



Improving the Performance of the SRU Thermal Reactor and Incinerator

Brimstone Sulfur Symposium – 2025
Vail

Uday N. Parekh
Blasch Precision Ceramics



PREAMBLE

RATIONALE FOR THIS PRESENTATION

- What are the best internals in a SRU Thermal Reactor to improve performance?
 - Checkerwalls
 - Choke Rings
 - None
- Discussed with Process Licensors, Burner Manufacturers, Operating Companies here and at other conferences -- there was no consensus at all !!
- Hence, this paper to provide some of Blasch's experience and get feedback – positive / negative / validation



Blasch Precision Ceramics

Founded in 1979, Blasch is an employee-owned manufacturer of engineered industrial ceramic shapes and systems

- Headquarters and engineering and manufacturing facility located in Albany, New York
- Highly experienced team with extensive product and system design capabilities in most industries
- GSP division located in South Carolina
- Sales / agency offices worldwide





Poor Integrity of Conventional Reaction Furnaces



BRICK CHECKERWALL

Most common



MATRIX WALL

Variation on brick wall



CYLINDRICAL CHECKERWALL

Less common

Brick Checkerwall

- Constructed from standard 9" refractory brick, two layers thick
- Bricks are mortared together in an open configuration
- Thermal cycling causes mortar to crack & fail over time
- Design inherently unstable - bricks are flat spans therefore in tension
- Generally erected with a manway, further complicating & destabilizing wall

These designs were not lasting the length of a SRU campaign leading to expensive shutdowns and repairs

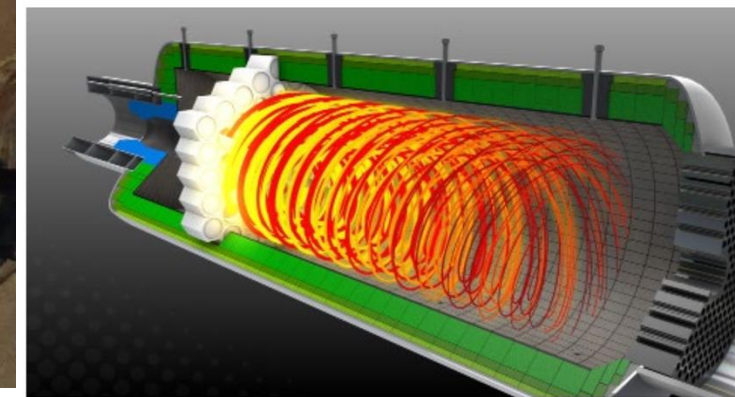
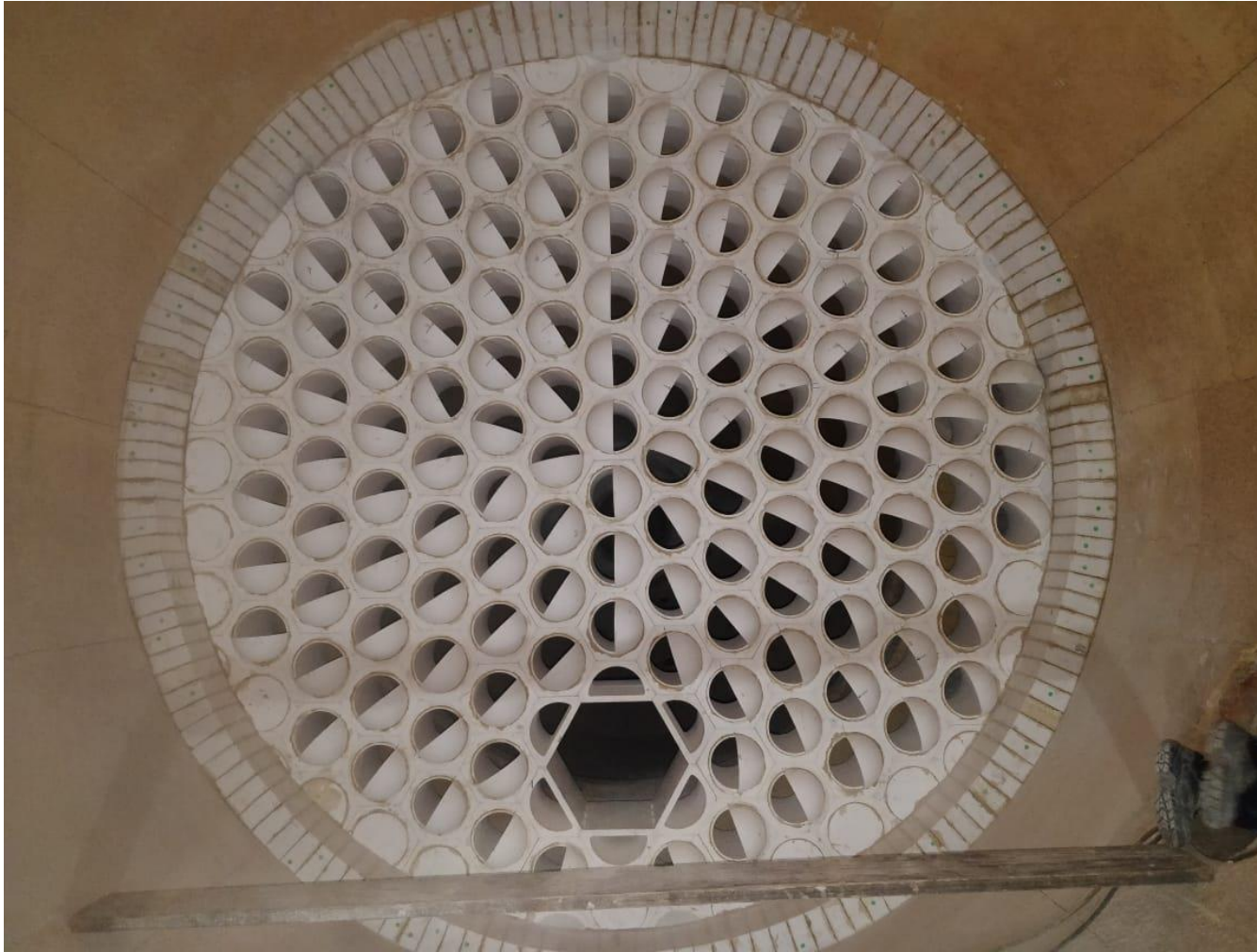


Blasch VectorWall™

Tile Shapes
Customized

Open Area equal
or greater than
replaced
checkerwall

- Time
- Temperature
- Turbulence



Key Benefits of the VectorWall in the Thermal Reactor

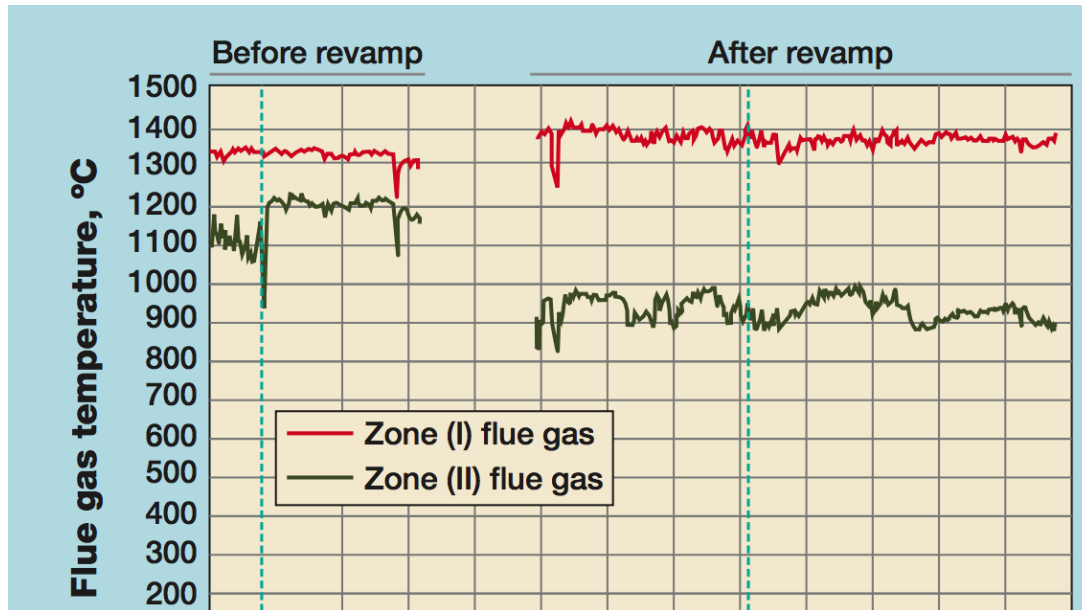
- Tighter residence time distribution utilizing full volume of the TR
 - Prevent streamlines from jetting through, especially for choke ring configurations
- Higher temperatures in the front-end of the TR
 - Better NH_3 and BTEX destruction
 - Fuel savings
 - Potentially smaller TR
- Vector tiles provide much better mixing / turbulence
 - Less contaminant breakthrough
 - Higher conversions
- Higher **reliability**
 - Protection of the tubesheet
 - Reduced vibrations / bricks dislodged



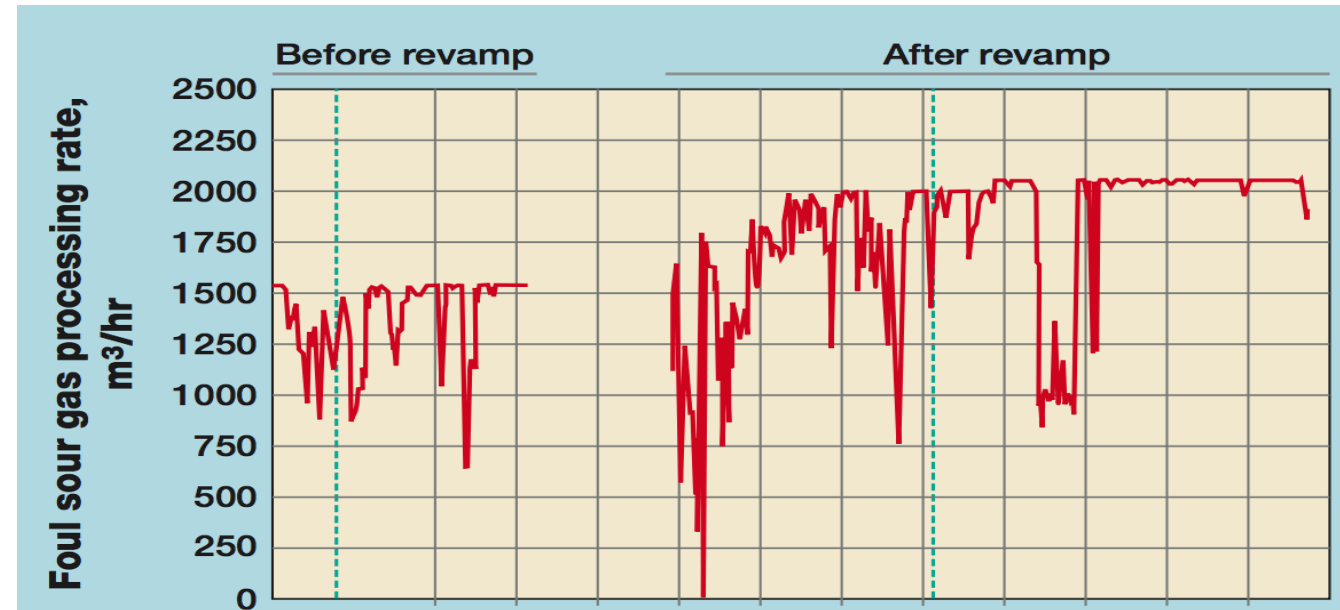


VectorWall Installation Results

Higher Temperature & Capacity

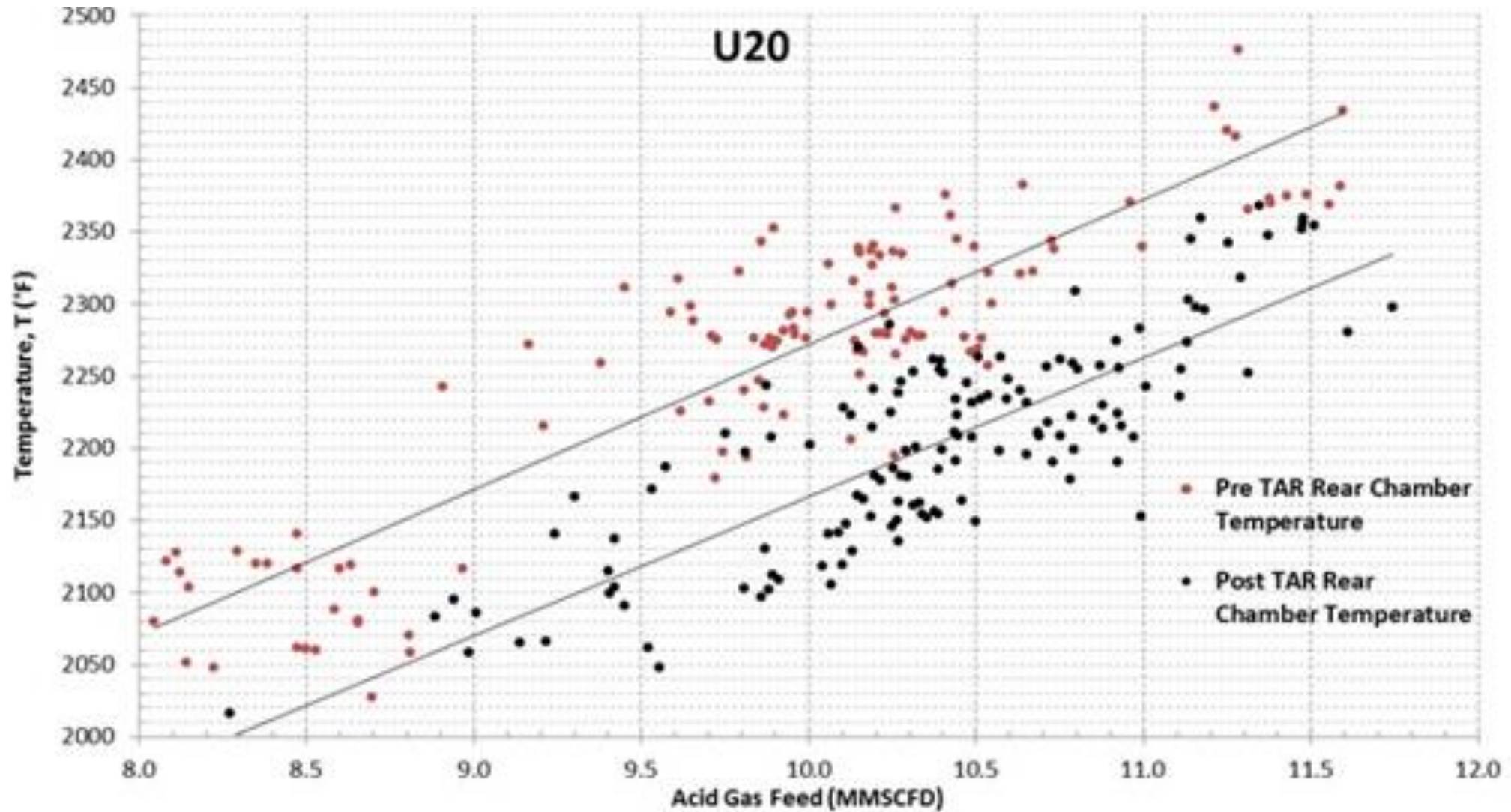


Higher Front Zone Temperatures



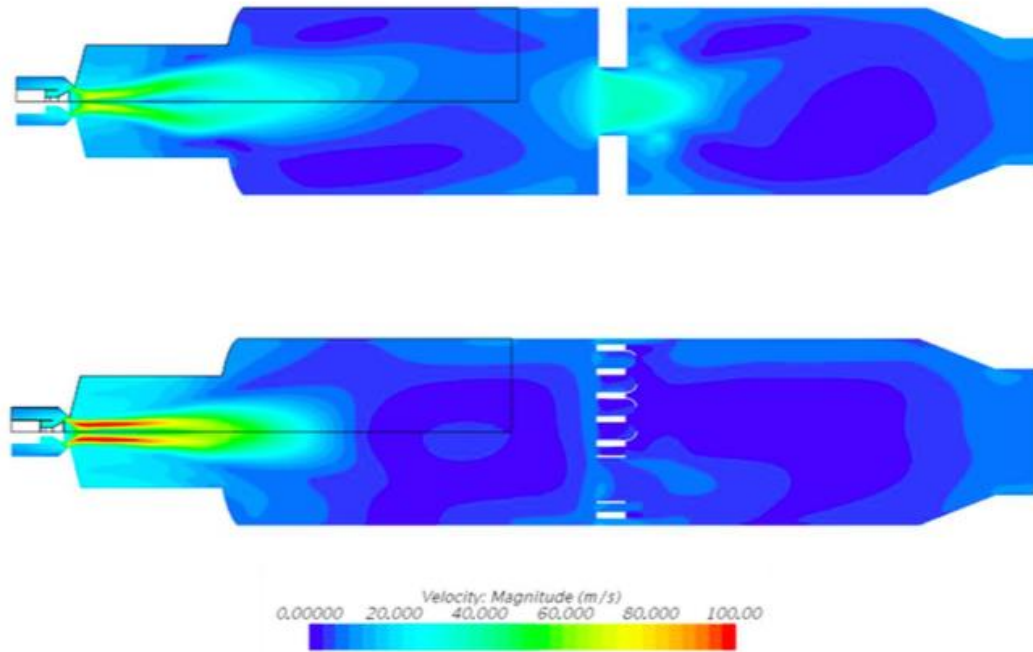
SRU Capacity

Lower Temperature in the TR Rear Chamber

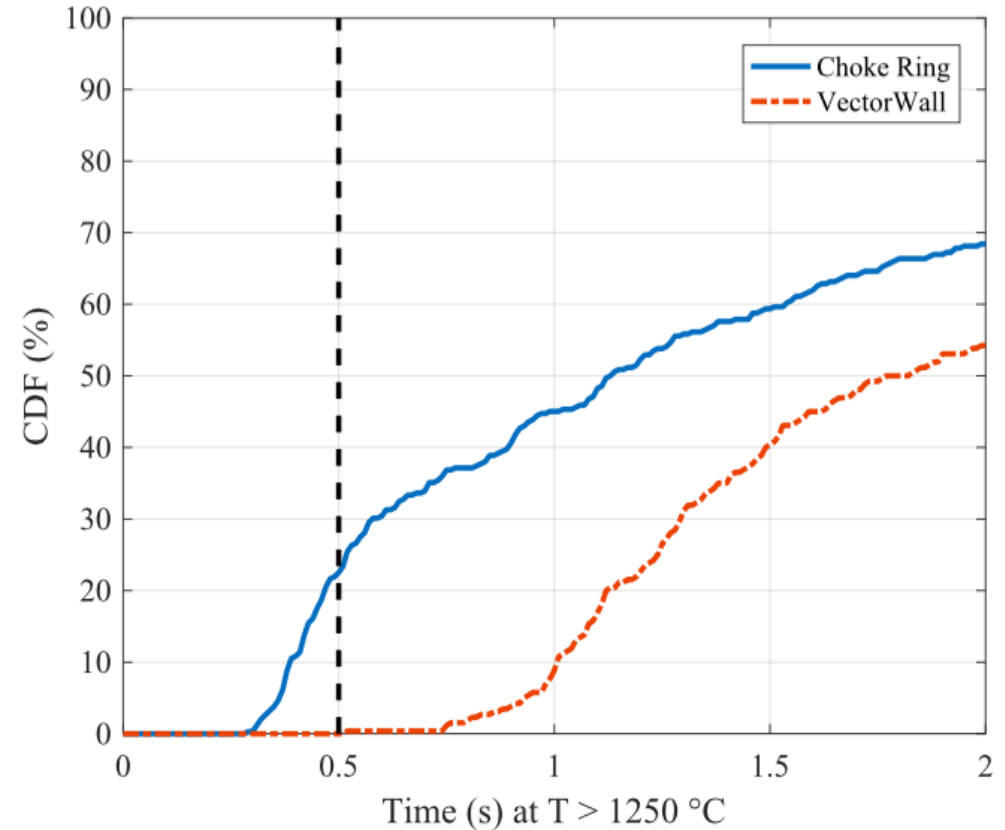




VectorWall Installation Results Improved Ammonia Destruction

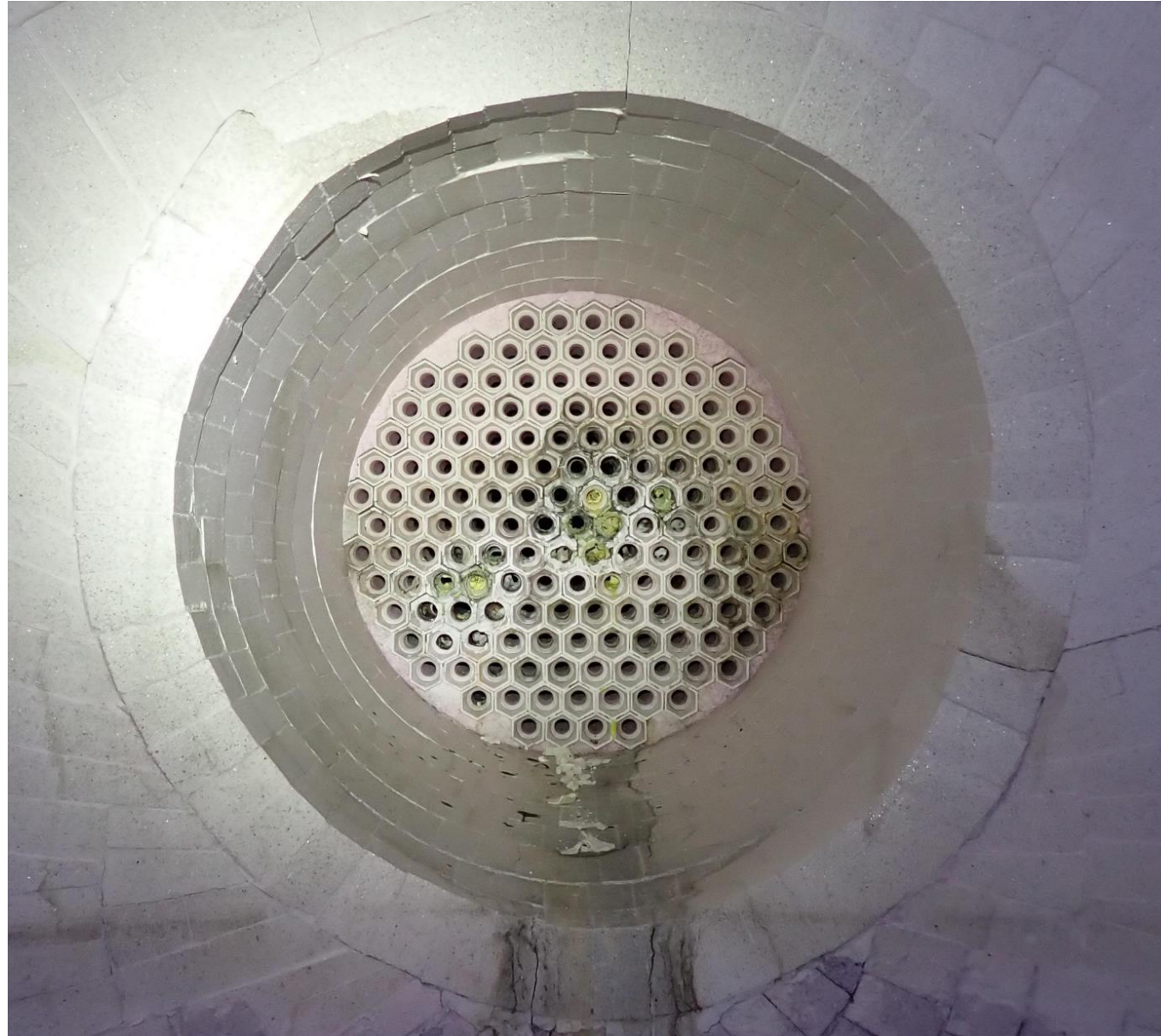


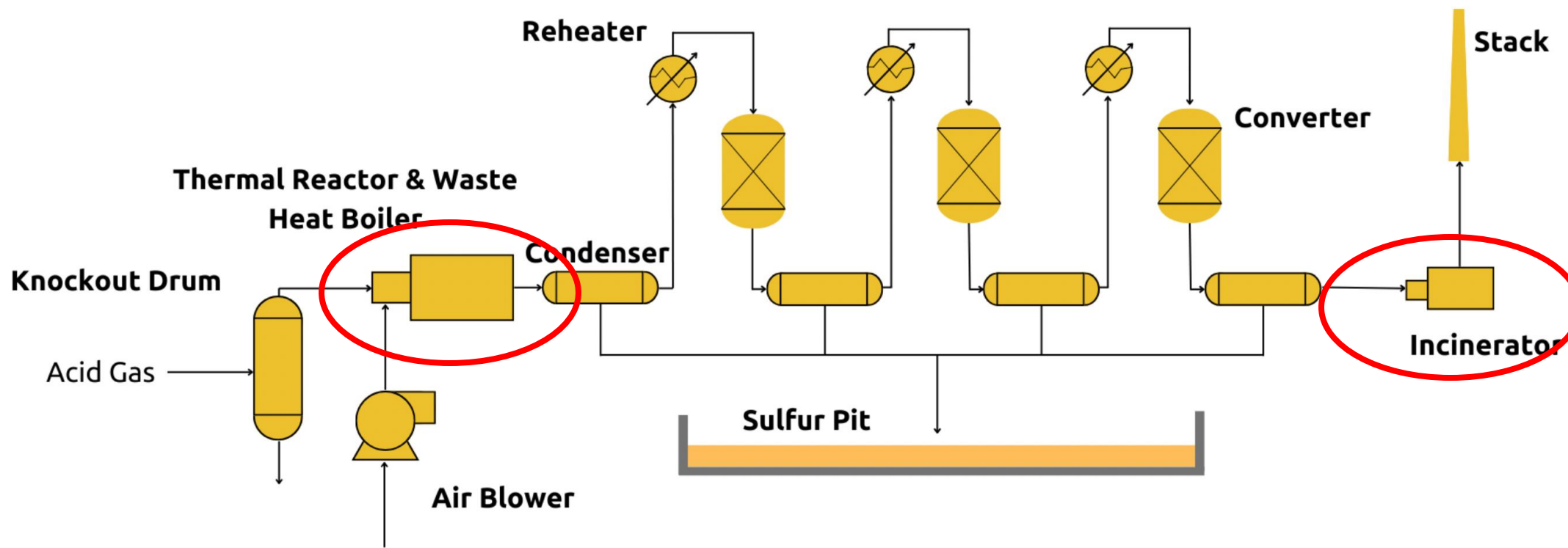
**Velocity Magnitude Comparison Between Choke Ring
(Top) & VectorWall (Bottom)**



Cumulative Distribution Functions of Residence Time
Vertical dashed line indicates cutoff residence time for
contaminant destruction

Ferrule / Tubesheet Damage





The Claus Sulfur Recovery Process

SRE

Primary Objective of the SRU Thermal Incinerator

Combustion of the H_2S , COS , CS_2 , Sulphur Vapour, Hydrogen and Carbon Monoxide to the mandated stack gas outlet specs for CO , TRS, etc.



SRE

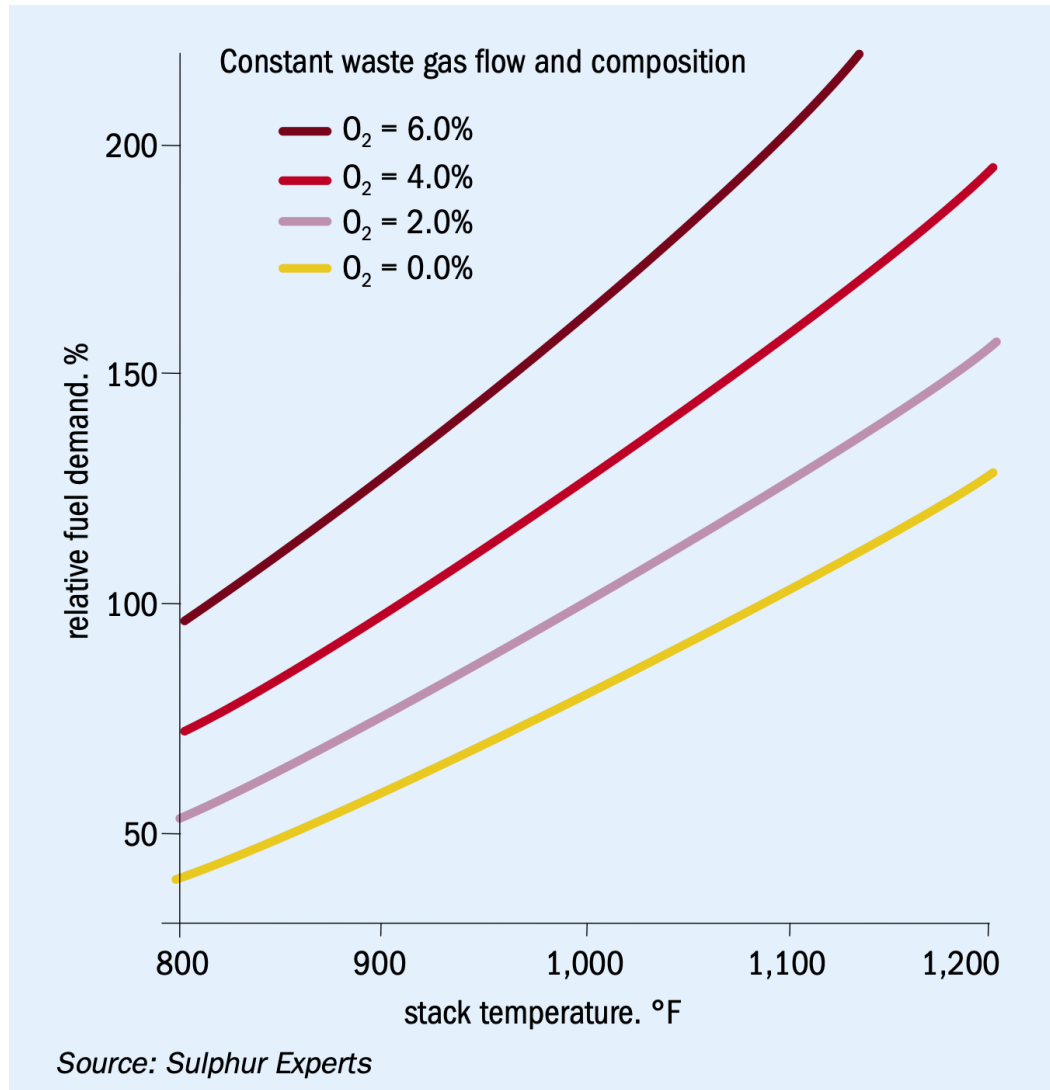
Thermal Incinerator Performance

- Incinerator Temperature
- Excess Oxygen
- Residence Time
- Kinetic Design Factor “K”
 - Empirical factor describing extent of mixing between the process streams
 - Equipment and Design Specific
 - Higher K values give lower emissions
 - Same emissions at lower temperatures/fuel gas consumption

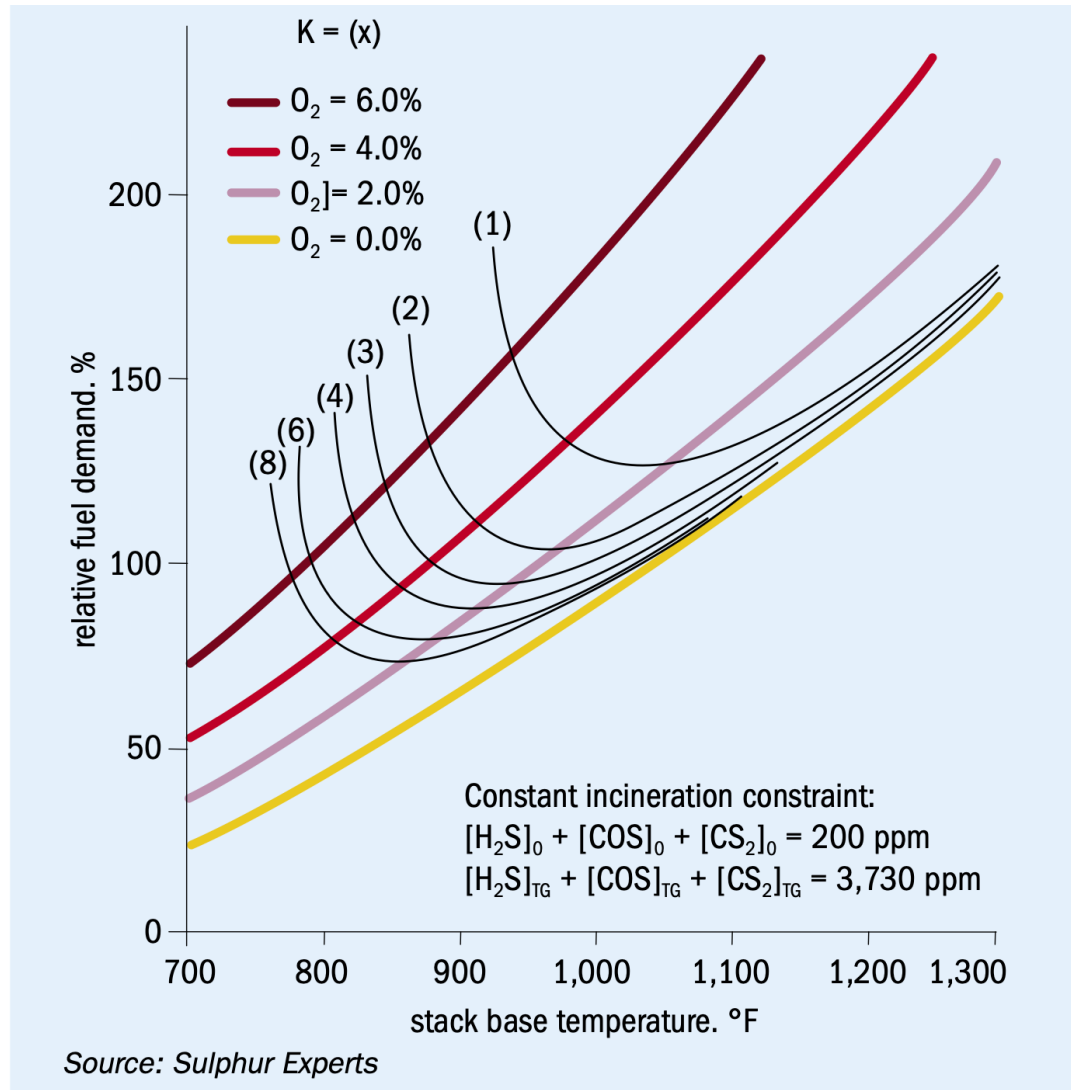


SRE

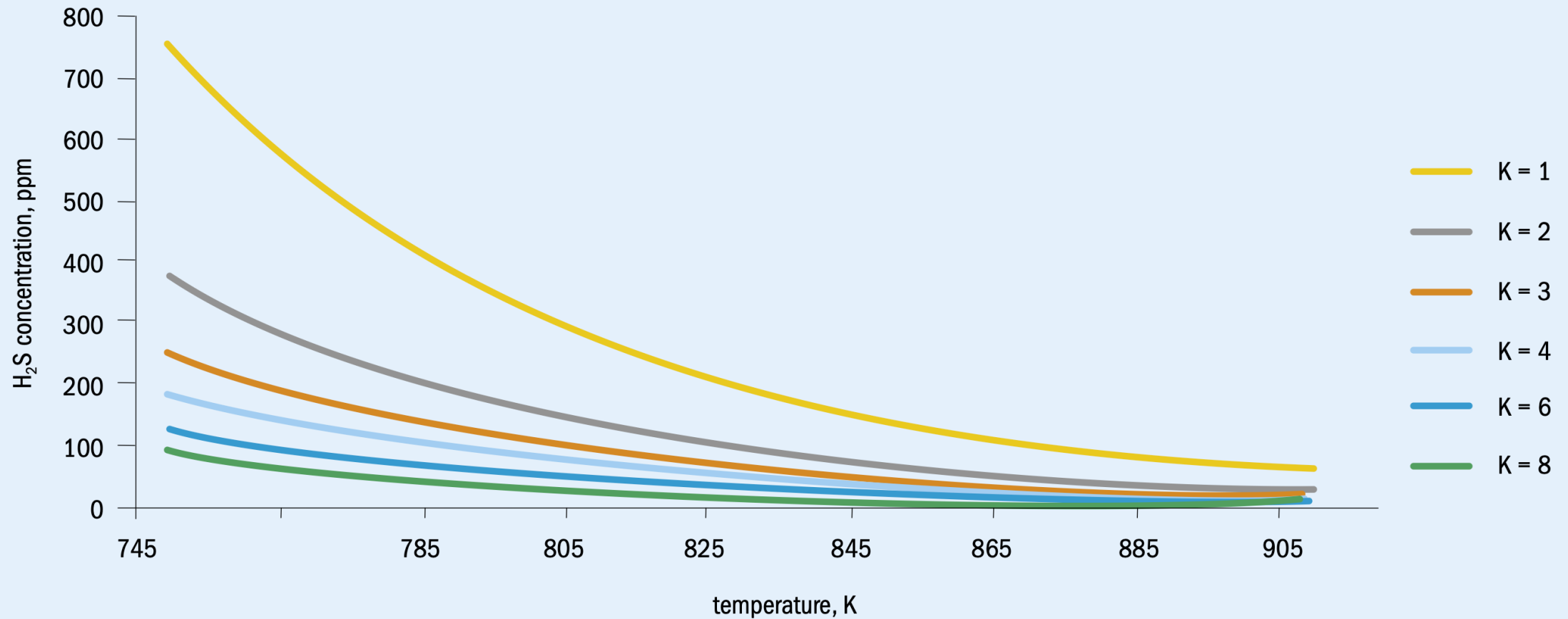
Fuel Demand vs Stack Temperature and XS O₂



How K values improve Incinerator Performance

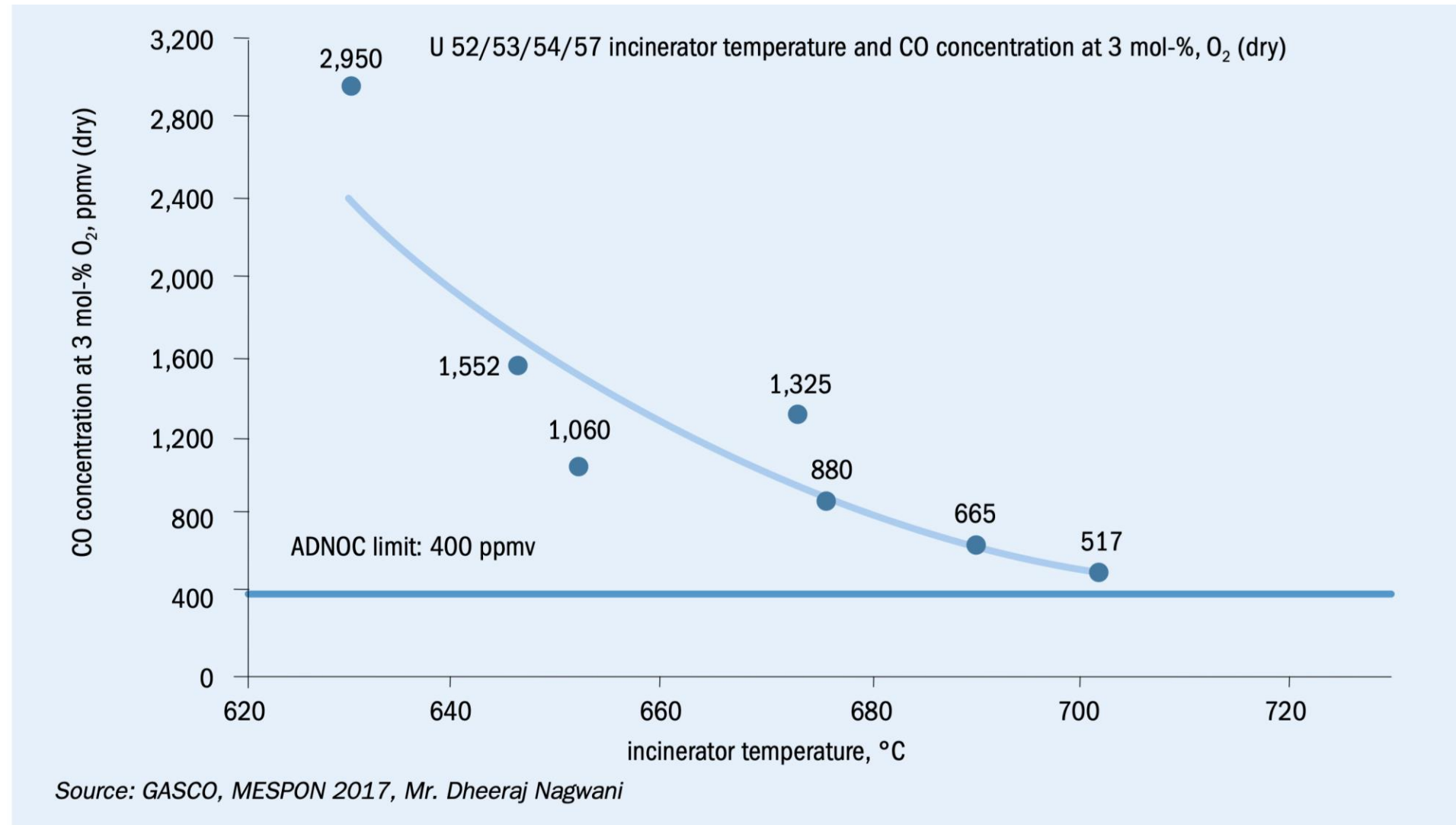


Effect of Kinetic Design Factor on H₂S Emissions



Source: Aspen Technology

Incinerator – Challenge meeting CO Limit



Blasch VectorWalls help meet CO specs by helping raise front-end incinerator temperature

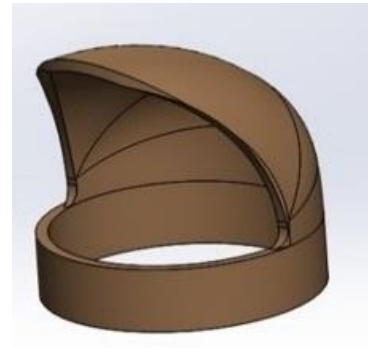
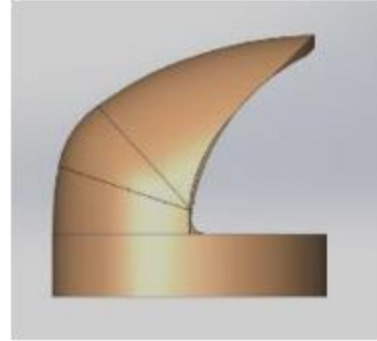


Vector Tile Configurations

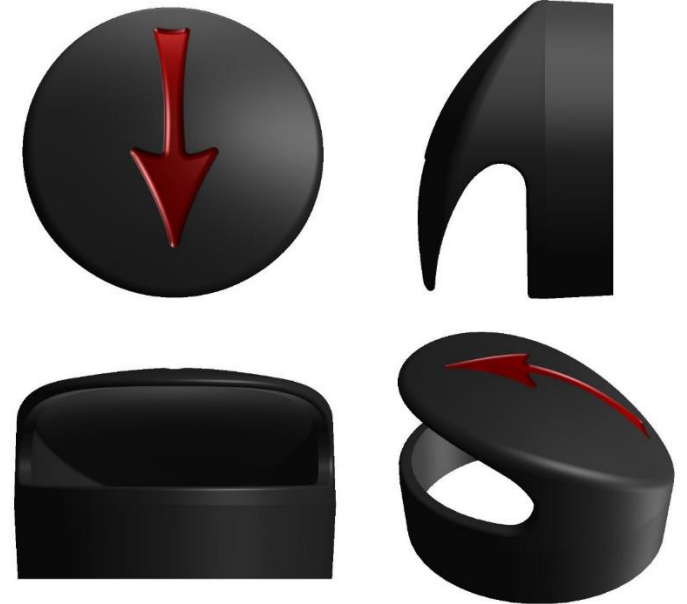
Version 1 (Existing)



Version 3 (Enhanced)



GEN 2: VECTOR WALL TILE



Blasch VectorWalls in Thermal Incinerators

Operating Results

VectorWalls installed by major companies in the Middle East in recent years

- Higher Front-End Incinerator Temperatures
- Fuel Gas Savings of 4 -10+%. – optimizing tile design can further boost savings
- Cost Savings of over a million USD/year for a 1,500 – 2,000 TPD gas plant (not accounting for CO₂ credits)
- Lower CO emissions
- Improved margin for operating within the specified emission regime

Successful Installation of the VectorWall at an Incinerator in ADNOC

ADNOC Classification: Internal



CARBON EMISSION REDUCTION THROUGH INNOVATIVE PRACTICE APPLICATION IN SRUS



Concept

Vector wall is an innovative technology in SRU incinerators that can reduce CO & CO₂ emissions by improving combustion process:

- Better Mixing Dynamics
- Improved reliability & less vibrations
- Lower Fuel Gas Consumption



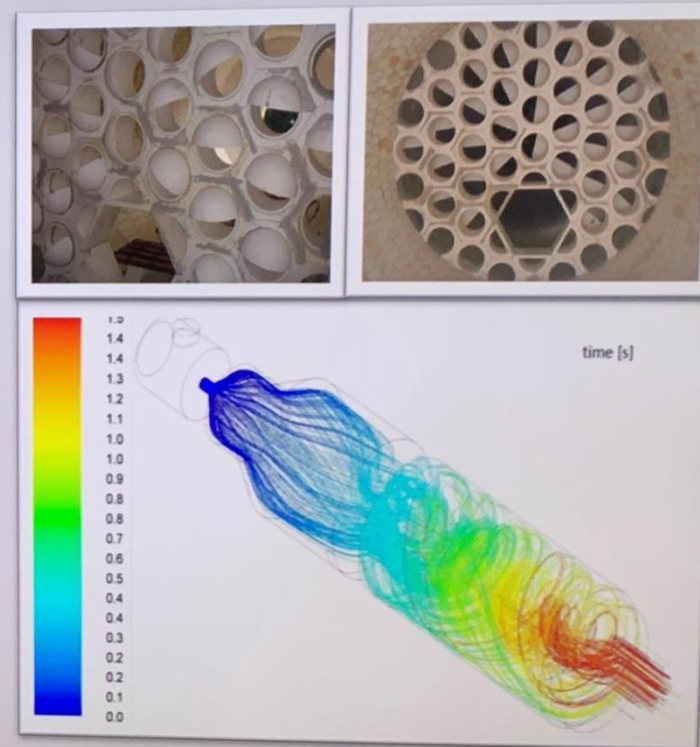
Value Proposition

- Achieve enhanced CO destruction
- Fuel gas reduction by 4%.
- Enhancing combustion zone at Incinerator.



Implementation within Sulphur Recovery Unit

Vector wall technology was deployed in an incinerator of one of the SRUs in ANDOC Gas operating sites in 2021 resulting in substantial improvement in the process dynamics, enhanced product yield and cutting of excess oxygen requirement



VectorWalls in Incinerators

Operating Results -- US Refinery

- Fuel gas usage reduced by almost 50%
- Elimination of almost all sulfur carryover downstream
- Lower excess oxygen required to maintain complete combustion
- Increased incinerator skin temperature eliminating sulfuric acid condensation
- VectorWall has not cracked or deteriorated after several years in operation



Blasch Experience

Blasch HexWalls and VectorWalls have been successfully deployed at over 250 units worldwide

- Gas Plants, Refineries, Sulphuric Acid Plants and Thermal Oxidizers
- Sizes ranging from under 100 TPD to over 1,000 TPD
- 1 meter up to 6 meter diameter
- Recently installed at several TOX in the Middle East to demonstrate fuel savings and other benefits
- Several offering reliable service in SRUs with oxygen enrichment

Also deployed in several dozen sulphuric acid plants to obtain a more compact furnace design and reduce NOx



HexWalls & VectorWalls -- Stability

- Several in trouble-free operation for 10 to 20+ years through many turnaround cycles, including at one of the largest SRU complexes in the world (8 TRs, 16 feet ID) for over ten years
- Excellent mechanical stability and reliability compared to traditional checkerwall and choke rings
 - Walls incorporate a patented tongue-and-groove interlocking design on all six sides forming a robust system when stacked; this design helps withstand extreme thermal expansion and contraction cycles
 - Mortarless construction provides enhanced integrity
- Resolved vibration / dislodged brick issues at several SRUs
- Highly creep-resistant mullite-bonded composition helps resist deformation under heavy loads and function effectively in high-temperature environments including O₂ enriched SRUs
- Depth of VectorWalls customized to Thermal Reactor / Incinerator size (diameter) to ensure maximum stability





VectorWalls Cost/Benefits

Slightly higher cost of the VectorWalls compared to traditional systems offset by several demonstrated benefits:

- Mortarless design ensures much faster installation, minimizing plant downtime
- Integrity through several turnaround cycles eliminates frequent replacement
- Protection of the tubesheet from direct flame radiation, a unique feature of the VectorWall design, eliminates catastrophic failures and costly repairs and downtime – key rationale for a leading refiner adopting the VW as their standard design.
- Payback is under a year, often a few months, because of fuel savings and other benefits



Thank you!

Questions?