SCR CATALYST TESTING FACILITY

Innovative Combustion Technologies' independent catalyst testing services can help you avoid the costs of replacing your catalyst too early or too late

Offering unbiased 3rd party testing with a high ROI and a quick turnaround time

COMPANY OVERVIEW

Innovative Combustion Technologies, Inc. (ICT) is first and foremost a service company. Based in Pelham, Alabama, we have been serving the power industry since 1993. We provide cost efficient, reliable solutions to the most challenging problems. We specialize in offering assistance to power plants (with units ranging from 50MW to 1300MW) to resolve operational and maintenance challenges, optimize combustion, improve operating efficiencies, increase unit capacities, and minimize emissions.

We are most frequently called upon as troubleshooters to identify opportunities for improvement that can be achieved by optimizing the operation, maintenance and function of equipment between the pulverizer and the stack. Along with providing services as boiler and combustion system specialists, we provide high quality testing equipment, the design and manufacture of devices to measure and manage airflow, along with other equipment to enhance the performance of pulverizers, electric utility boilers, and combustion systems.

ICT operates the only independent pilot-scale SCR catalyst testing facility in the U.S.

In addition to the services outlined above, we operate the only independent pilot-scale SCR catalyst testing facility in the U.S., meaning we will provide unbiased data, independent of the original equipment manufacturers or regeneration companies.

ICT's strength is the combined manpower, specialized testing equipment, and expertise to provide comprehensive boiler and SCR/AIG tuning programs to meet the complex needs inherent in today's power industry.

WHY YOU SHOULD TEST YOUR SCR CATALYST WITH ICT

When it comes to replacing catalysts, power plant operators often find themselves following the manufacturer's recommendations. Many manufacturers use a standardized model to predict when it's time to replace catalyst layers, and often these OEM recommendations are not available to the end-user until it is too late. If you're like most EGUs, you may wonder if this standard replacement schedule accounts for the unique operating conditions of your plant and if the manufacturer is prioritizing your needs.

For various reasons, some catalyst material deactivates at irregular intervals; therefore catalyst should be tested regularly to ensure they are run to the end of serviceable life, rather than replaced simply because the manufacturer says they should be.

At Innovative Combustion Technologies we think taking catalyst replacement advice from the company that's selling you the catalyst is a bit like having a fox in the henhouse. It doesn't make a lot of sense. As the only independent pilot-scale SCR catalyst testing facility in the U.S., ICT provides power plants unbiased data (available within weeks of sampling), independent of the original equipment manufacturers or regeneration companies. At the end of the day, that means potentially saving millions in operating costs with the confidence your catalyst is keeping your EGU in environmental compliance.

1) Maximize your catalyst investment potentially saving millions in operating costs

2) Upfront, flexible turnaround times to meet your EGU's needs with preliminary sample results in as little as two weeks

3) Unbiased data, independent of the catalyst manufacturers and regeneration companies

4) 25 years of experience in helping EGU's meet stringent EPA emission standards

5) 1,000 catalyst samples tested to date

6) EPRI Round-Robin participant

SCR CATALYST TESTING FACILITY

Independent, highly reliable and accurate data

- Reporting unbiased data, independent of the original equipment manufacturers and regeneration companies
- EPRI Round-Robin participant
- Catalyst sample activity is evaluated at the exact temperature and flue gas composition of the full-scale SCR system
- Over 1,000 catalyst samples tested to date

Catalyst deNO_x activity

- 5% error in NO_x removal can translate into millions of dollars of NO_x credits or failure to maintain emissions compliance
- Primary measure of SCR catalyst performance

SO_2 - SO_3 conversion rates that profoundly influence:

- Visible emissions/opacity (blue plume)
- Acid dew point (back-end corrosion)
- Heat rate (lower SO_3 allows lower air heater exit gas temperatures)
- ABS fouling of the air heaters (reduced or eliminated with lower SO_3)
- Efficacy of mercury (Hg) capture systems (elevated SO_3 reduces activated carbon injection (ACI) Hg capture efficiency)

Compositional analysis of the catalyst samples using X-ray flourescense (XRF) to identify poisons and/or contaminants that contribute to increased deactivation rates. Samples analyzed for both bulk and surface poisoning/fouling species.

Comparison of actual catalyst deactivation rates to design and projecting catalyst lifetime for the SCR system to aid catalyst management programs.

Evaluate impact of firing different coals on catalyst life.

FURNACE

An 800,000 Btu/h natural gas furnace is used to generate flue gas. Sample inlet oxygen (O_2) and NO_x levels are controlled at the furnace by adjusting the air-to-fuel ratio and dosing the natural gas with ammonia (NH_3), respectively.

MOISTURE CONTROL

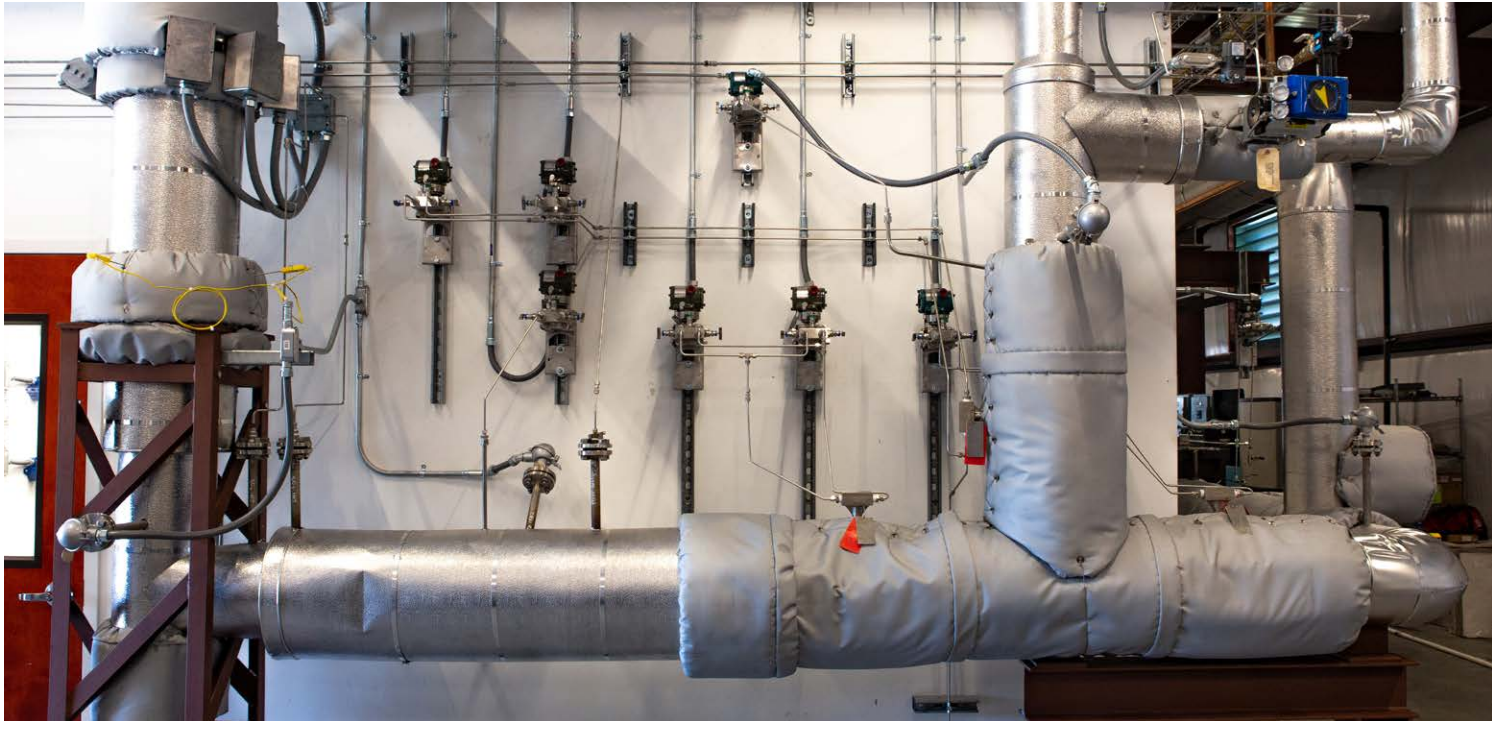
The facility has the capability to accurately control the moisture content of the flue gas to match that of the full-scale SCR system being evaluated. This eliminates the need to apply moisture correction curves when determining catalyst activity.

ELECTRIC AIR HEATER

The electric air heater is used to re-heat the cooled flue gas after the moisture control point to the SCR design operating temperature (typically 600-800°F).

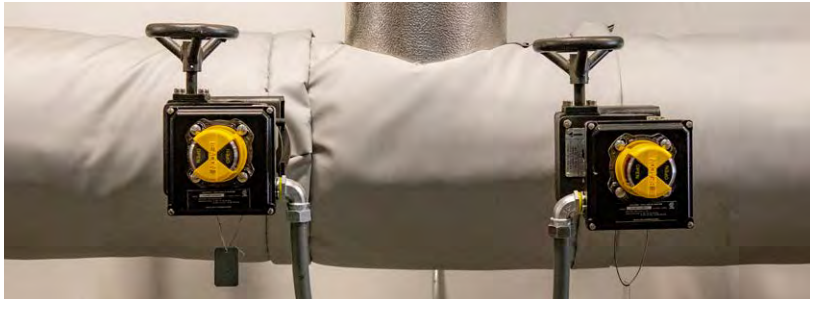
GAS INJECTION POINT

The flue gas is doped with sulfur dioxide (SO_2) via cylinder-fed injection. Post combustion NH_3 is added during deNO_x activity testing to achieve the desired NH_3-to-NO_x ratio.



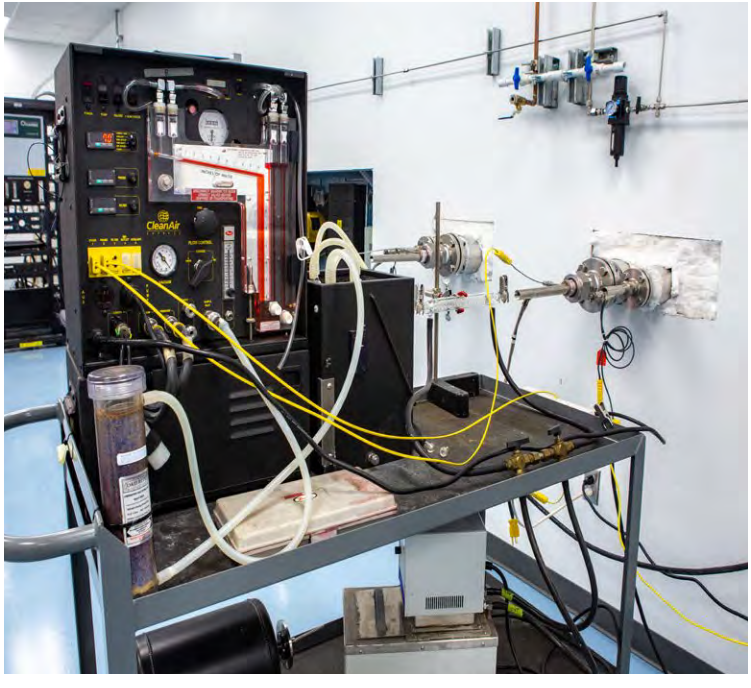
TESTING CHAMBERS

Catalyst samples are tested in one of four available testing chambers. The chambers are sized to house full-length catalyst samples (>1,400 mm) with a nominal cross-section of 150mm x 150mm.



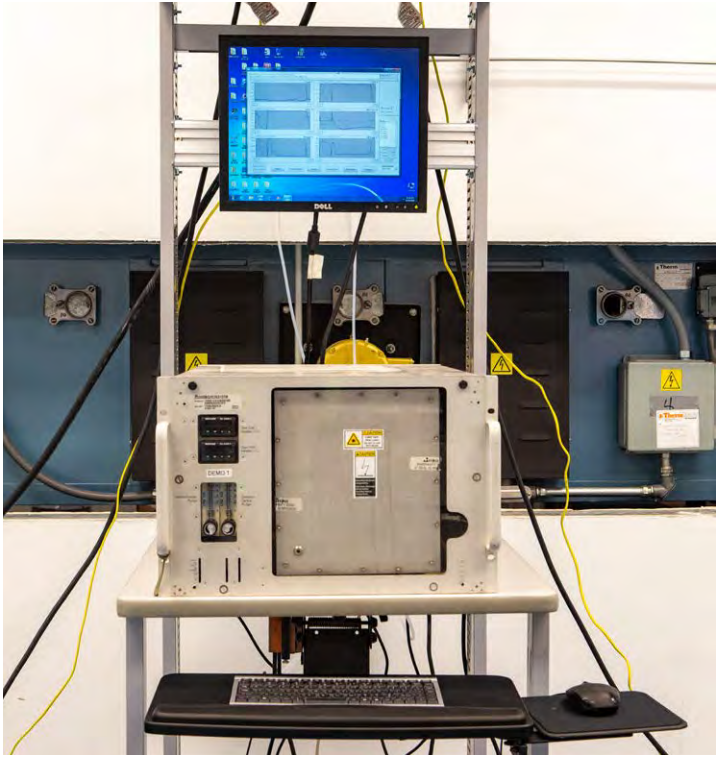
SO_2-SO_3 CONVERSION (EPA METHOD 8A/CCM)

Controlled condensation testing (EPA Method 8A) is conducted to measure SO_3 at the catalyst inlet and outlet simultaneously. All probes and lines are heated to maintain temperatures above the condensation dew point of SO_3.



SO_3 TITRATIONS

All SO_3 titrations are performed with an auto-titrator to provide rapid and precise results. Performing titrations on-site ensures no trending in the final reported result.



CATALYST ACTIVITY

The facility is equipped with Fourier Transform Infrared (FTIR) analyzers to measure the flue gas composition at the catalyst inlet and outlet, including NO_x, to calculate the deNO_x activity for a given sample.

INDUCED DRAFT FAN

The Induced Draft (ID) fan controls the gas volume passing through the test chamber. This flowrate is set to match the full-scale linear velocity through the catalyst.

FULL LAB WITH XRF ANALYSES

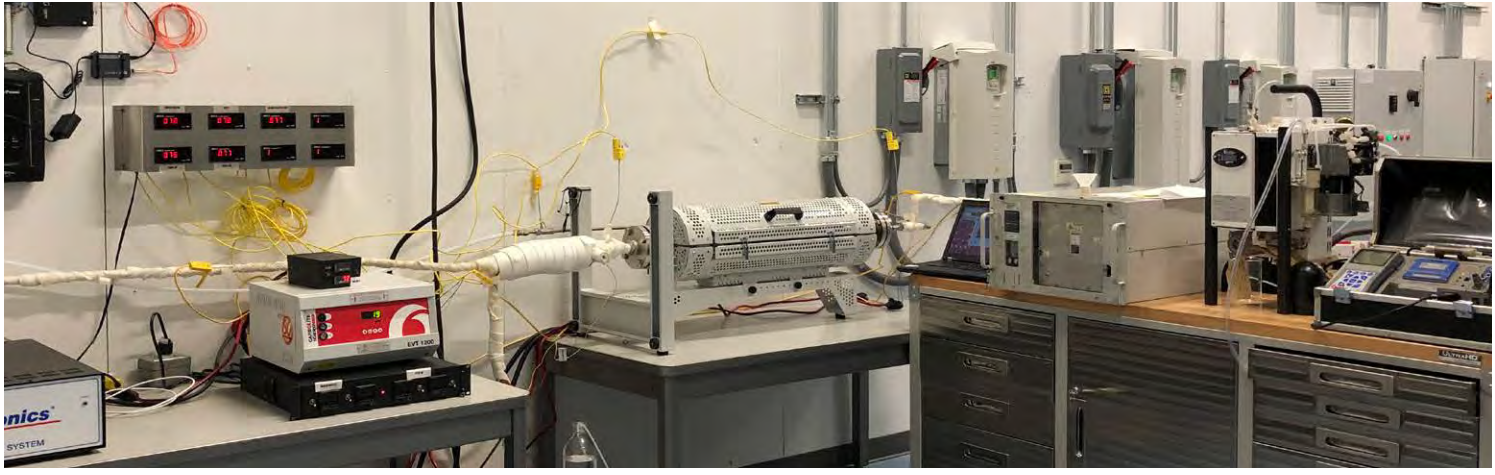
In addition to bench-scale testing, routine analysis of catalyst chemical properties is an important aspect of long-term catalyst management. Catalyst bulk and surface chemical analyses by x-ray fluorescence (XRF) can be performed to measure the levels of contaminant species present that may increase catalyst deactivation and SO_2 conversion rates. Primary contaminants include arsenic, sulfates, iron, silica, and alkali metals.

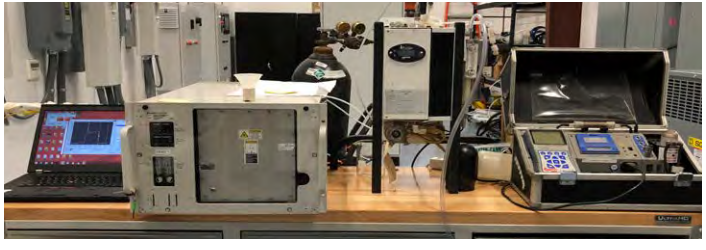
CATALYST PREP STATION

Upon receipt, all samples are inspected for any damage, lost ceramic material, and plugged cells. Geometric measurements of each sample are taken to determine the individual sample volume. Following bench-scale testing, small sections are cut from the inlet and outlet edges of the catalyst samples for XRF analysis.

NATURAL GAS CATALYST SERVICES

In addition to the bench-scale catalyst testing services, ICT also provides catalyst testing, sampling, and inspection services for natural gas catalyst applications. In many cases, emissions limits for natural gas facilities are much more stringent which requires the SCR system to operate at high efficiencies at all times. ICT has the capabilities and experience to provide testing and consultation services to maximize natural gas SCR system efficiencies while minimizing operational and capital costs.



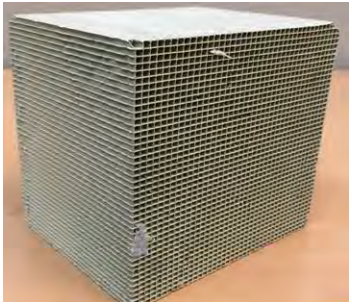


MICRO-BENCH FACILITY

ICT's micro-bench catalyst testing rig allows for the determination of deNO_x activity and CO oxidation for smaller catalyst samples, such as core and button type, that cannot be tested in the larger pilot-scale facility. This provides the flexibility to test multiple catalyst samples taken across the entire volume of catalyst as opposed to only from the single location with pre-installed test blocks.

REACTOR INSPECTION AND CATALYST SAMPLING SERVICES

Experienced field engineers come onsite during unit outages, thoroughly inspect the SCR reactor and catalyst for any major issues, extract catalyst samples for testing, and provide consultation on operational or maintenance changes that can improve SCR performance.



Laura Berry
Senior Testing & Process Engineer
lberry@innovativecombustion.com

Innovative Combustion Technologies, Inc.
10 Commerce Drive | Pelham, AL 35124

205.453.0236
www.InnovativeCombustion.com

To be completed and returned with samples.
See reverse side.

SCR System Data

Parameter	Units	Value
Plant, Unit	-	
Generating Capacity	MW	
Fuel Type	-	
SCR Reactors	#	
Available Layers for Catalyst	#	
Filled Catalyst Layers	#	
Catalyst modules per layer per reactor	#	
Flue Gas Flow Rate per reactor	N m^3/h	
Reference O_2	vol%,dry	
Actual O_2	vol%,dry	
SCR inlet NO_x concentration	ppmvd (ref O_2)	
Target SCR outlet NO_x concentration	ppmvd (ref O_2)	
Ammonia Slip Limit	ppmvd (ref O_2)	

Existing Catalyst Data (complete for all applicable catalyst layers)

Parameter	Units	Layer 1	Layer 2	Layer 3	Layer 4
Catalyst Type	-				
Installation Date	-				
Nominal Pitch	mm				
Volume Per Reactor	m^3				
Element Length	mm				
Specific Surface Area	m^2/m^3				
Flue Gas Exposure Age	h				
Initial $DeNO_x$ Activity, k_0	m/h				

Complete the form on the reverse side and return with samples to:

Innovative Combustion Technologies, Inc.
Attn: Laura Berry
10 Commerce Drive
Pelham, AL 35124

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205.453.0236
www.InnovativeCombustion.com