



SO₃ Injector Fouling Causes and Solutions

Michael Vukmir
Regional Manager, Environmental Field Services
Chemithon Corporation

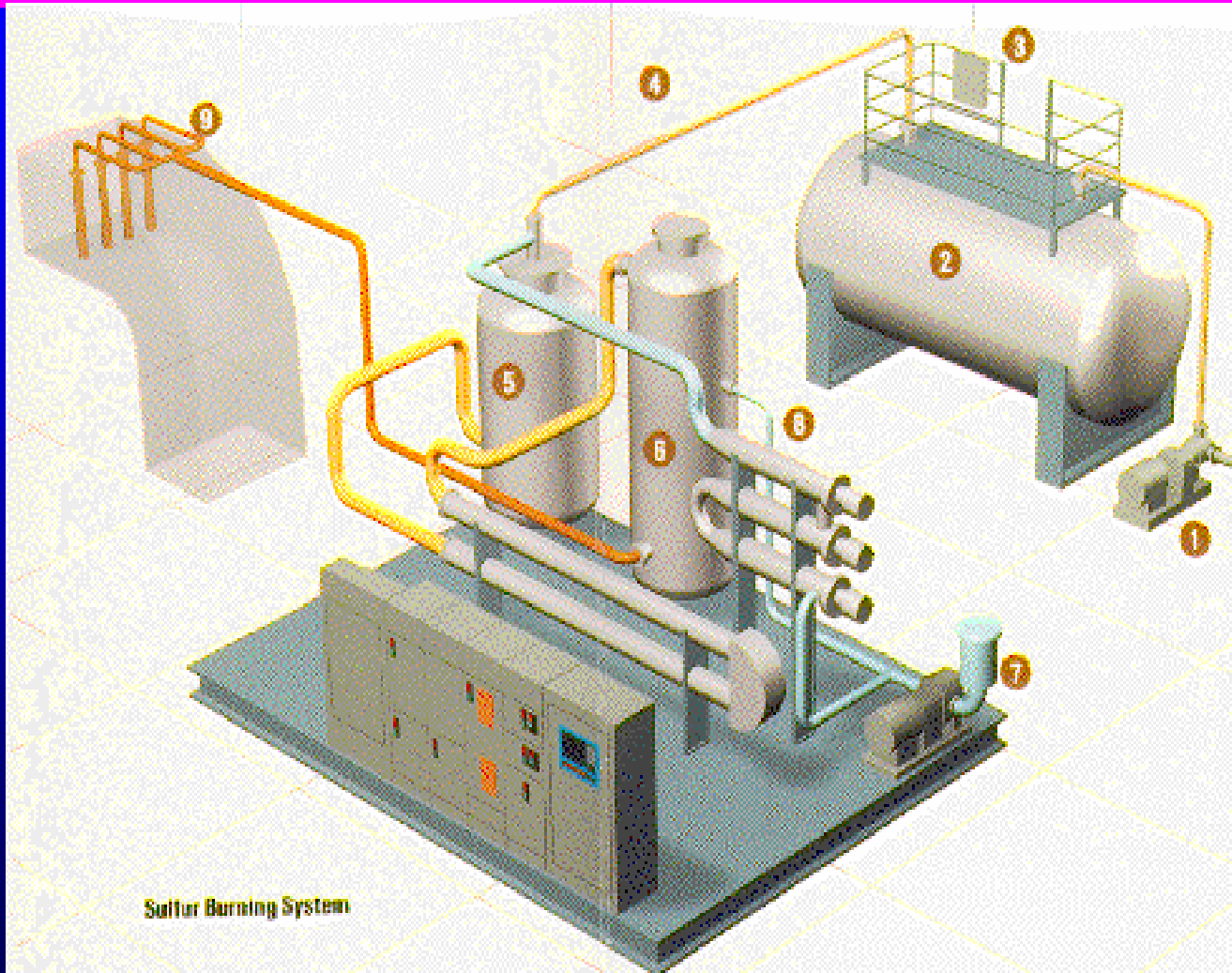
Presentation Topics

- ◆ SO₃ overview
- ◆ Typical SO₃ system
- ◆ Preventing SO₃ injector fouling

SO₃ Conditioning Overview

- ◆ Sulfur is burned to form SO₂ which is then converted to SO₃ and injected into the flue gas stream
- ◆ H₂O in flue gas stream combines with SO₃ to form H₂SO₄ (sulfuric acid) mist in flue gas
- ◆ Sulfuric acid condenses on fly ash reducing resistivity
- ◆ Increasing collection efficiency of the ESP

Typical SO₃ System



Sulfur Burning System

- 1 Unloading Pump
- 2 Storage Tank
- 3 Metering Pump
- 4 Liquid Sulfur at 135°C
- 5 Sulfur Burner
- 6 Multi-Stage Converter
- 7 Air Blower
- 8 Air Heater
- 9 SO₃/Air at 475°C

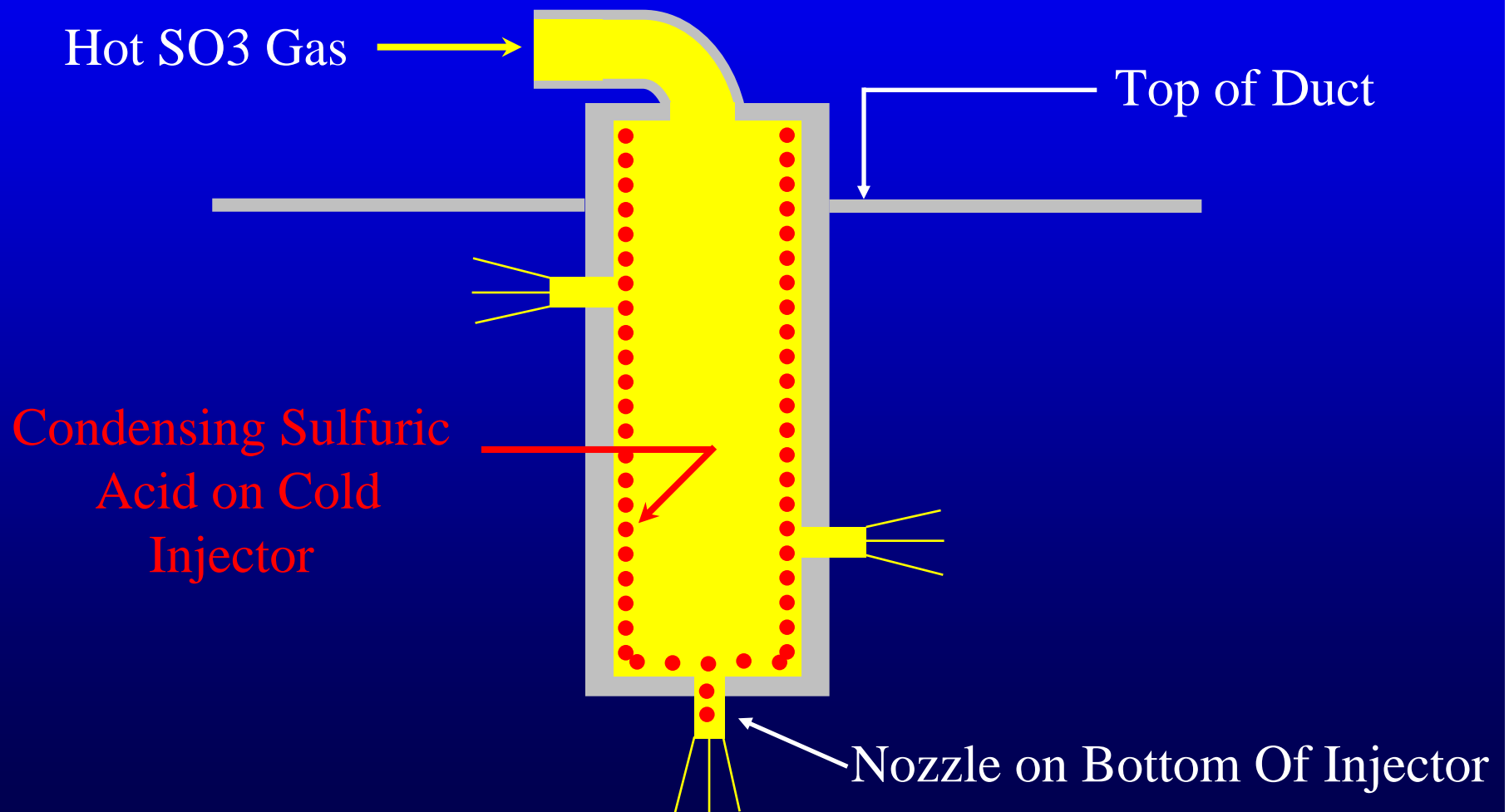
Prevention of Fouling

- ◆ Orientation of probes in duct work
- ◆ Operational methods
- ◆ Equipment tuning
- ◆ Maintenance

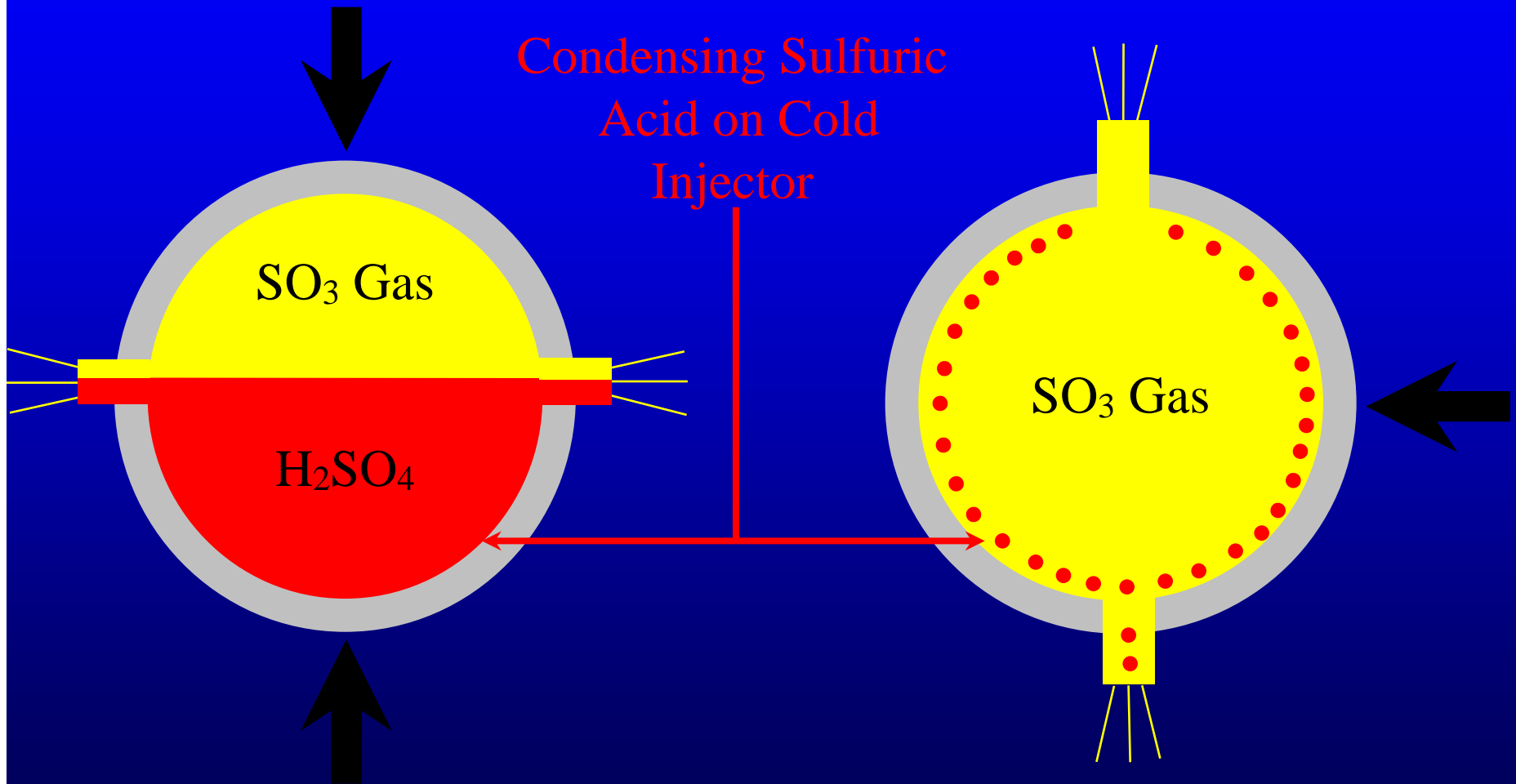
Injector Installations

- ◆ Vertical from top of duct
- ◆ Horizontal from sides of duct
- ◆ Vertical from bottom of duct

Vertical From Top



Horizontal Injectors

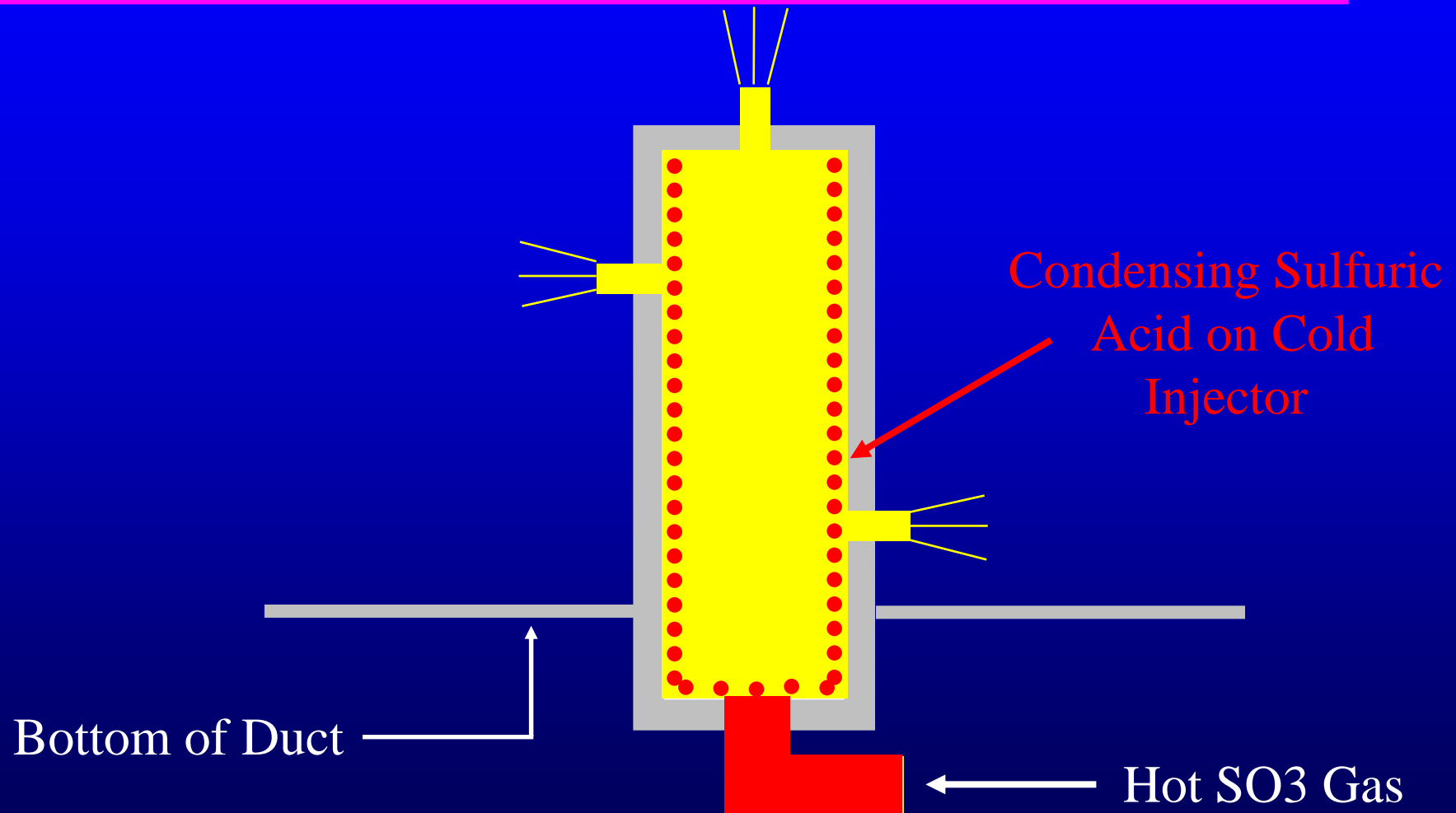


Horizontal Injector

- ◆ Looking at downstream side acid damage



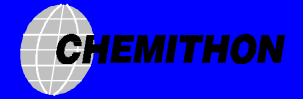
Bottom Injectors



Bottom Injector Installation Piping



Bottom Injector Installation in Duct



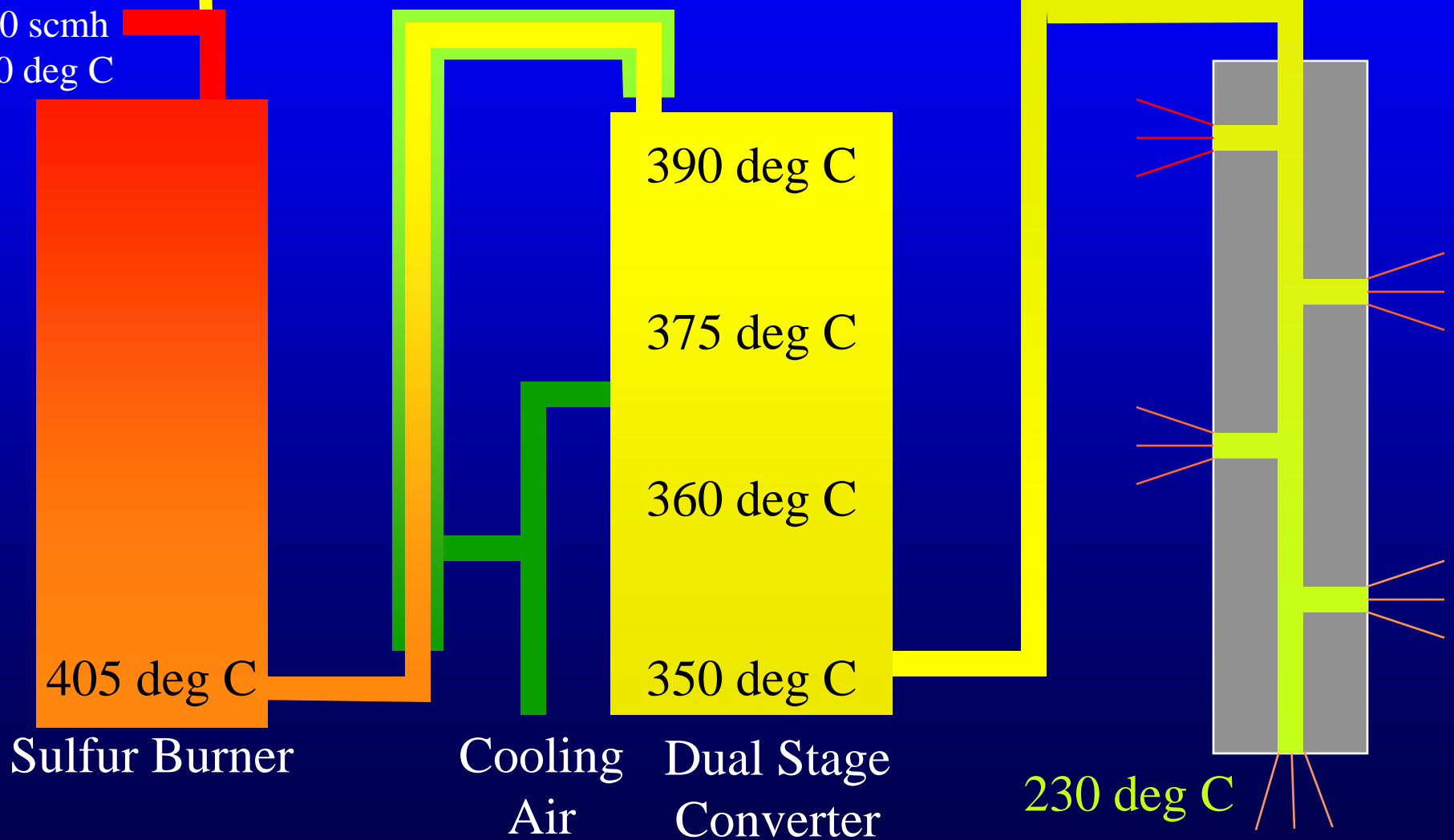
Operation of SO₃ System

- ◆ Start SO₃ system as soon as FD or ID fans are put in operation
 - Prevents dust from entering injector
 - Allows SO₃ system time to reach operating temperature prior to ESP requiring SO₃ treatment to reduce opacity
- ◆ If two shifting leave SO₃ system in hold at 480 deg C to keep injectors hot

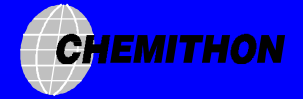
Start-up Temperature Profile

Process Air
550 scmh
480 deg C

0 kg/hr Sulfur

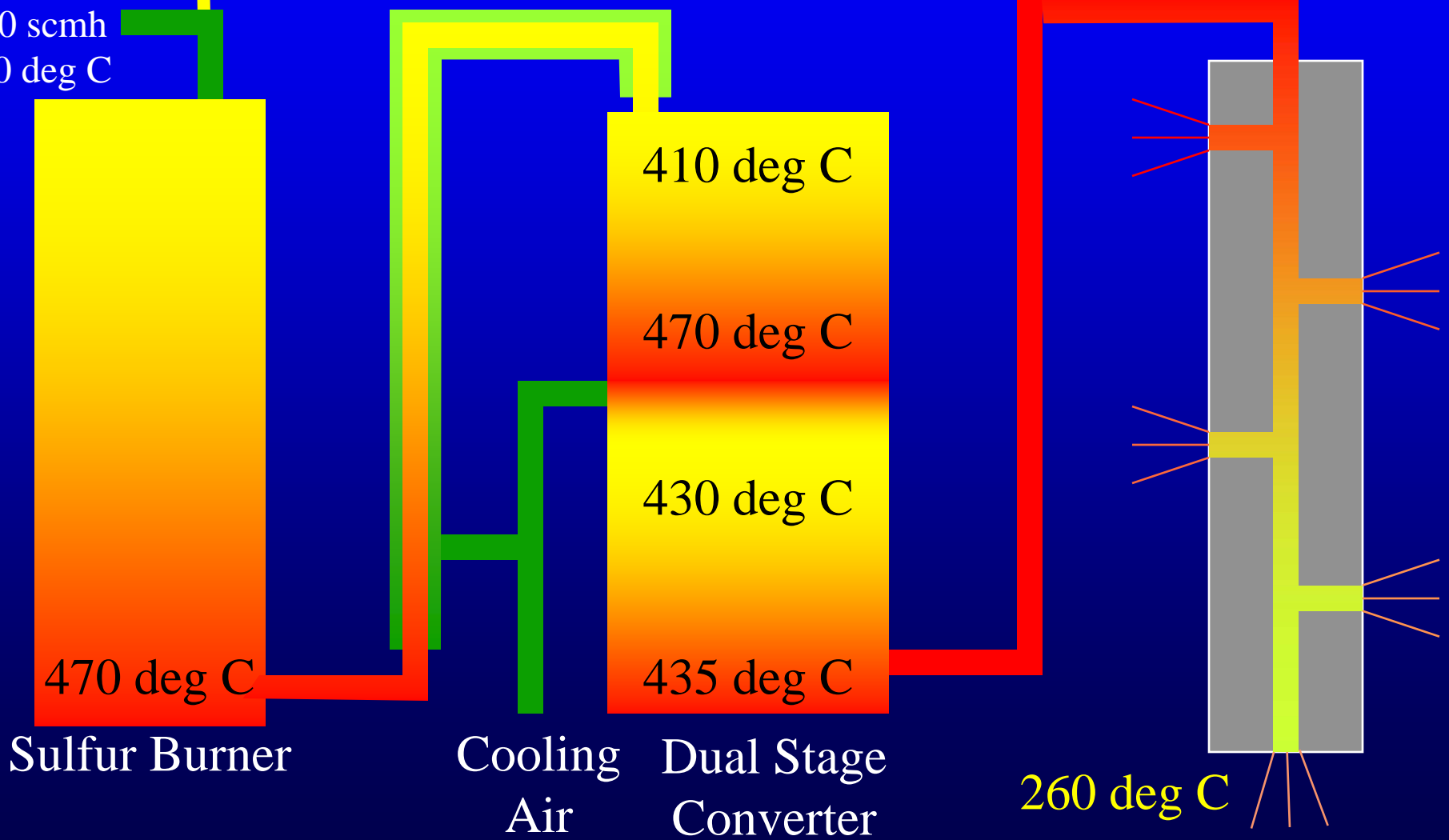


Low Treat Rate Temperature Profile



Process Air
550 scmh
400 deg C

10 kg/hr Sulfur



Low Temperature Operation

- ◆ Sulfuric acid formation on injector



Wet Air in Gas Conditioning

- ◆ A sulfur burn rate of 40 kg/hr together with the moisture in atmospheric air has the capacity to form 82 kg/hr of sulfuric acid at injectors if dew point is reached

Low Temperature Operation

- ◆ Destruction of nozzle

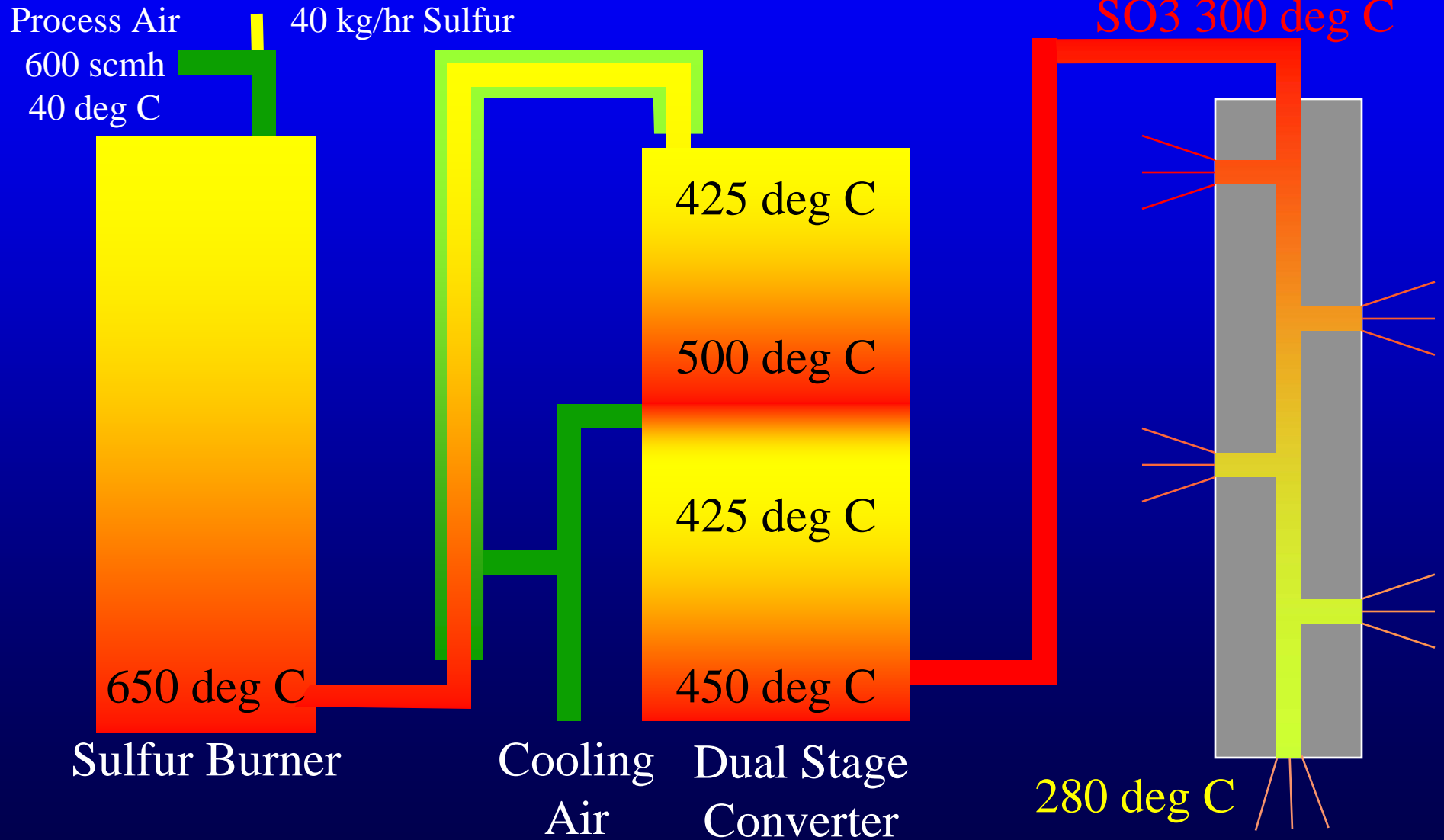


Low Temperature Operation

- ◆ Plugging of nozzle



Ideal Temperature Profile



Shutting Down System

- ◆ Stop burning sulfur and allow ample time to purge gases from system
 - Most systems have purge mode
 - » Keeps system hot to prevent formation of acid
 - » Keeps air flowing to purge residual SO₃ from system
- ◆ Keep system in standby mode if ID or FD fans are operational
 - Prevents dust from entering injectors

Maintenance

- ◆ SO₃ gas generating skid
 - Heater operation
 - Insulation of converter vessel
- ◆ Sulfur storage and piping
 - Steam leaks into sulfur
 - » Tank
 - » Piping
- ◆ SO₃ hot gas piping
 - Insulation

Maintenance

- ◆ SO₃ gas piping insulation



Conclusions

- ◆ Fouling of injectors can be minimized or prevented by
 - Proper installation of system
 - Operation guidelines
 - System tuning
 - Maintenance