Full-Scale Demonstration of a Mercury Oxidation Catalyst Upstream of a Wet FGD System

DOE-NETL Cooperative Agreement DE-FC26-06NT42778

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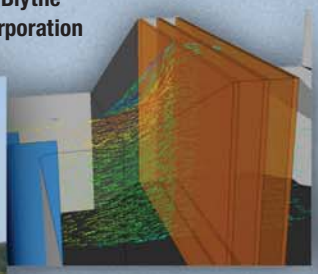
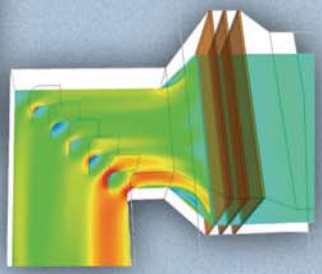
URS Corporation





Project Overview

- Demonstrate gold catalyst upstream of a full-scale wet FGD module for oxidizing Hg^0, enhancing FGD removal of total Hg
- To be conducted at the Lower Colorado River Authority's (LCRA) Fayette Power Project Unit 3
  - Located near LaGrange, Texas
  - 460 MW
  - Fires PRB coal
  - Low NO_x burners, cold-side ESP, LSFO wet FGD
  - FGD has 3 absorbers, 2 operate at full unit load
  - Only Module C will have catalyst retrofitted (~200 MW)

Project Description

- NETL Project Manager: Chuck Miller
- Total Value: $4.08 million ($2.5 million DOE share)
- Period of Performance: 7/24/06-7/23/09
- Project Participants/Co-funders (role):
  - LCRA (host)
  - EPRI
  - Great River Energy
  - Johnson Matthey (catalyst supplier)
  - Southern Company
  - SRP
  - TVA (patent holder)
  - URS (prime contractor)
  - Westar

Project Objectives

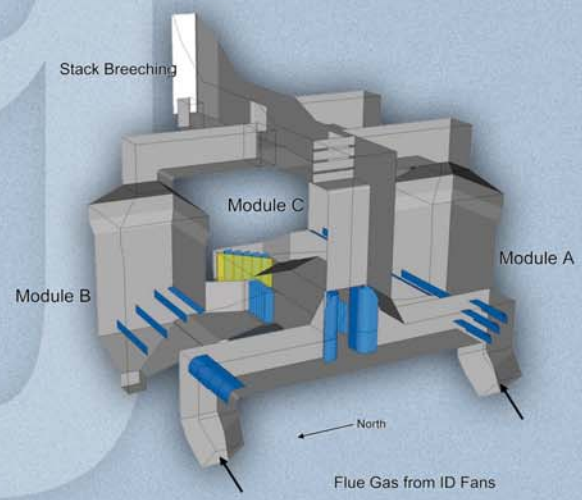
- Confirm catalyst quantities and life for achieving:
  - Average of 70% oxidation of Hg^0 in PRB flue gas over 24-mos.
  - Corresponding increase in FGD capture of Hg
- Meet or exceed solicitation objectives:
  - 50% to 70% Hg removal beyond baseline removal
  - Cost at least 50% lower than baseline of $60,000/lb of Hg removed

Major Project Tasks

- Design Module C duct modifications for catalyst retrofit (Aug-Dec 06)
  - Reduce gas velocity to ~15 ft/sec at catalyst
  - CFD modeling of gas flow distribution
  - Future application on entire unit would likely be installed at ESP outlet (~5 ft/sec)
- Construct duct modifications (Dec 06-May 07)
- Procure and install catalyst (Dec 06-July 07)
- Operate catalyst upstream of Module C (July 07-June 09)

Long-term Catalyst Evaluation

- Up to 24 months duration
- Bimonthly SCEM measurements
  - Hg0 oxidation across catalyst,
  - Net removal of Hg across FGD Module C
  - Compare to other FGD module in service
- Three sets of Ontario Hydro verification measurements (each w/triplicate runs)
  - Catalyst inlet, catalyst outlet, Module C outlet
  - "Baseline" sampling across other FGD module
- Track catalyst pressure drop vs. time
- Other flue gas characterization (HCl, etc.)



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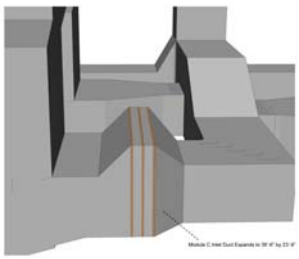
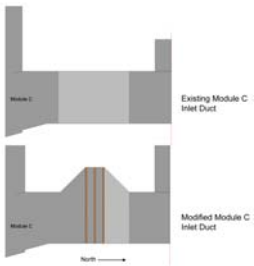
CFD Modeling Results

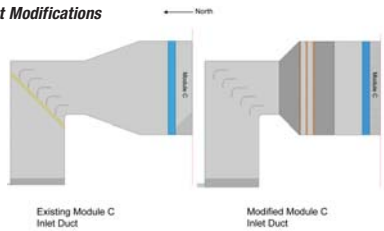
Module C Inlet Duct Modifications



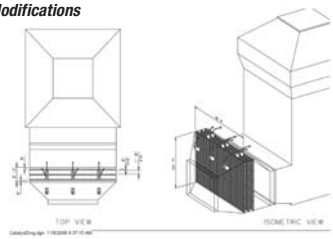
Module C Inlet Duct Modifications
Elevation View, Looking West



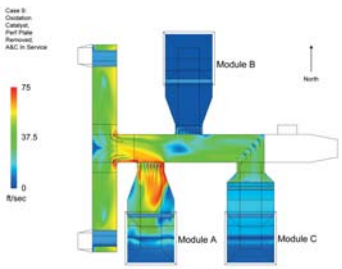
Module C Inlet Duct Modifications
Plan View



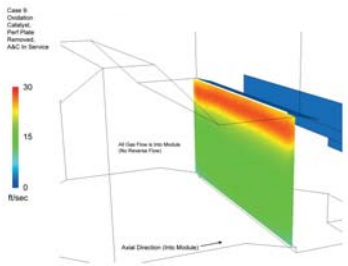
Module C Inlet Duct Modifications
Sonic Horn Layout



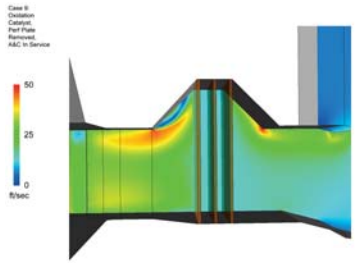
Gas Velocity Magnitude
Plan View



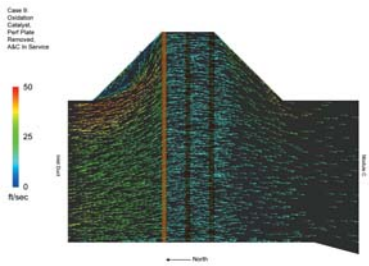
Axial Component of Gas Velocity
Module C Inlet



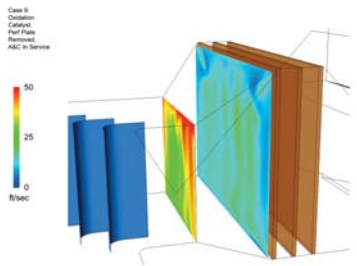
Gas Velocity Magnitude
Module C



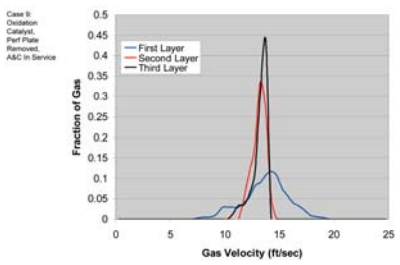
Gas Velocity Vectors
Module C



Gas Velocity Magnitude
Module C, Upstream of New Oxidation Catalyst



Gas Velocity Distribution Upstream of Each Catalyst Layer



Summary of CFD Results

Case	Description	Gas Flow Split to FGD Modules			Perf Plate dP	Catalyst dP	Average Superficial
		A	B	C	IWG	IWG	Gas Velocity (ft/sec)
1	Existing Operation	50.5		49.5	0.80		
2	Existing Operation		51.0	49.0	0.80		
9	Catalyst	54.8		45.2		1.40	13.2
10	Catalyst		55.1	44.9		1.40	13.1

Conclusions:

- Existing perforated plate can be removed
- No gas flow straighteners required at catalyst chamber
- Predicted 0.6 IWG increase in pressure drop to module C will not significantly alter gas flow distribution among modules

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