

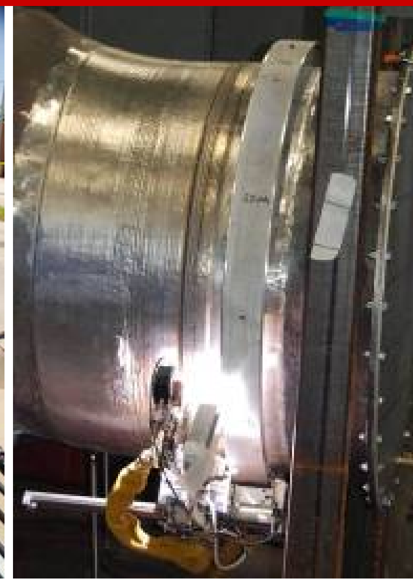


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MORE PRODUCTION - LESS RISK!

aquilex®

Oct 22-26, 2012, Ft McMurray, ON, CN

Coker Fractionator Project Review: Driving Safety and Integrity with Analytical Sophistication

Review of Scope

Need for Repair

•Significant Corrosion Thinning

•Large Portion of the Vessel Affected (18m Height)

Background

•Bottom portion clad with 405 SST

•Improved Corrosion Resistance Needed

•Uncertainty with extent of damage

Repair options considered

•Section Replacement

•Component Replacement

•Weld Metal Overlay

Owner Preferences

•Short duration of overlay preferred

•Structural impact concerns must be addressed

Main Fractionator Vessel

Machine Based Welding Repairs

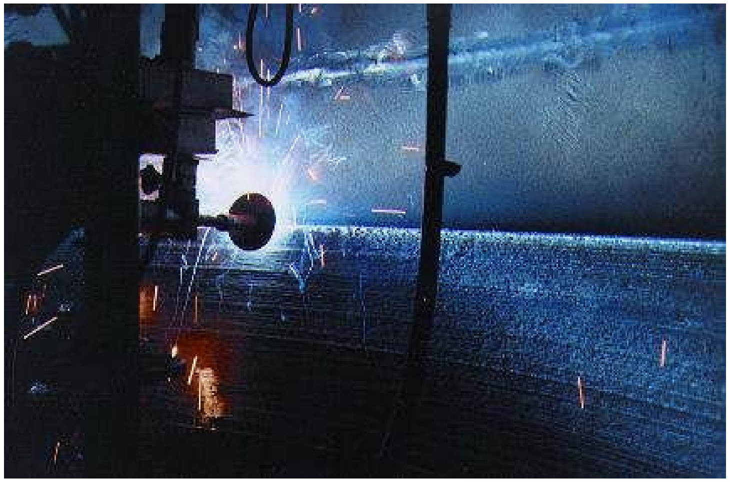
Importance: Machine vs. Manual

Component Repairs

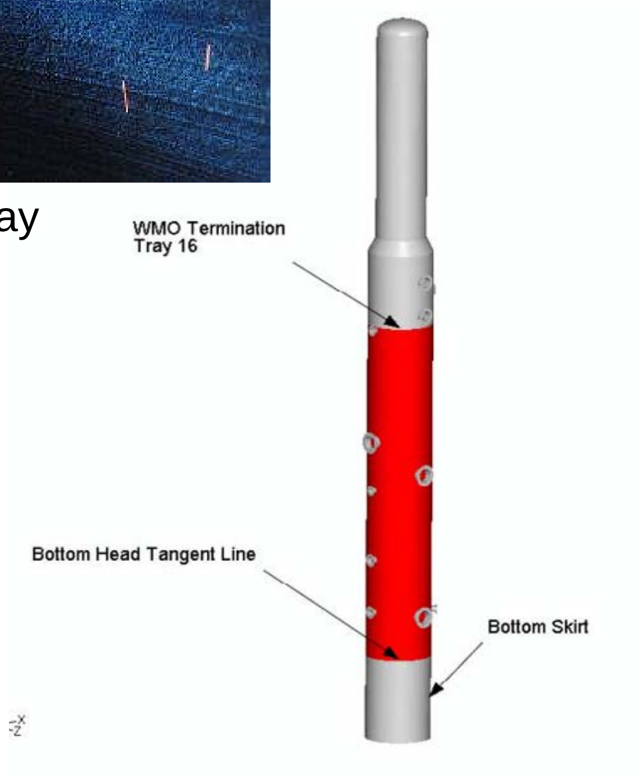
Repair vs. Replace

Comparison against conventional welding practices

- Control of Heat Input and Distortion
- Homogeneous Deposit Quality
- Production Rate



Machine Applied Overlay



Welding Beneficial Stresses

Welding Stresses

- Inevitable with full fusion bond
- Must be managed through parameter control
- Must be homogeneous

Basis / Key Contributors

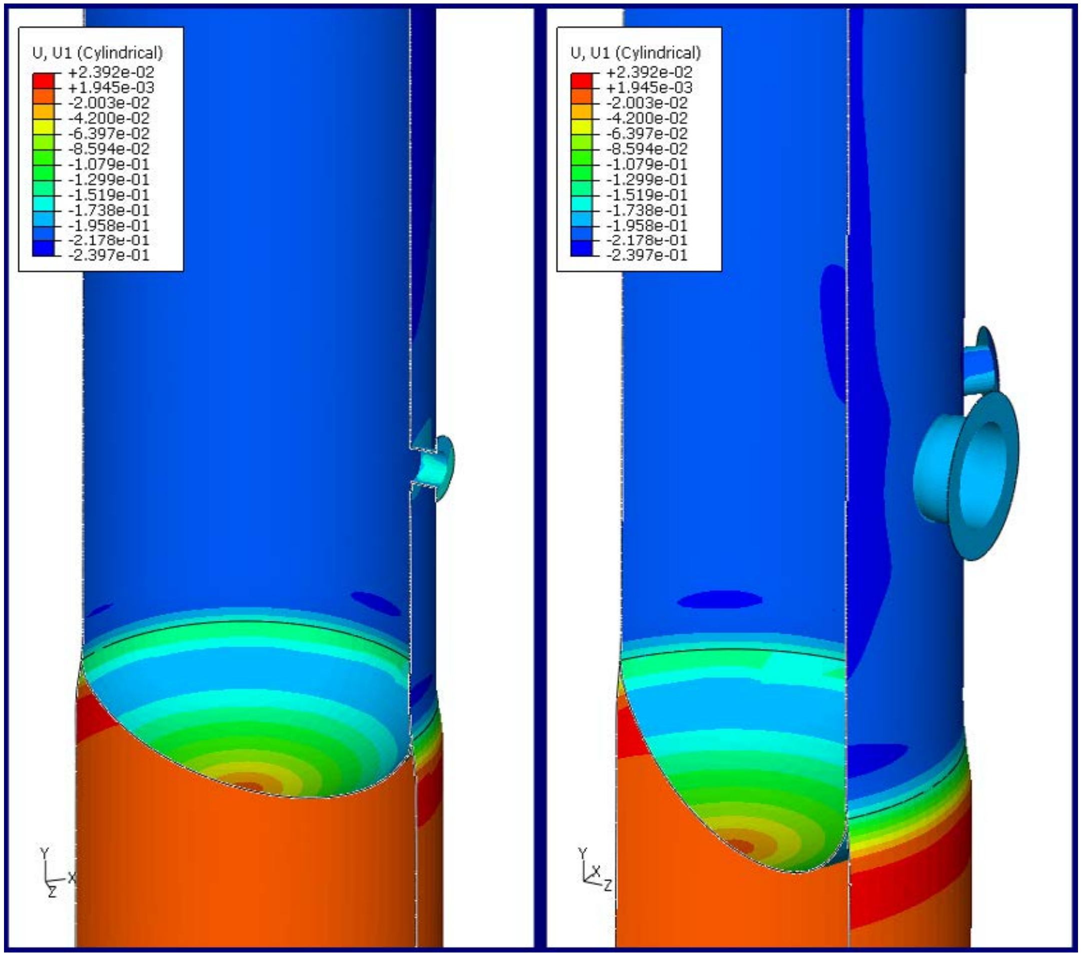
- Non Symmetrical structural components

Consequences

- Non Symmetrical distortion behavior

Machine applied predictability

- Allows for accurate modeling



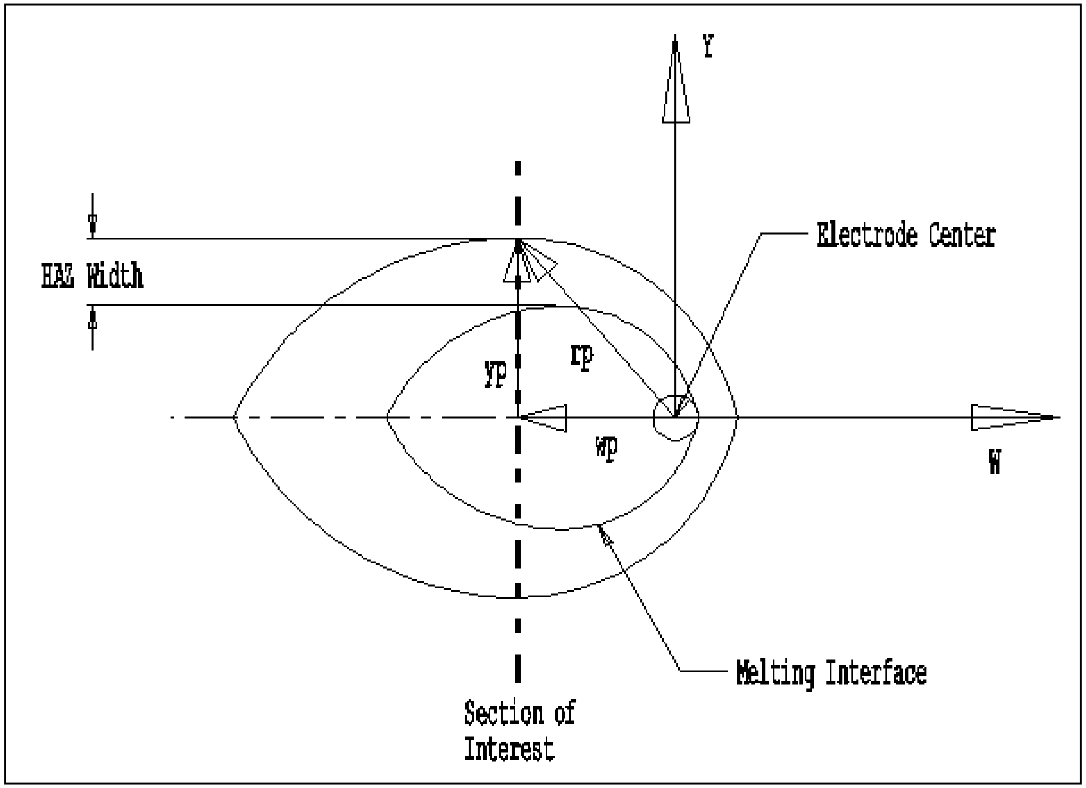
Predicting Welding Stresses

Basis for predicting –

Consistency of application

Brief review of history of Numerical Predictive Analysis

Benefits of NPA in validating repair designs



Coker Fractionator Repair Design

Repair Issues

•Improved Corrosion Performance

•Concerns about out of roundness ASME Section VIII

Objective of Repair Design

•Address structural risks

•Model Optimum Application Order

Considerations

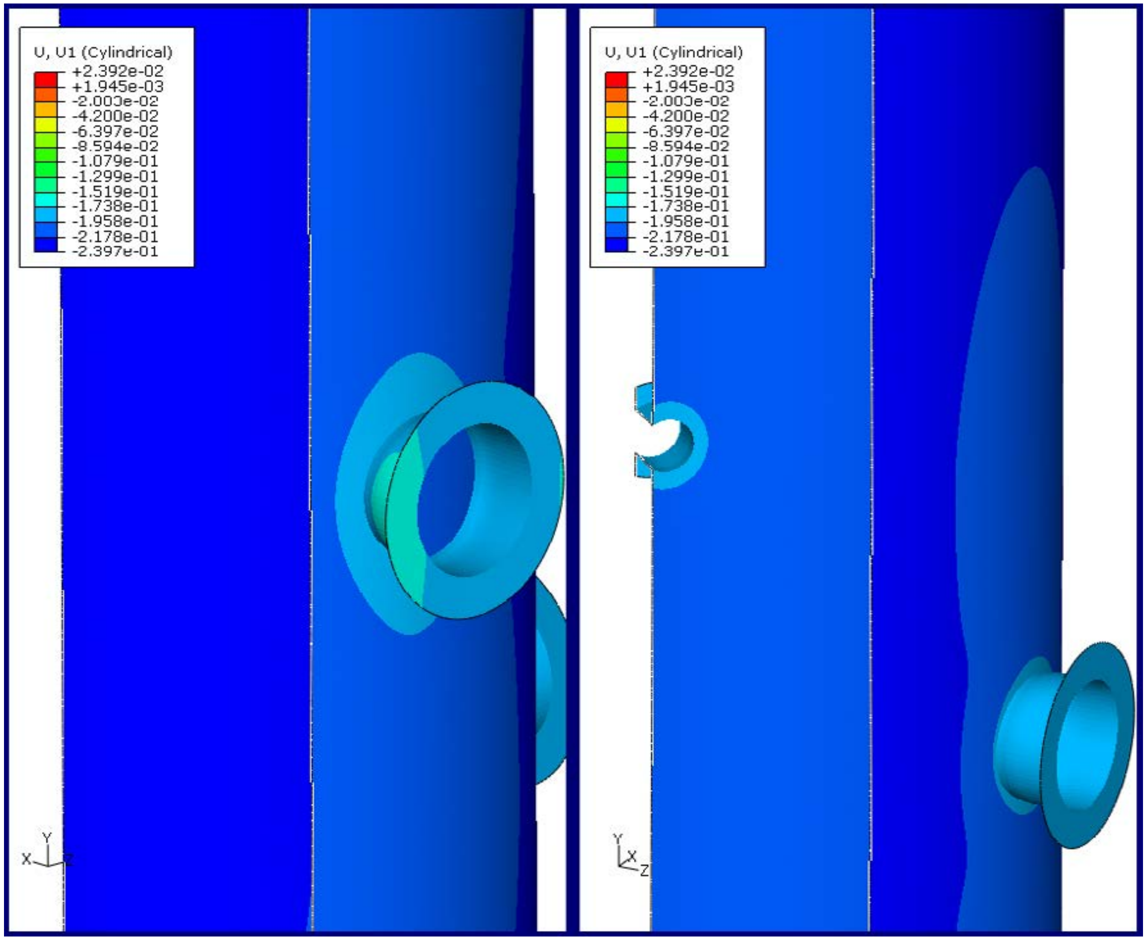
•Improve vs. replace

•Safety, Schedule, Performance

Application of NPA

Results

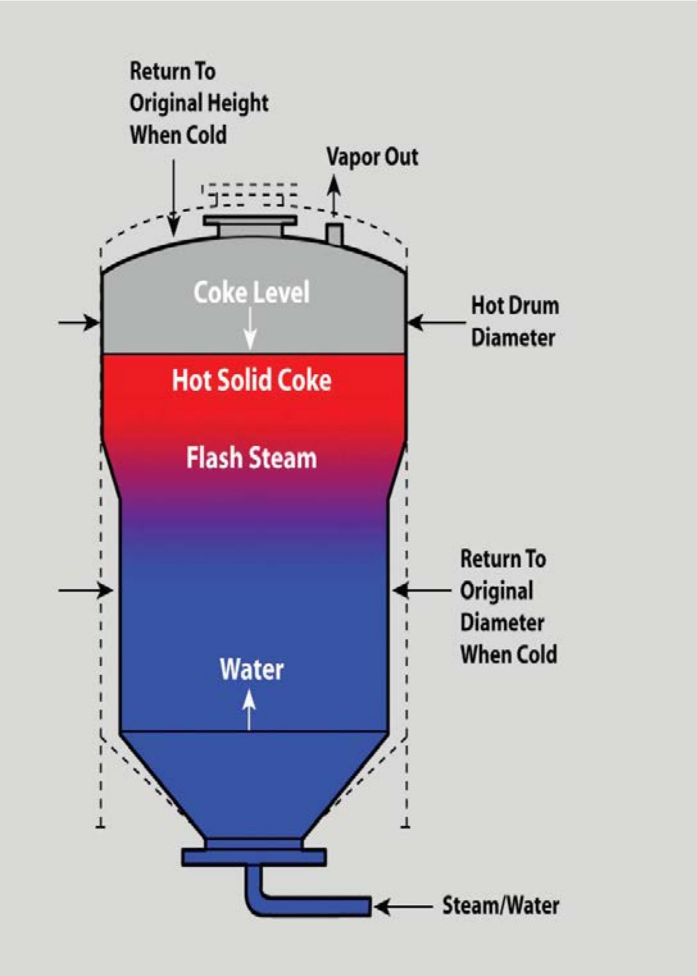
•0.04% and 0.02% Deviation at Critical



Delayed Coking Coke Drum Weld Repairs

Many applications for WMO

- Circumferential Seams
- Cracks
- Cladding repair / replacement
- Cone refurbishment
- Skirt cracking repairs
- Bulging



Graphic Courtesy of Stress Engineering

NPA of FCCU Design Repair

Additional example

•FCCU Stripper/Reactor

• High Temperature Creep Failure

•5 Year Life Extension Required

Anticipated Design Repair

•Model Existing Failure Condition

•Develop "Engineered Design Repair" to manage stress levels below creep failure limits

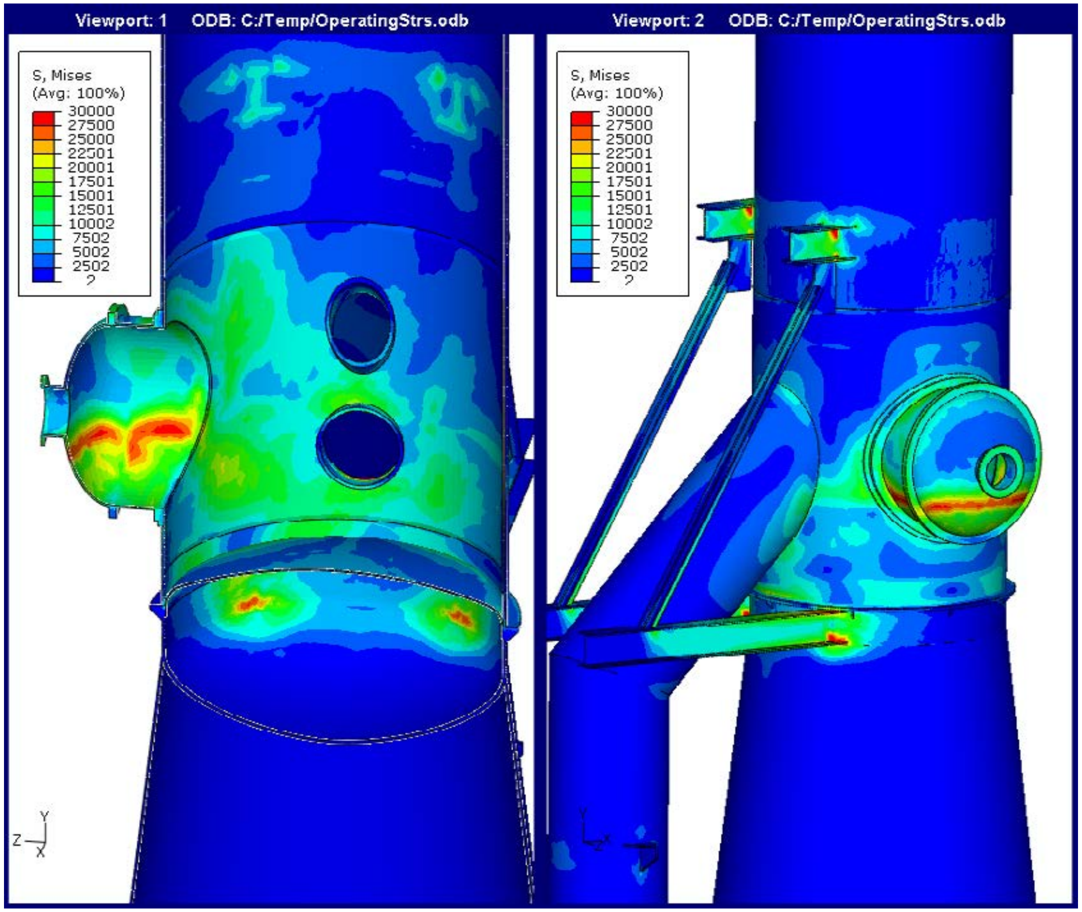
•Perform Level 3 FFS Analysis

Engineered Design Repair

•Reduced scope of work

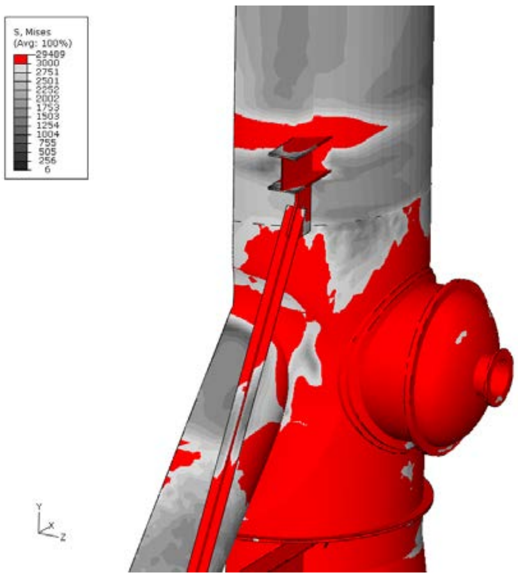
•Reduced cost for repair

•Validation of repair lifetime



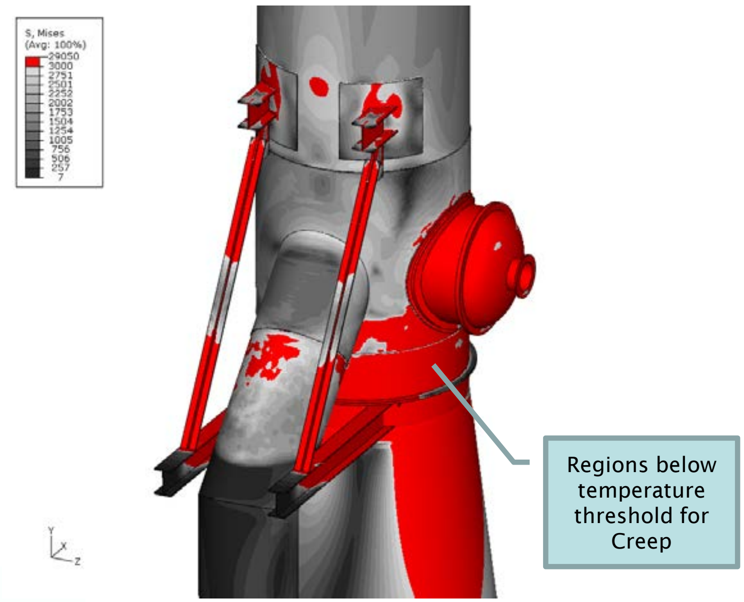
FCCU Stripper/Reactor Failure Area

NPA of FCCU Design Repair

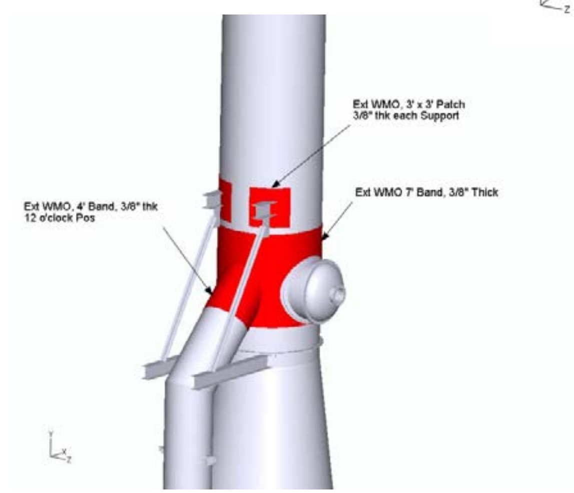


Areas Exceeding Creep Stress Limit

Estimated Life of Repair Well in Excess of 5 Years



Post Overlay Stress Gradients

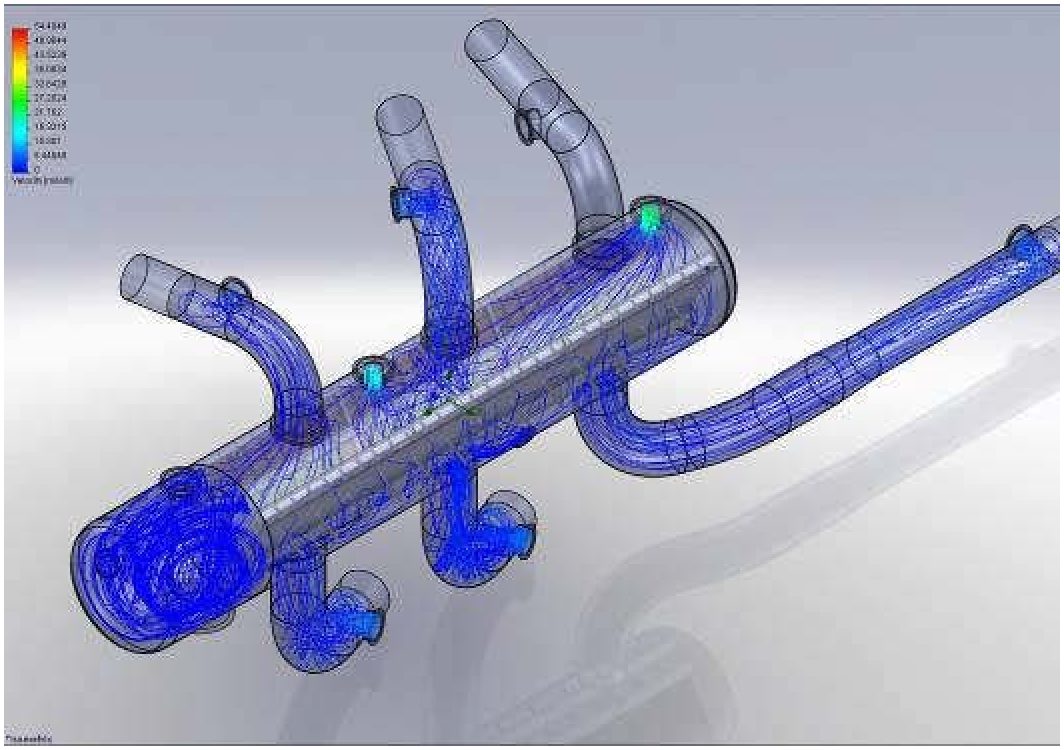


Engineered Structural Overlay

Engineering Analysis for Fume Control

Application of CFD

- Fume / Smoke Control
- Ventilation Design
- Temperature Control
- Personnel Safety & Productivity

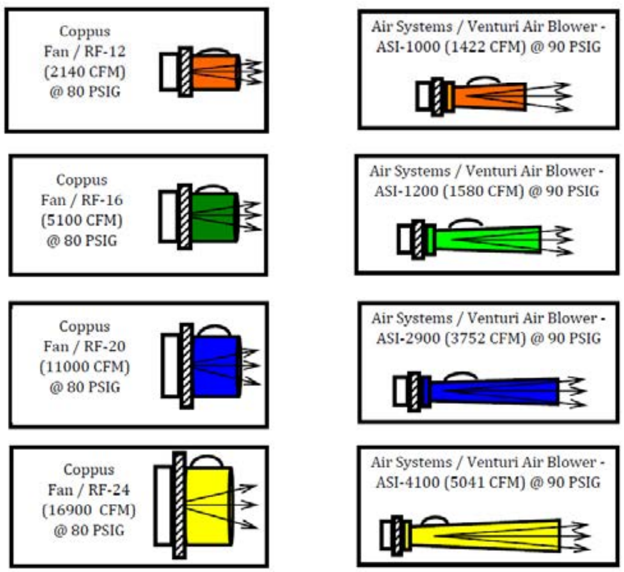


Aquilex WSI / Ventilation Plan

Ventilation Equipment

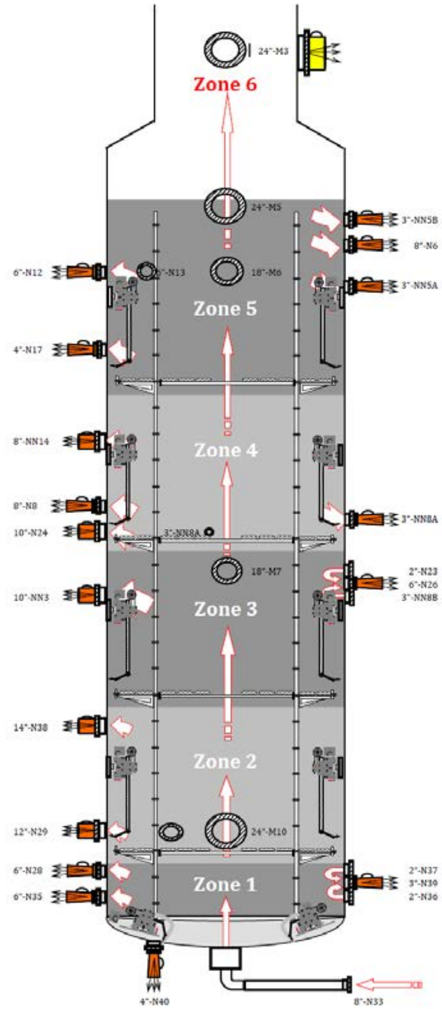
Location of Open Inlet Nozzles and Exhaust Blower Nozzles

Zone #1 & #2			Zone #3 & #4			Zone #5 & #6		
Nozzle Number	Blower Model	Blower CFM	Nozzle Number	Blower Model	Blower CFM	Nozzle Number	Blower Model	Blower CFM
N38	RF-12	2140	NN14	RF12	2140	M3	RF-24	16900
N29	RF-12	2140	N8	ASI-1000	1422	NN5B	ASI-1000	1422
N35	ASI-1000	1422	N24	RF12	2140	N6	ASI-1000	1422
N39	ASI-1000	1422	NN8A	ASI-1000	1422	NN5A	ASI-1000	1422
N40	ASI-1000	1422	N26	ASI-1000	1422	N12	ASI-1000	1422
			NN3	RF12	2140	N17	ASI-1000	1422
CFM Zone		8546	CFM Zone		10686	CFM Zone		24010
			Total CFM all zones		43242			



25% Efficiency 10811

Average per weld machine 1081



Summary

Keys to Reliable Design Repairs

Weld Overlay is not a commodity

Does your organization have the specifications in place to include automated weld overlay as a viable option?

- Engineered Repairs
  - Machine Technology
  - Tooling Development
  - Welding Engineering
  - FE Modeling / NPA
  - Metallurgical Engineering
  - Resource Depth
    - Equipment
    - Procedures / Programs
    - Trained Personnel
  - Demonstrated Experience

Questions

Contact Information

Jack Brownlee
General Manager – Aquilex WSI Canada
Jbrownlee@aquilex.com
(780) 690-0688
Edmonton, AB, CN

(678) 728-9100
Norcross, GA, USA