WHITE PAPER

Advanced In-Situ SCR Catalyst Cleaning

Thompson Industrial Services offers advanced in-situ SCR Catalyst Cleaning Technologies that have been proven to increase efficiency, reduce backpressure, help meet EPA regulations by exposing more catalyst surface area for optimal reaction, and extend catalyst life – all without any damage to the catalyst or modules.

Catalyst Becoming Plugged Can Cause:

- Large and dense ash piles that totally block flow to accumulated areas.
- Reduction of surface area for catalytic reaction.
- Ammonia to be improperly consumed in the top layer, preventing lower layers from producing oxygen for mercury oxidation and SO^2 to SO^3 conversion.
- Increase in ammonia slip potential.
- Negative effect on reactor flow distribution.
- Higher catalyst channel velocity.
- Greater potential for catalyst erosion.
- Increased backpressure costing for supplemental fan power

Properly Cleaned Catalyst Providing Maximum Surface Area

SCR for MATS Compliance

With the EPA's upcoming MATS requirements, including the oxidation of mercury and the regulation of other acid gases, optimal catalyst performance will become more important than ever for environmental compliance.

Under optimal conditions most ammonia can be consumed in the top layer, and lower layers can produce oxygen for subsequent mercury oxidation as well as SO^2 to SO^3 conversion. However, as catalysts become plugged or contaminated, the surface area is reduced. Some of the NOx may not be removed and the ammonia may not be properly consumed in the top layer. As a result, lower layers may be challenged to produce oxygen for mercury oxidation as well as SO^2 to SO^3 conversion.

www.thompsonindustrialservices.com
Call our experts at: 800-849-8040

Thompson Industrial Services

Ammonia Slip

Ammonia slip is a serious issue, caused directly by uneven ammonia distribution within the catalyst. When channels are plugged or partially blocked by ash deposits, ammonia becomes unevenly distributed within them. The potential for ammonia to pass through the reactor unreacted is increased, decreasing its efficiency and secondarily causing contamination of downstream BOP equipment such as air preheater elements.

Decreased Efficiency

The overall effect of blocking and plugging due to ash deposits is decreased efficiency for the entire process that relies on the catalyst's proper functioning. Allowing deposits to persist will also reduce the life of a catalyst's hours of service, necessitating replacement before the end of its expected lifespan.

Associated Damage

Obviously, the catalyst itself is not the only unit affected by the buildup of debris. As the contaminated catalyst fails to fully perform its role, other pieces of equipment "downstream" from the catalyst are negatively affected as well. They may become contaminated by sulfur trioxide, ammonium bisulfate, and other corrosive substances. Keeping the catalyst as clean as possible benefits the entire process and saves money on repairs/replacements and maintenance of related equipment.

Equipment Preservation: Reducing Wear and Tear

Heavily contaminated catalysts are in danger of garnering a shorter lifetime of service, due to damage to components and the excessive strain on the operating components. Traditional cleaning methods leave many deposits and plugging in place, especially deep within the module itself, forcing equipment to work harder than necessary *even after routine, conventional maintenance.* However, by exposing the maximum catalyst surface area, in-situ SCR catalyst cleaning maximizes the useful service life of each layer.

Cost Savings: Plant-Wide Benefits

Thorough catalyst cleaning on a regular basis creates savings opportunities that "trickle down" throughout the plant. While the catalysts themselves enjoy an extended life of service, equipment located downstream in the process also suffers less wear and tear, as fewer harmful chemicals make their way to them from underperforming, contaminated catalysts. Obviously, the increase in efficiency in catalyst performance has a direct effect on production and operating costs. Also, it can increase

the number of times that the catalyst can be successfully regenerated. Finally, the regeneration process can be less costly when a catalyst has already been cleaned using our patent-pending and proprietary methods.

Regeneration Complications

Beside the release of polluting fly ash, a major real world, potential issue during transport of catalyst components is the introduction of moisture to existing imbedded deposits. When certain types of deposits combine with moisture, they become hardened and extremely difficult to remove. This interferes with the regeneration process, reducing catalyst efficiency even after regeneration. The best way to prevent hardening of deposits due to moisture is to remove deposits completely *before* transport.

Traditional Cleaning Methods

Unfortunately, most traditional catalyst cleaning methods only achieve partial success in removing ash deposits and plugging. The most common method, vacuuming debris from above the screens and on the surface of the catalyst, and an attempt at air-lancing the modules only addresses a portion of the deposits and leaves internal buildup and plugging in place. Until recently, reaching these internal deposits and removing them within the modules was extremely difficult and threatened to cause damage to the catalyst.

In-Situ SCR Catalyst Cleaning

Thompson Industrial Services has developed a *proven,* proprietary (patent-pending) approach to cleaning catalyst components that begins where traditional cleaning methods end. Instead of affecting only above the exterior of catalyst screens and catalyst surfaces, this process safely penetrates deep inside the catalyst channels and breaks up hardened deposits and plugging. This proprietary service (which has been used since 2010 on all types of catalyst materials) is only available through Thompson Industrial Services. Thompson's in-situ SCR catalyst cleaning has gained national attention for its effectiveness and ability to remove destructive contaminants completely, while avoiding any damage to components. The service has enjoyed a 100% success rate and zero reported incidents of damage to clients' equipment.

Multi-Faceted and Comprehensive Cleaning

In-situ SCR catalyst cleaning consists of three simultaneous approaches, which complement one another and combine to remove all or nearly all fly ash deposits from the catalyst:

1. Strategic Vacuuming

Expert technicians vacuum fly ash from catalyst screens and surfaces. This part of the cleaning process includes removal of screens and thorough vacuuming of all external surfaces, using specialized, high-grade equipment. Every technician that handles this equipment is skilled and trained to use it properly, including adherence to Thompson Industrial Services' zero-incident safety policies.

2. Media Blasting

Our proprietary media blasting technology safely removes hardened ash from the catalyst surface and penetrates much deeper *into the catalyst's interior module* than any vacuum or air lancing procedure can. This approach clears a much higher percentage of a blocked catalyst's contamination, and is also 100% safe for the catalyst itself. Both vacuuming and blasting occur from above the catalyst.

3. Precision Vibration

Another key feature of our unique three-step catalyst cleaning process is the precision vibration of the catalyst components from below. We carefully install our proprietary and custom-designed equipment in connection with the catalyst, as well as monitoring equipment to ensure the safety of the SCR components throughout the cleaning. As our equipment vibrates the catalyst, it loosens deposits and plugging, allowing our simultaneous vacuuming and media blasting techniques to remove them and clear the screens, surfaces, and channels extremely effectively.

Since the introduction of our in-situ SCR catalyst cleaning service in 2010, we have encountered zero incidents of damage to clients' equipment. The vibration, vacuuming, and media blasting processes are 100% safe for all catalyst components.

Results

In-situ SCR catalyst cleaning by Thompson effectively addresses all of the negative consequences of contaminated catalysts mentioned above. Testing and reporting on catalyst performance subsequent to cleaning using our method have confirmed that:

- Backpressure is significantly reduced, often back to near design.
- The probability of ammonia slip is dramatically reduced.
- Process and plant efficiency increase.
- There is far less contamination of downstream equipment.
- Service life of catalyst increases and its regeneration/replacement frequency decreases.

Utilities across the United States have benefitted from Thompson Industrial Services' unique catalyst cleaning service, with plant management regularly commenting on the speed, safety, low profile, and thorough work of our cleaning teams, often times in no more time than conventional attempts at cleaning.

Why Choose In-Situ SCR Catalyst Cleaning?

The primary benefits of this unique, comprehensive process fall into three main categories: EPA compliance, equipment longevity and cost savings.

Patent-Pending Technology

One of Thompson's proprietary methods vacuums and blows within an SCR reactor from above the catalyst while simultaneously vibrating the catalyst layers from the bottom, safely cleaning catalysts of potentially harmful contaminates by removing fly ash that cannot be reached by traditional methods. The
catalyst does not have to be removed from the unit and the process prolongs catalyst life, accomplishing all in about the same amount of time as conventional cleaning.

Another Thompson proprietary method uses a sponge blast media to safely remove hardened ash from within the catalyst without damaging the catalyst surface.

About Thompson Industrial Services

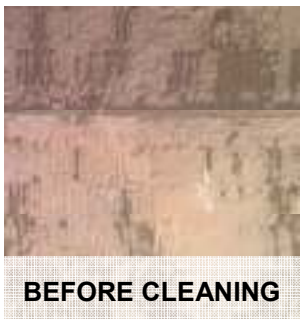
Thompson Industrial Services is a nearly 30-year specialty leader in its field, developing proprietary equipment, methods, and applications for a wide range of industrial cleaning needs. In addition to catalyst cleaning, Thompson Industrial Services offers automated hydroblasting, chemical, and dry ice cleaning solutions and combustible dust remediation for plants and industrial facilities of all types. All work is done within a company-wide culture of safety, which includes extensive, supervisory experience and hands-on training for technicians and a complete understanding of the client's equipment that they service.

Case Study:

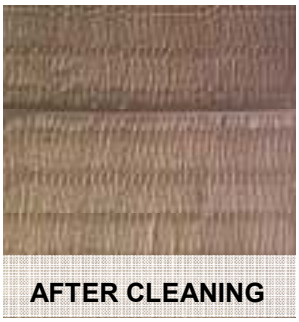
A client contracted us to perform a catalyst cleaning under a strict time constraint and difficult space limitations. The catalyst had recently been cleaned using traditional methods, but its performance was still unsatisfactory. The in-situ SCR catalyst cleaning that our technicians were able to perform within the highly restrictive timeframe allowed reduced the remaining plugging in three catalyst layers by up to 50 percent (before we introduced our newest and highly effective hardened ash removal, dry media blasting method).

Another utility recently reported to us after our SCR cleaning service that just the savings in their net amps required to run their FD fans, which computed to 1 MW per hour per fan, more than paid for the differential of the specialized cleaning, in addition to the other associated benefits of clean catalyst surfaces.

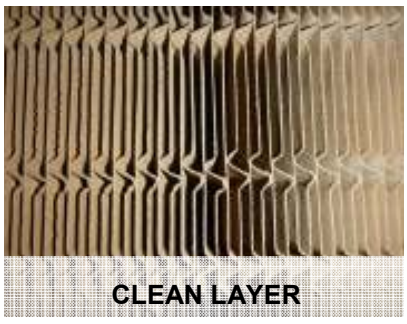
The surprisingly thorough, unprecedented results of our cleaning process have gained the attention of industry leaders and regulatory organizations. Experts in the field, including regeneration companies, now recommend that plants have their catalyst components cleaned in this manner before transporting them in order to comply with EPA regulations concerning fly ash release and to prevent plugging due to moisture accumulated during transport.



BEFORE CLEANING



AFTER CLEANING



CLEAN LAYER

INSIDE CLEAN LAYER