

REFINERY COLD TOWER OPERATIONAL CHALLENGES IN 2020

COQA Meeting
Virtual Session

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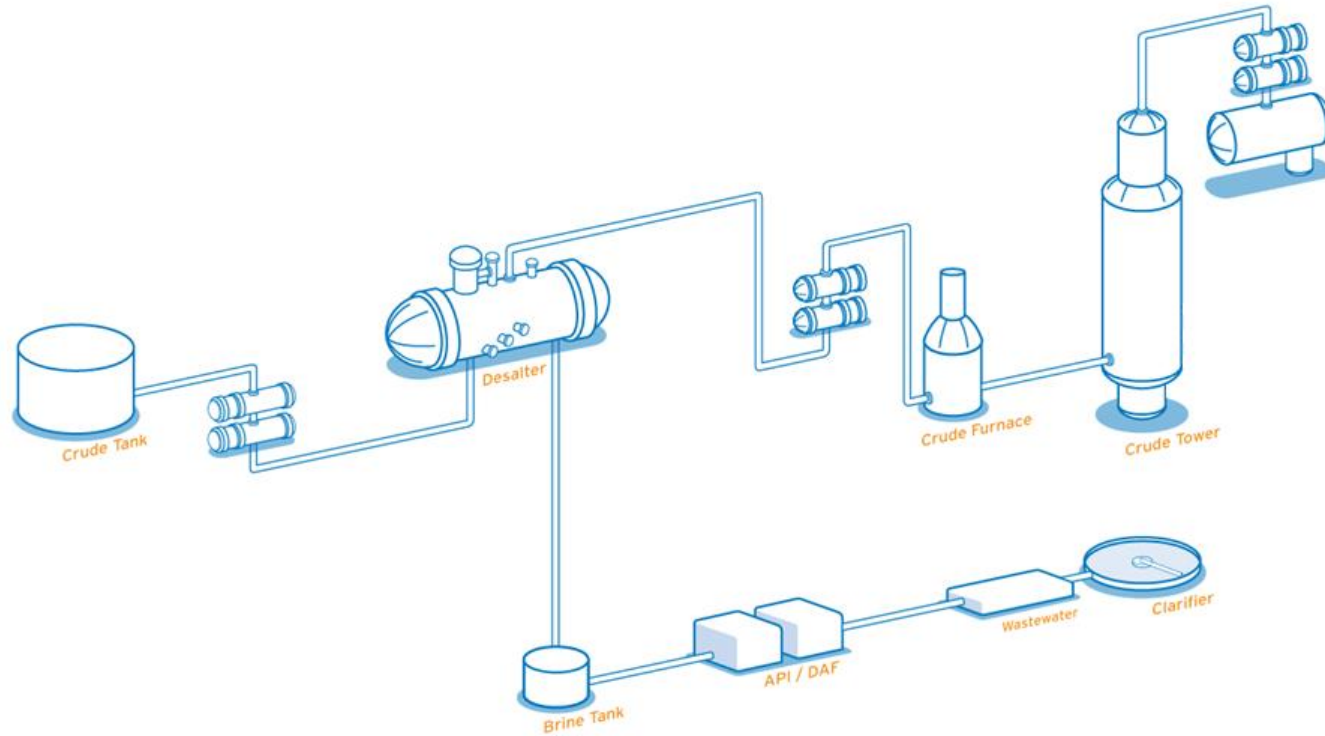


HOW DOES THIS FIT IN WITH CRUDE QUALITY



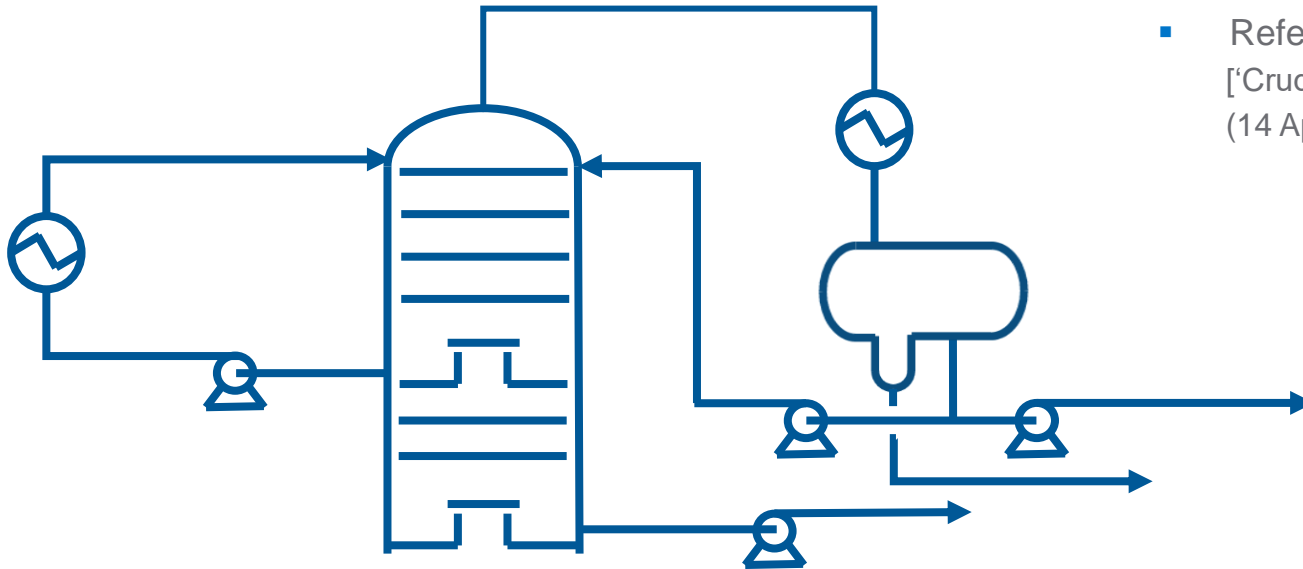
Goal

CRUDE UNIT CONNECTIVITY



TURNDOWN (PROCESS OR CIRCUIT)

- Changes to Corrosion Environment
 - ✓ Dew points
 - ✓ Salt Points
- Turndown Capability
 - ✓ Tray or packing types
- Reference
[‘Crude Unit Turndown’ Webinar
(14 April 2020); Becht]



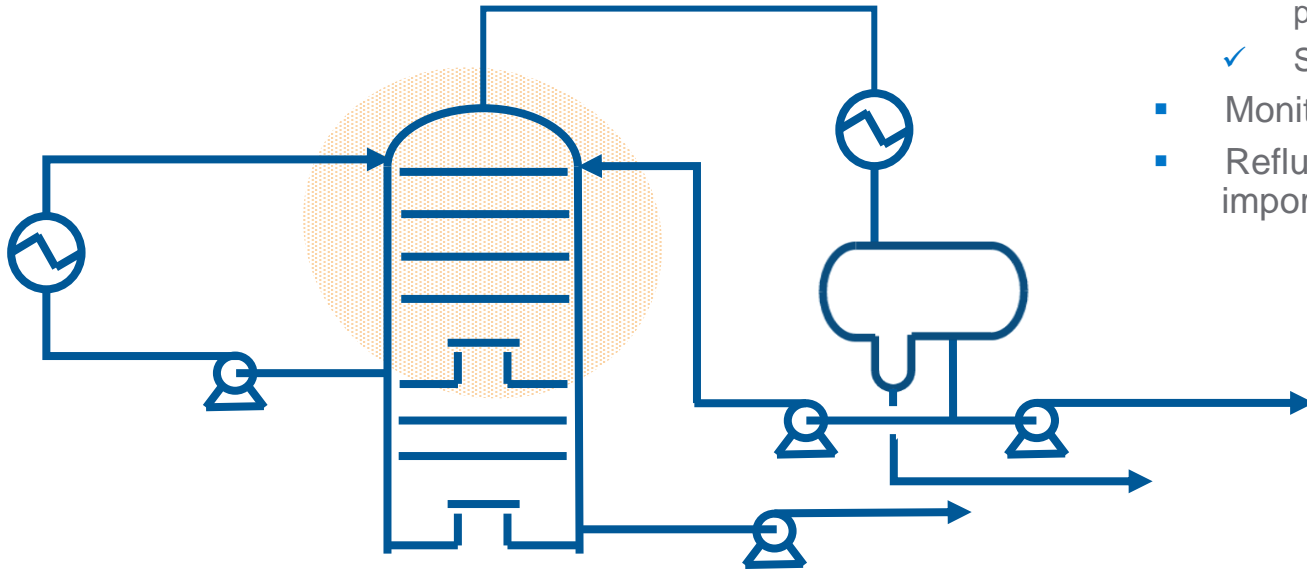
COLUMN OVERHEAD SECTION



- Components distill up the column
 - ✓ Naphtha
 - ✓ Steam
 - ✓ Acid Gases (HCl, H₂SO_x, H₂S, etc.)
 - ✓ Bases (Ammonia, Amines, etc.)
- Partial pressures of components and Temperature determine
 - ✓ Dew point
 - ✓ Acids and Bases may absorb in dew point
 - ✓ Salts formation points

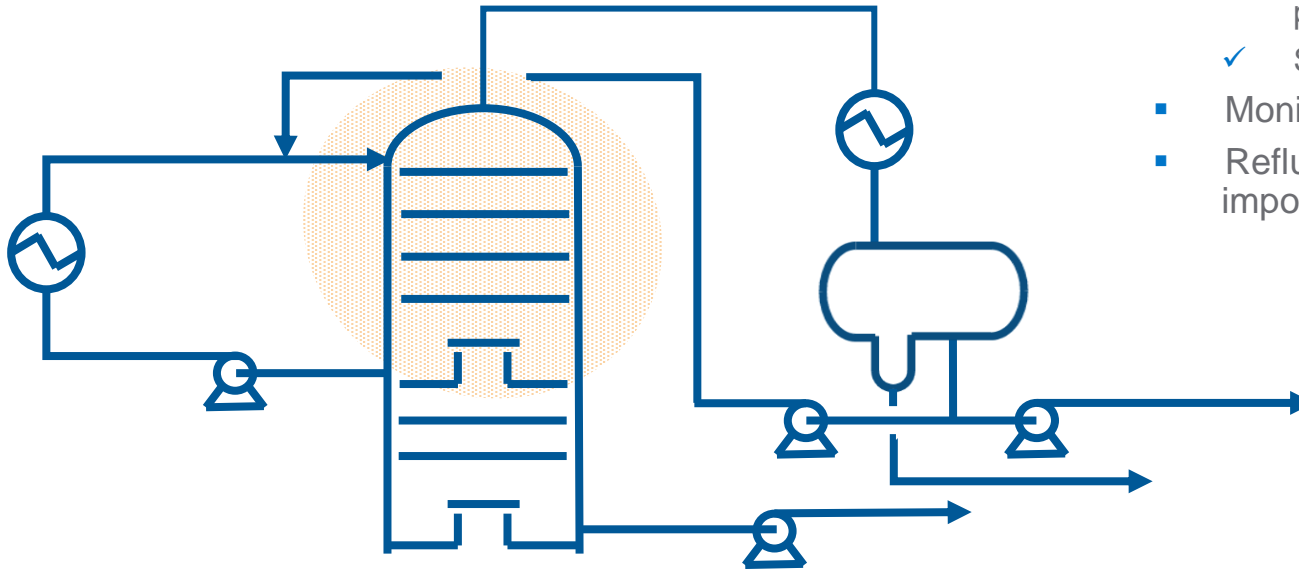
COLUMN TOP INTERNAL SECTION

- Components distill up the column
 - ✓ Similar to overhead situation
- Depending on partial pressures and process temperatures
 - ✓ Dew point may occur
 - ✓ Acids and Bases may absorb in dew point
 - ✓ Salts formation
- Monitoring becomes problematic
- Reflux configuration and distribution important



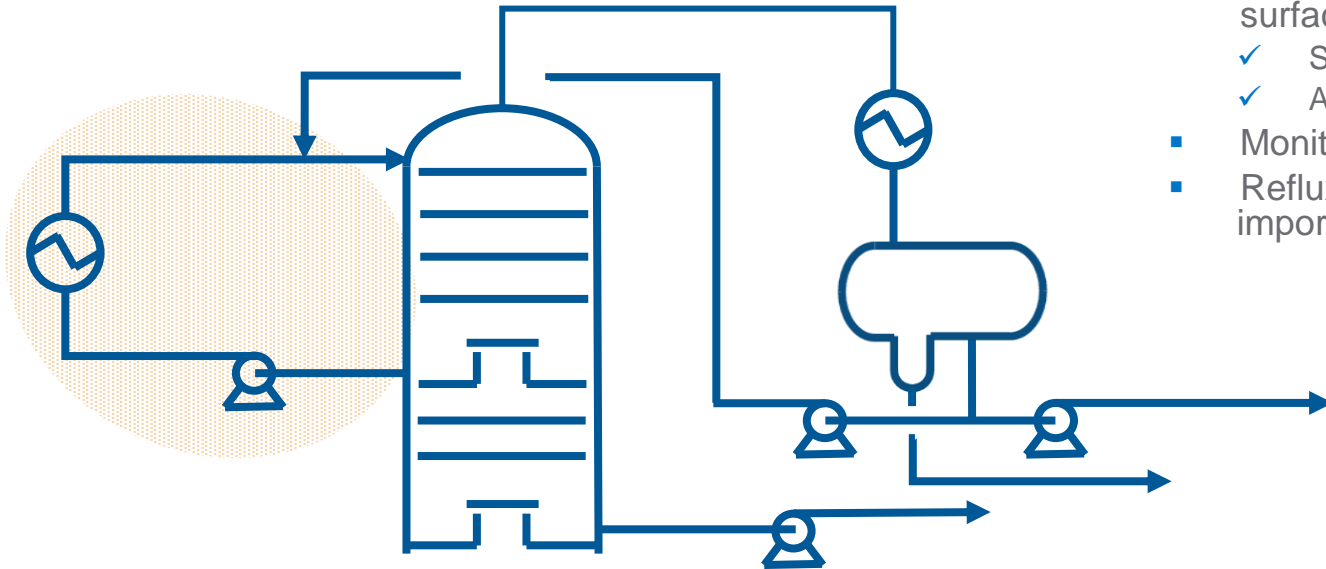
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COLUMN TOP PUMP AROUND SECTION

- Multiple mechanisms possible
 - ✓ Azeotrope
 - ✓ Water
 - ✓ HCl
 - ✓ Salts
 - ✓ Corrosion byproducts (FeCl_2)
- Cooling environment on heat exchange surfaces
 - ✓ Soluble water may separate out
 - ✓ Acids may dissolve into water
- Monitoring becomes problematic
- Reflux configuration and distribution important



COLD DISTILLATION COLUMN CHALLENGES

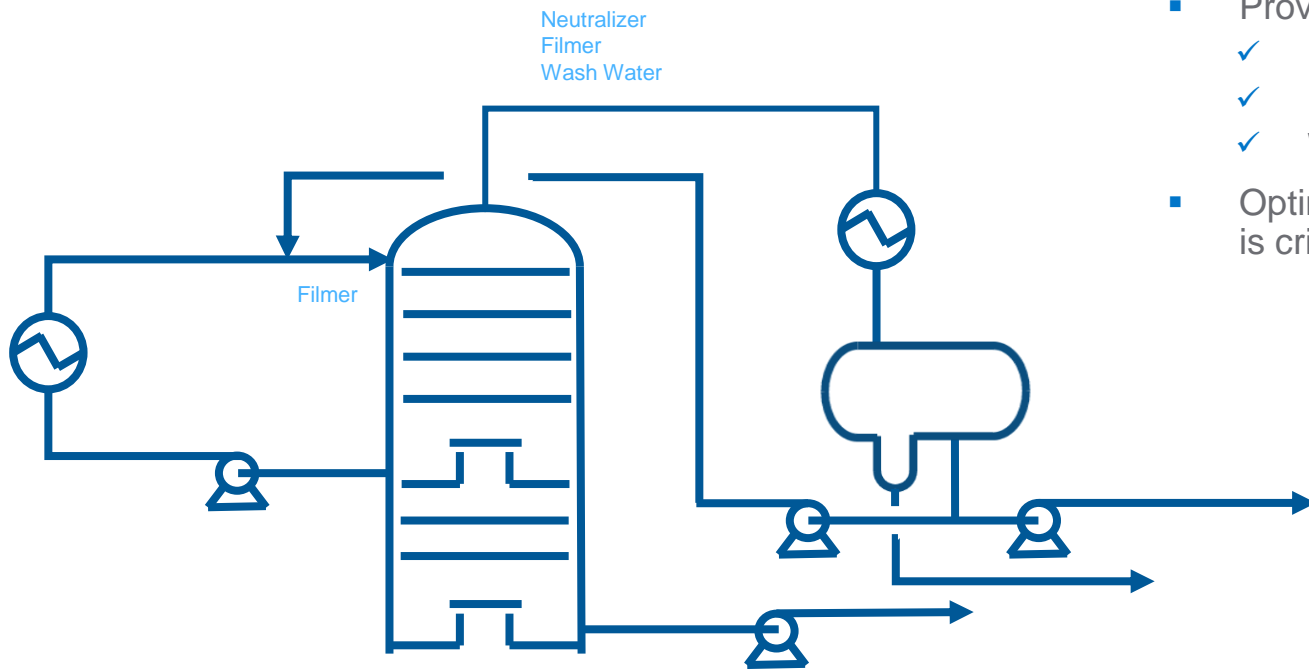


- So...
- By reducing rates to the top of the column, there is the likelihood of adding significant complexity to base case operations
- Reducing flow rates via
 - ✓ Lower tower top temperatures
 - ✓ General Turndown

MONITORING FOR THE SYSTEM IS IMPORTANT

- Understand where the temperature limits are
 - ✓ Relative to dew points
 - ✓ Relative to salt points
- Quantifying any deposition on heat exchanger surfaces
- Being able to obtain and determine aqueous condensate sample
- Measurement of corrosion rates on process surfaces
- Ability to trend changes in composition of overhead condensate

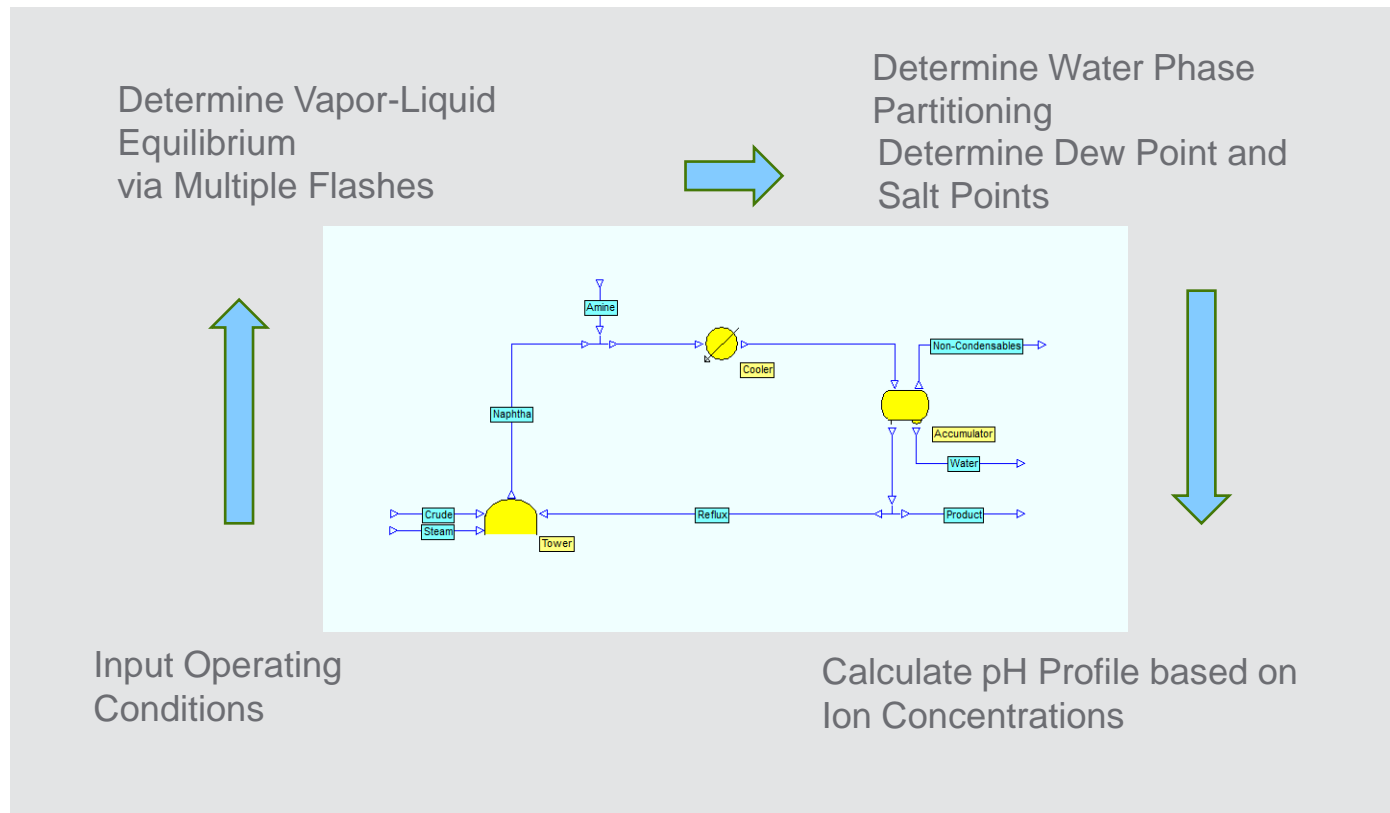
CORROSION CONTROL APPLICATIONS



- Best in class chemistries
- Monitoring is very important
- Proven technologies exist
 - ✓ Neutralizer
 - ✓ Filmer
 - ✓ Wash Water
- Optimization based on knowledge is critical

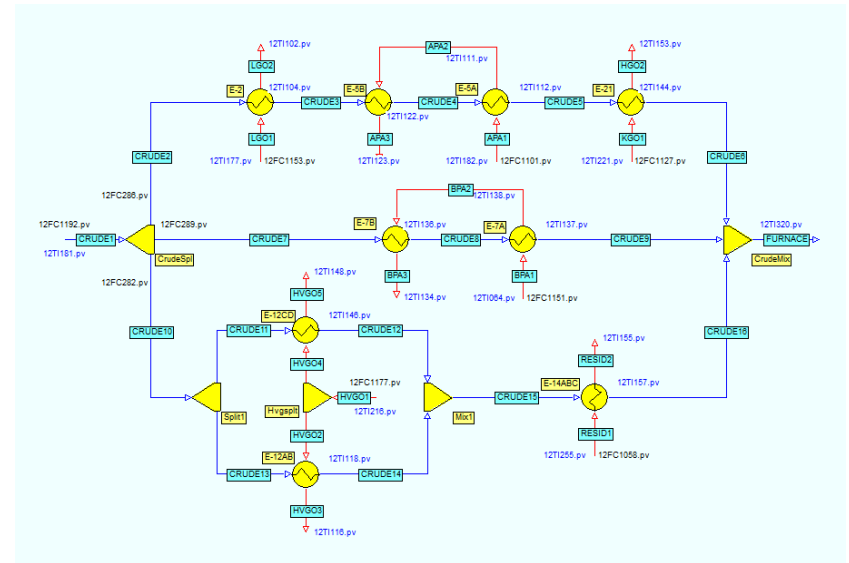
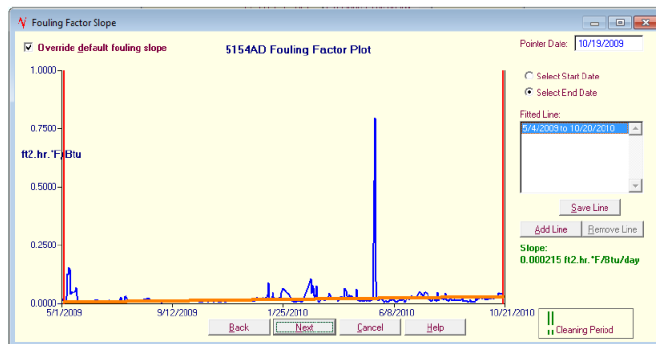
OVERHEAD AND TOWER TOP MODELING

- 35+ year history
- Detailed Ion Balance Model

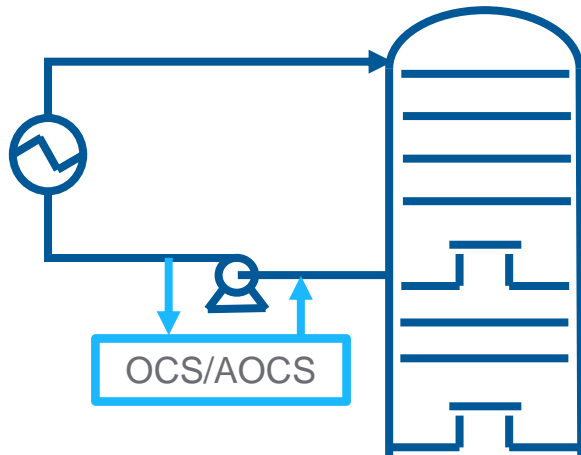


HEAT TRANSFER RATING

- 25+ year history
- Rigorous thermodynamic model
- Heat exchanger network monitoring
 - ✓ Fouling Factors
 - ✓ U-values
 - ✓ Normalized Circuit Performance



APPROPRIATE SYSTEM SAMPLING

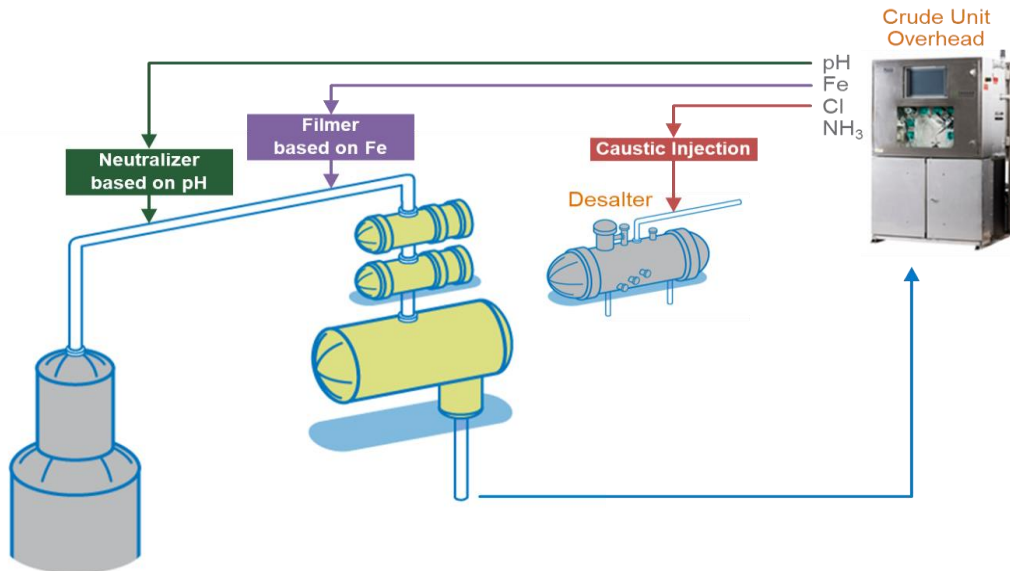


- OCS/AOCS in TPA applications for 25+ years
- Samples represent condensation that may form on heat exchange surface
- Can catch materials from the tower top internal that flow down into TPA



CRUDE UNIT OVERHEAD ONLINE ANALYSIS

- 3D TRASAR for Crude Overheads
✓ (3DTCOS)



- Online analysis for
 - ✓ pH
 - ✓ Iron
 - ✓ Chlorides
 - ✓ Ammonia

SUMMARY

- Changing process operational envelope may provide options for refineries
- Yet it also changes scope on how the distillation system will behave
- There are solutions available that have been applied with good track records
- Many monitoring technologies available but need to be creative
- A combination of the components discussed here can lead to optimized reliability

