Acid Management Workshop

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System Acid

The hydrofluoric acid is the alkylation catalyst and the condition of the acid is critical to the operation:

- Reactor operation and product quality
- Reliability – slowdowns and shutdowns due to low acid strength
- Corrosion and fouling

Poor Reliability – Consequences

Poor acid regeneration system reliability can lead to:

1. Acid runaway due to low acid strength
    - Must reject ASO at same rate that it is formed
2. Reduced unit throughput due to acid strength limit
3. Complete shutdown or recycle circulation
4. Increased operating costs due to high acid losses

Corrosion

Poor acid management can increase unit corrosion:

1. Increased fractionator corrosion due to high water content
2. Increased fractionator system corrosion due to excessive acid carryover from the acid settler
3. Fouling from iron fluoride formation
4. Acid regeneration system corrosion due to high velocities
5. Acid regeneration system corrosion due to high temperatures.

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Regeneration Fundamentals

Acid Regenerator (UOP) or Rerun Column (Philips):

1. Provide heat to vaporize HF
    a. Acid feed heater
    b. Stripping isobutane superheater
    c. Reboiler (older UOP units)
2. Provide isobutane atmosphere to reduce partial pressure of HF
3. Dilute HF vapors with isobutane to reduce overhead vapor temperature (reduce corrosion).

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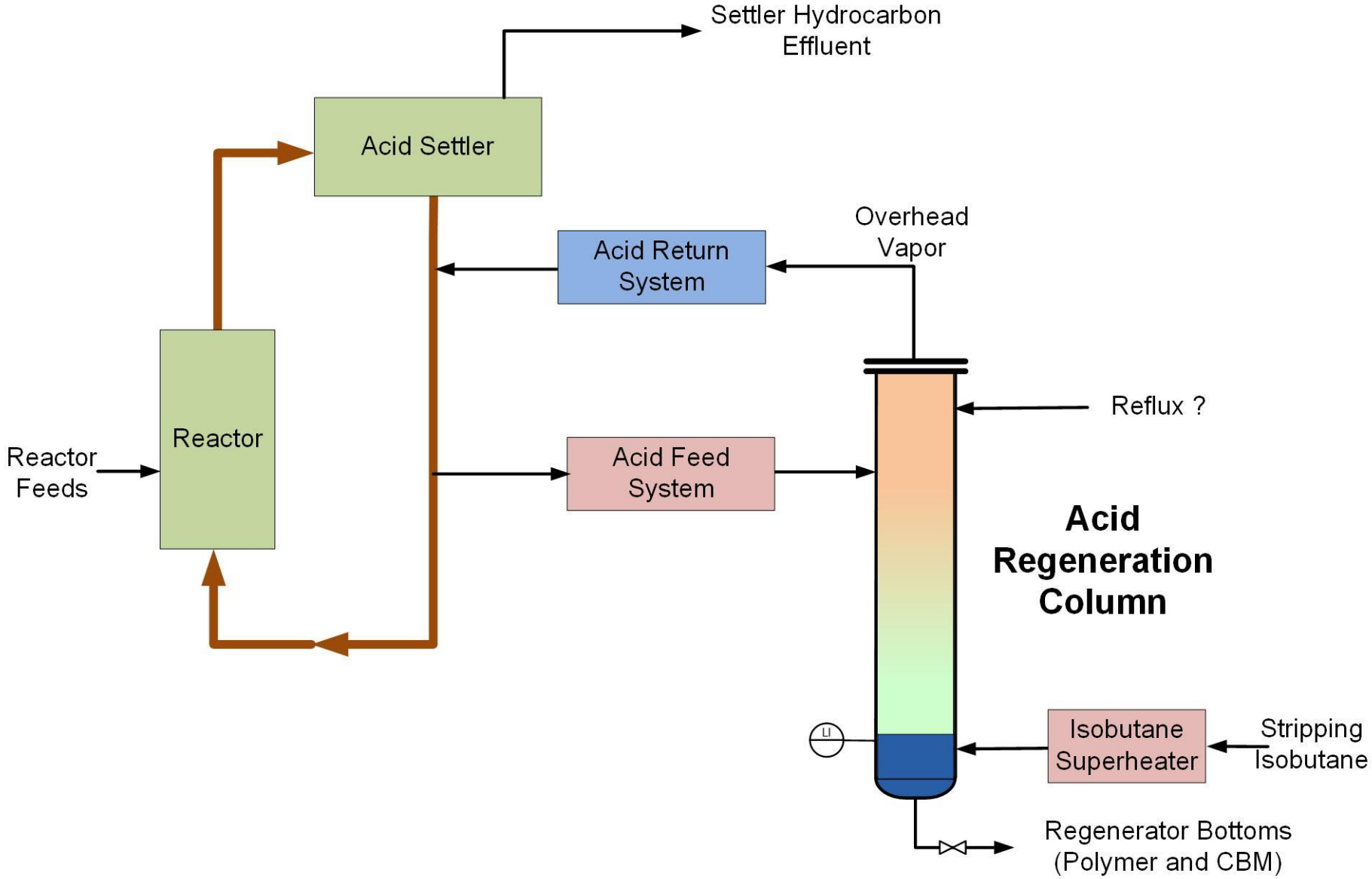
Acid Regeneration System



Regeneration Effectiveness

The capability of the acid regeneration system to remove contaminants depends on 2 things:

1. Acid charge rate to the regeneration system
2. Efficiency of the acid regenerator

   Efficiency = ASO removed/ASO in the acid feed

Example: Acid feed with 8 wt% ASO and 2 wt% ASO in acid returning to reactor system.

6 wt%/8 wt% = 75% efficiency

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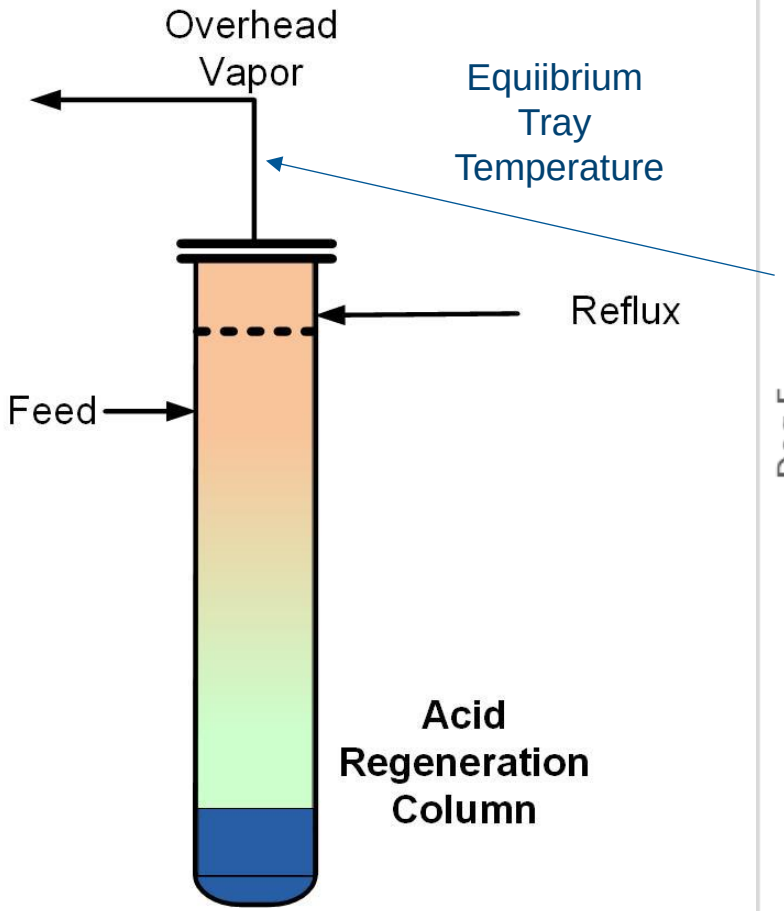
Acid Regeneration Reliability Concerns

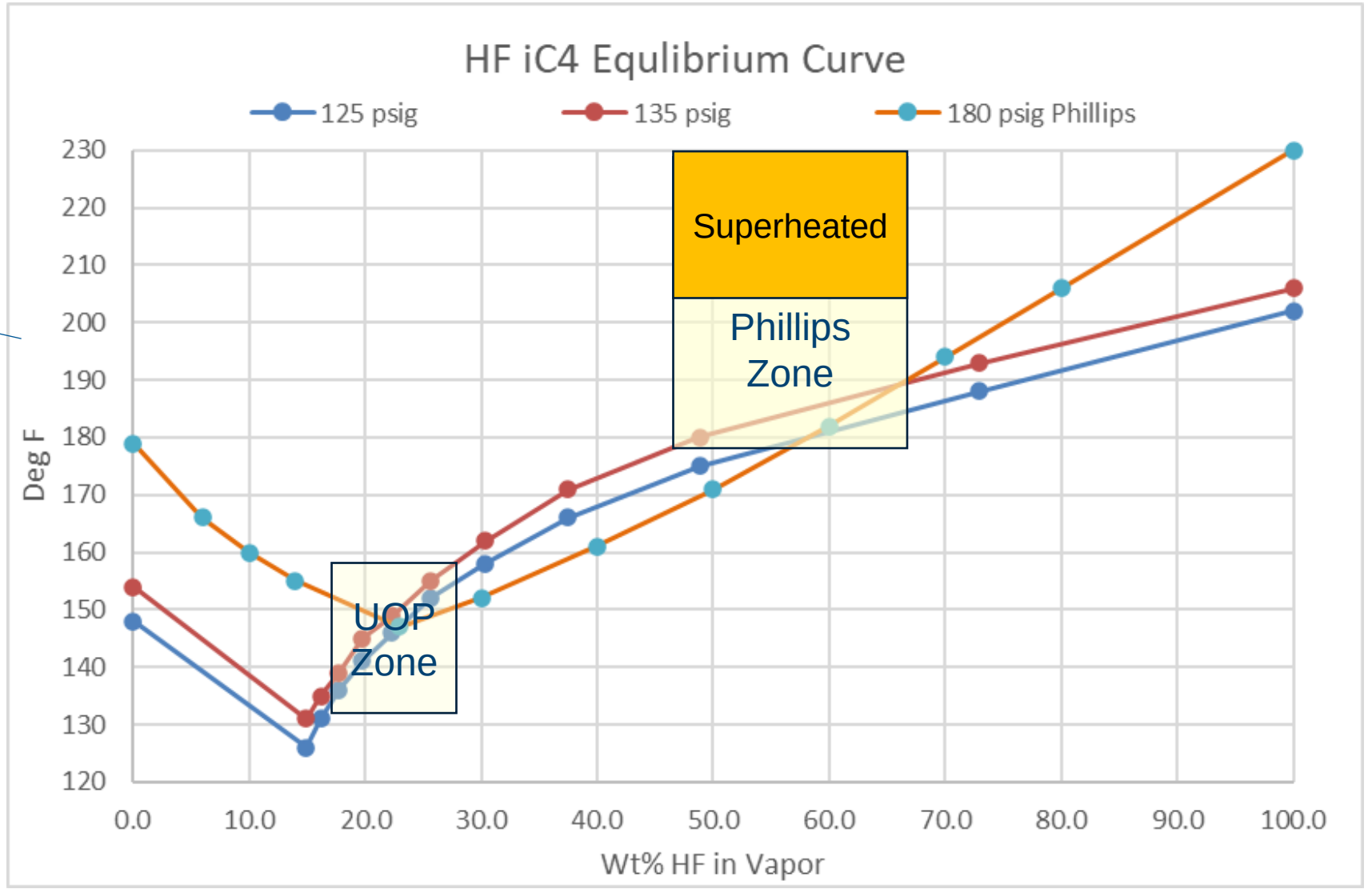
1. Inadequate capacity during “normal” operation
2. Inadequate capacity during upsets
3. Corrosion or pluggage issues:
    a. Acid Vaporizer
    b. Overhead Condenser
    c. Packing or Trays
4. Feed pump or overhead pump failures

Reducing Corrosion

1. Keep bottoms temperature below 300 deg F
2. Submerged sparger reduces metal temperatures in stripping zone
3. Reduced acid feed temperature for Rerun column
4. Replace packing with trays
5. Increased isobutane reduces overhead vapor temperature (Azeotrope Effect)

HF/Isobutane Equilibrium Curves





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