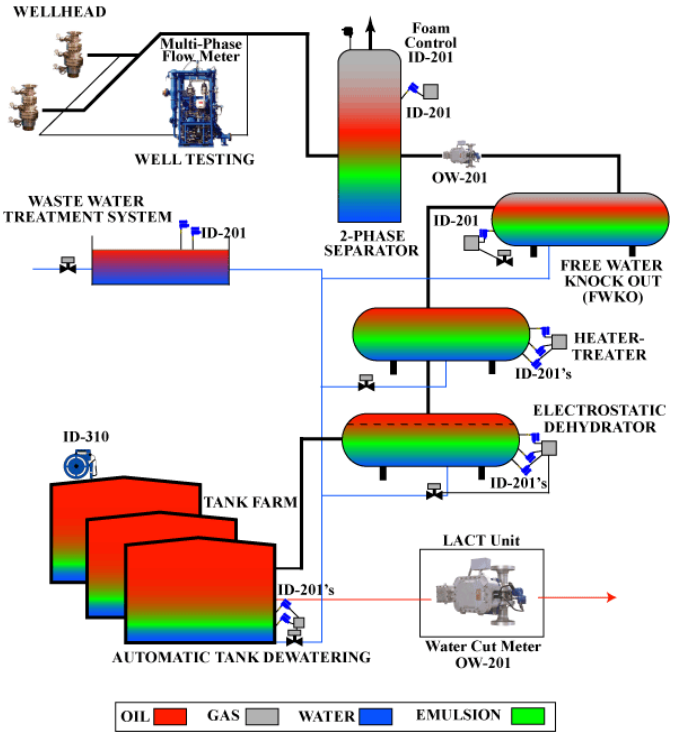
PREVENTION IS BETTER THAN A CURE

1 INTRODUCTION

Production Fields, Refineries and Chemical Plants spend millions of dollars each year to treat their waste water---this usually involves re-claiming HC and Organics from the waste water before the water can be disposed of in a variety of means including discharge over-board from offshore platforms, re-injection into the production formation, or in some cases, simply sending the water to the municipal sewer system. There are normally several different process steps/systems required to remove/reduce the HC and Organics in the waste water to an acceptable level—this process is expensive. If through better separation/interface control, the amount of HC and Organics being discharged to the Waste Water Treatment Facility (WWTF) could be significantly reduced at the source, the size of the WWTF and the cost of recovery will be reduced. In other words, if you do not dump "IT" with the waste water, you do not have to spend money to clean "IT" up in the WWTF. This paper reviews the case of one US Refinery that was able to reduce the amount of HC being accidentally discharged with the waste water by 82% and saving over $ 65MM in additional costs for an expansion/upgrade to the WWTF.

2 WHAT DO PRODUCTION FIELDS, REFINERIES AND CHEMICAL PLANTS ALL HAVE IN COMMON?



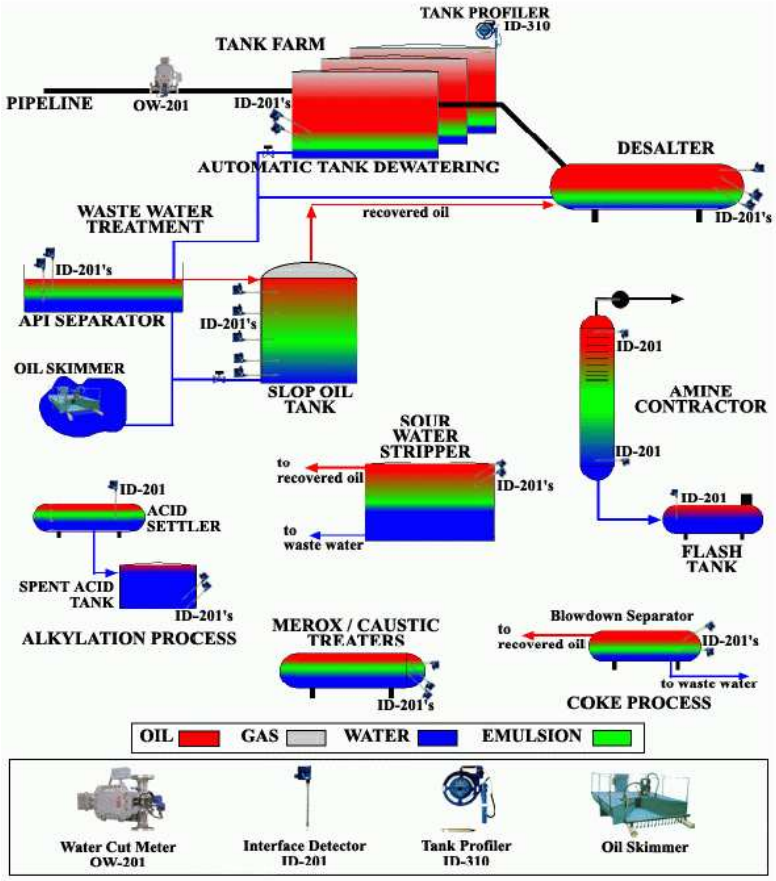
Typical Production Field Applications

They all have gravity separators---in the Production Fields they are called them Free Water Knock Outs and Heater Treaters; in the Refineries they are called Desalters and Crude, Finished Products and Slop Oil Tanks; in the Chemical Plants they are called Decanters.

The separation of the HC/Organic Phase from the Water/Aqueous Phase in these process units must be controlled even in the presence of emulsions. The HC Phase must be Dry and the Water Phase must be HC free when it leaves the process separators. It seems to be more common that the HC is accidentally discharged with the waste water.

3 A TYPICAL REFINERY

Using a Refinery as an example…. because of poor oil and water interface/separation control, refineries accidentally dump Crude Oil and/or Refined Product with the waste water to the Waste Water Treatment Facility (WWTF) on a regular basis. The Oil/Product is not actually lost….it is recovered in the WWTF/API Separator. But it is no longer virgin Crude Oil or Refined Product----the lights have evaporated, the product has been sheared and emulsified by pumps & contaminated with solids, etc.—it has been reduced to recovered SLOP OIL.



Typical Refinery Applications

The typical refinery will accidentally dump 0.5% to 2.0% of its total throughput to the WWTF because of poor interface/separation control. For a 100,000bpd refinery, this equals 500 to 2000bpd of recovered SLOP OIL.

4 WHAT DOES IT COST TO MAKE A BARREL OF SLOP OIL?

Today, Crude Oil is currently around $80/bbl. The recovered Slop Oil is certainly no longer worth $80/bbl. Would you be willing to pay $60/bbl for another refinery's SLOP OIL? Probably not……but for this example let's assume that Slop Oil is worth $60/bbl and it COSTS $20/bbl every time you make a barrel of Slop Oil.

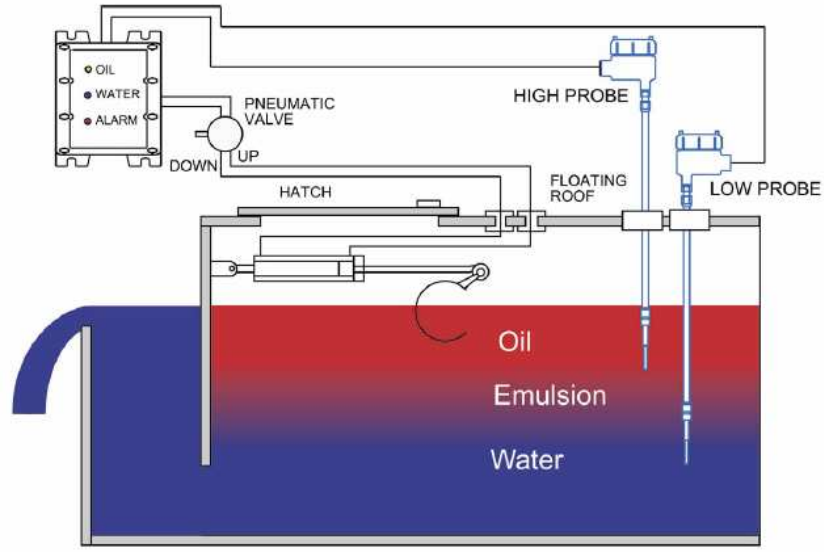
Most refineries do not view Slop Oil as costing them $20/bbl. But it is a COST and a WASTE of valuable product and refining capacity. Most Refineries view it simply as a Cost of Doing Business---they have been making Slop Oil for the past 50 to 75 years.

In this example, a typical 100,000bpd refinery accidentally dumping 0.5% of the throughput with the waste water will make 500bpd of Slop Oil. At a COST of $20/bbl, that equals $10,000/day; or $300,000/month; or $3,650,000/year. That is a lot of money in any currency…..

5 IS THE WASTE WATER TREATMENT SYSTEM JUST A BIG MOP?

When Oil/Product is accidentally discharged to the sewer with the waste water, the refinery has just experienced a contained spill or more simply "made a mess". Refineries have spent millions of dollars upgrading and expanding their WWTF over the past several years because the old WWTF was not large enough to handle all of the HC being accidentally discharged. In simplistic terms, the WWTF is the Big Mop that cleans up the mess created by poor separation/interface control in the process units. One would think that instead of spending millions of dollars building a bigger Mop…it would be more prudent to fix the problem.

One US refinery was faced with the problem of being out of compliance with the EPA's NESHAP standards and discharging 70% more Benzene than allowed by law (17 tons/year actual vs 10 tons/year allowable). The initial approach was to add a Benzene Stripper to remove the Benzene accidentally discharged with the waste water. In other words, build a bigger MOP to clean up the mess. The initial estimate for the Benzene Stripper was over $70MM…certainly more that the refinery wanted to spend. Instead of following the traditional approach of building a bigger Mop, the refinery decided to investigate how the amount of HC being discharge with the waste water could be reduced or eliminated……they wanted to fix the problem.

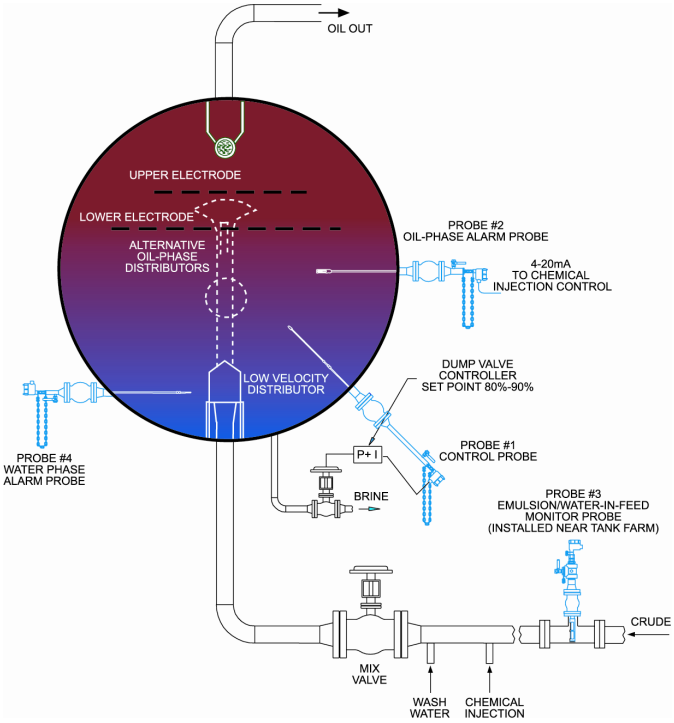


API Separator Control System in WWTF

6 THE SOLUTION—SOURCE REDUCTION

The strategy of reducing the amount of HC being discharged with the waste water instead of cleaning up the mess later at in the WWTS is referred to as Source Reduction. By installing the latest technology in the Desalters, Crude Tanks, Refined Product Tanks, Sour Water Strippers, etc., this US refinery was able to reduce the total amount of HC being discharged to the WWTF by 82% with better interface/separation control. This dropped the refinery's benzene levels from 17 tons/year to 3 tons/year. The total installed cost of the project was not $70MM…it was less than $4MM---saving the refinery millions of dollars by reducing the HC being discharged with the waste water instead of building a bigger $70MM Mop to clean up the mess after HC discharge.

In the example above—*4.0--What does it Cost to make a Barrel of Slop Oil*, this technology did not eliminate 100% of the HC being accidentally discharged to the WWTS---it only reduce it 82%. However, this equals a savings/additional profit of $2,993,000/year. Not just for the first single year, but continuing year after year.



Desalter Control System

7 INCREASED THROUGHPUT

An additional advantage of using this advance control technology is Increasing throughput of the Refinery by Optimizing Separation Control. Most refineries are able to increase throughput 5% to 10% by optimizing separation control on the following units: Desalters, Crude & Finished Product Storage Tanks, API Separator, Slop Oil Tanks, Amine Contactors, Sour Water Strippers, Alky Units, Merox Units, Acid Settlers, Coker Blow-Down Drums, Sulfur Units, etc. This increased throughput translates into millions of dollars in additional profits with a minimum investment.

8 REFERENCES

[1] L. Helm; C. Spencer; R.T. van den Dungen. Minimize Wastewater Contamination. Hydrocarbon Processing Magazine. June 1998, pages. 91-100

For more info please contact:
Kimman Process Solutions B.V.

Address: 3161 GN, Dienstenstraat 25, Rhoon, NL
Tel: +31(0)10-5030077
Web: www.WaterInOil.com

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