Process Considerations for the Safe Design of Sulphur Tanks and Collection Systems

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Figure 1- Simplified Claus Process
Figure 2- Liquid Sulphur Handling

External Degassing

Pit Degassing
Liquid Sulphur Hazards

- Severe burns
- Combustion product, SO₂ is highly toxic
- Production method results in H₂S and SO₂ being dissolved in liquid
  - Degassing in storage creates explosive vapours
  - Degassing in storage creates toxic atmosphere
Mitigation of Personnel Hazards

• Exposure to Toxic Vapour
  – Use of sulphur seal legs
  – Improvement in lookbox design
  – Elimination of lookboxes

• Exposure to Molten Sulphur
  – Proper tracing and steam supply
  – Packing glands for rod-out connections
Figure 3
Sulphur Seal Leg

- Sulphur flow down centre pipe
- Returns up annulus
- Length of seal leg should ensure blower deadhead cannot blow seal
- Proper heat tracing required on outside of return pipe
Figure 4 – Lookbox Evolution

a) Second Generation

b) Newest Style
Figure 5 – Sulphur Sight Glass
Figure 6 - Inline Sulphur Site Glass
Figure 7 – Effective Heat Tracing

Courtesy of Controls Southeast Inc.
Figure 8 – Heat Tracing Large Pipe
Figure 9 – Liquid Sulphur Viscosity

![Graph showing Liquid Sulphur Viscosity vs Temperature]

- **Viscosity (Pa s)**
  - 0.001
  - 0.010
  - 0.100
  - 1.000
  - 10.000
  - 100.000

- **Temperature (°C)**
  - 120
  - 130
  - 140
  - 150
  - 160
  - 170
  - 180
Figure 10 - Steam Ingress to Sulphur Rundown
Prevention of Explosive Atmospheres

• Sweep air required in rundown vessel
• Degas liquid sulphur in pit or in external degas vessel
• In pit degas start-up concerns
  – Increase air flow rate
  – Start degassing before pit is full
Storage Tank Considerations

- Properly degassed sulphur should provide no problems, small $\text{H}_2\text{S}$ venting
- Proper heat tracing of roof and vents
- Undegassed sulphur may create explosive atmosphere in tank
  - Proper rim and centre vents recommended
  - Steam purge may create larger problem
Prevention of Pyrophoric Deposits

- Prevent formation by having oxidizing atmospheres
- Undegassed sulphur to rundown tanks creates a reducing atmosphere
- Steam purge creates wet conditions more conducive to pyrophoric deposits
- Pyrophoric deposits on tank roofs easily ignited when tank inbreathing
Prevention of Corrosion

- Keep surfaces hot to prevent water and/or sulphur deposition
- Use stainless steel for surfaces that can be uncovered of liquid sulphur
- Consider removal of sulphur tank heating coil in favour of external tank tracing