTENSIVE coke buildup that had hardened on the fractionator bottoms. On past turnarounds, upon opening of the equipment, the bottom of the fractionator had been filled with 'rock' hardened coke to a height of as much as 15-20 feet in various portions.

The Case

- On past turnarounds, the coke hardened in the bottom of the fractionator resulted in a lengthy and costly process of freeing the hardened coke of any entrained hydrocarbons etc., during the decontamination and then manually removing all of the coke prior to the inspections and any other work being performed on that equipment.
- Delta Tech had performed the 'Decon' on past occasions and witnessed the coke buildup, and the impact to the overall timeline by traditional coke removal processes

The Case

- Since the fractionator was to be the mechanical 'critical path' of the turnaround, It was requested that Delta Tech develop a chemical cleaning solution to this previously unaddressed issue.
- Delta Tech, working in concert with refinery planning and engineering personnel developed the process of using a chemical enhancer to the Light Cycle Oil Wash.
- This Chemical Enhancer would be Delta Tech's "Dsolvex".

Case for Presentation

- It is common in units that handle heavier fractions of hydrocarbon utilize some type of light oil wash during or after the shutdown process in order to lower viscosities into manageable ranges and reduces fouling and plugging as equipment cools.
- Light Cycle Oil or another inexpensive, re-runnable, lightweight hydrocarbon cutter is used to dilute the existing feed and fractionator product sections which exist in residual material.
- This can take place at any of a few different steps and is often done while the unit is still partially running but at a reduced capacity and lowered operating conditions.

The Chemistry

- Delta Tech's proprietary 'D-Solvex' is a 100% solvent chemistry, that is tailored to the treatment of heavy, high viscosity, hydrocarbons that are found in crude, various cracking, and other heavy oil processing units.
- It is comprised of a mixture of synergetic, highly aromatic, compounds that are favorable to its use as an enhancer solvent of light cycle oil.
- Solubility parameters suggest high compatibility with heavy fractionator products.
- Kauri Butanol solvent solubility value of 134
- Acceptable to refinery slop tank systems and can easily be recycled.
- Effective at temperatures from ambient to 330F.

DSolvEX

- General Appearance: Clear Liquid
- Density: 7.26 pounds per gallon
- Odor: Aromatic
- Flash point: >100.2 F Method COC.
- Boiling point: >330 F.
- Solubility in water: Negligible

Lab Testing – As part of the formulation process Delta Tech tested heavy oil processing unit deposits to determine solubility effectiveness. As you can see in the drawing below a 1” nipple was coated, inside and out, with heavy product pitch. DSolv-EX dissolved the product within one hour at ambient temperature with no agitation.

Dsolv-EX Lab Testing



Initial Condition



1 Minute



30 minutes



One Hour

The Application

- The unit shutdown process was executed per refinery procedure. When temperatures had reached acceptable parameters and unit circulations had been configured such that the fractionator was being refluxed with hot LCO (<330F).
- Delta Tech Injected approximately 6,000 Gallons of D-Solvex on the reflux loop downstream of the reflux pumps.

The Application

- The injection took place over the course of one hour, allowing for even distribution of the LCO enhancer throughout the solution.
- The circulation was allowed to proceed as temperature was maintained and the solution was monitored for dissolved solids. Although real time data was unavailable, the circulation was conducted based on time and chemical residence, with the goal being to dissolve the binders that were causing the coke to maintain its rock hard structure

The Result

- After a 4 hour circulation period at just below 330F the solution was drained to refinery slop and the unit decontamination procedure was conducted.
- The unit was Decontaminated in record time with ZERO incidents, utilizing DT-1000& DT-5000L 'oxysweet' Decontamination chemistries.
- Once the equipment was allowed to cool, refinery personnel were allowed to open and enter the main fractionator to perform initial inspections and evaluate the effectiveness of the chemical cleaning.

The Result

- The Main Fractionator was completely free of coke deposits less a small amount < 2ft of readily movable sludge type material that appeared to be the remains of all of the expected coke deposits.
- Additionally this remaining material was able to be removed in less than one shift of manual cleaning utilizing a water hose.
- This is a sharp contrast to traditional methods requiring many shifts of manual, hardened, coke removal.



The Result

While the new process was wildly successful, having saved the customer hundreds of thousands in lost time along the critical path, as always we continue to improve and refine the technology even further.

We learned valuable lessons to enable a more efficient and successful LCO enhancement in the future.

Since this application, D-Solvex has been successfully applied as an LCO enhancer on several other fractionator bottoms in a Crude, and Coker most notably with similar results.

Summary

- As chemical cleaning and decontamination Vendors, Delta Tech continues to strive for excellence in SAFETY, PERFORMANCE, and INNOVATION.
- This case study was a prime example of reaping the rewards of a strong professional partnership between vendor and customer, to engineer, and innovate turnkey, chemical solutions, in a persistently evolving world.
- Thank You!