REINHOLD ENVIRONMENTAL Ltd.

2016 NOx-Combustion-CCR Round Table Presentation

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SCR Maintenance for EPA Compliance

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Thompson
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Agenda

-EPA Regulations

-SCR + FGD Co-benefit for Hg control

-Requirement for optimal SCR reactor performance

-Proven Reactor Maintenance Technologies

-Conclusions

Presentation Abstract

Optimal catalyst performance is becoming more important than ever for environmental compliance. This presentation will discuss the co-benefits of SCR & FGD technology for MATS compliance, reactor cleanliness and some technologies to maintain performance of the SCR reactor.

Environmental Regulations effecting coal fired power production

- Cross-State Air Pollution Rule (CSAPR)
- Clean Air Interstate Rule (CAIR)
- National Ambient Air Quality Standards (NAAQS)
- Mercury and Air Toxics Standards (MATS)

- Other Rules

Environmental Regulations that will rely heavily upon SCR optimization

CSPAR - Cross-State Air Pollution Rule

- CSAPR was intended to regulate NO*x* and SO2 air pollution that crosses state lines and prevents downwind states in the eastern half of the country from meeting EPA standards for ground-level ozone and fine particulate pollution.

- CSAPR covered a similar, but not identical, group of states to those covered under CAIR.

Environmental Regulations that will rely heavily upon SCR optimization

NAAQS - National Ambient Air Quality Standards

The Clean Air Act requires EPA to set NAAQS for six criteria pollutants:

- **SO2**
- **No*x***
- **Ozone**
- **Particulate Matter**
- **Carbon Monoxide, and**
- **Lead**

The law requires the agency to review, and if appropriate, revise the requirements every five years.

Environmental Regulations that will rely heavily upon SCR optimization

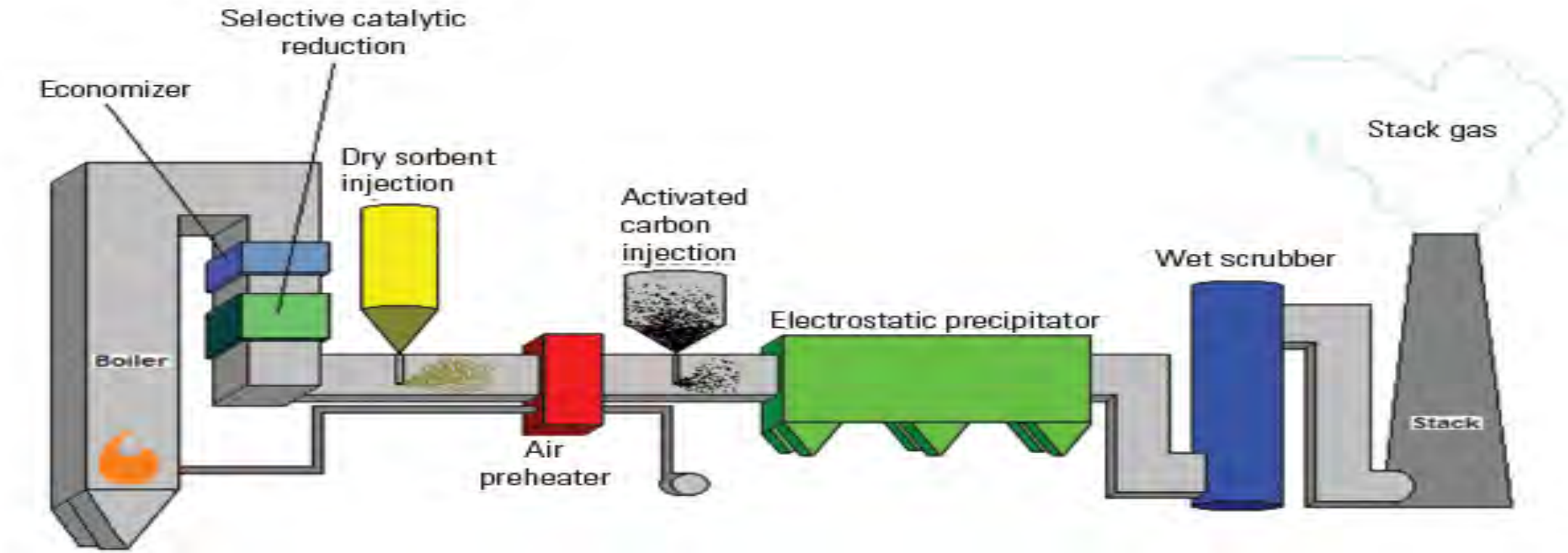
MATS - Mercury Air Toxics Standards

The rule regulates emissions of heavy metals and acid gases from new and existing coal- and oil-fired power plants.

Regulates:

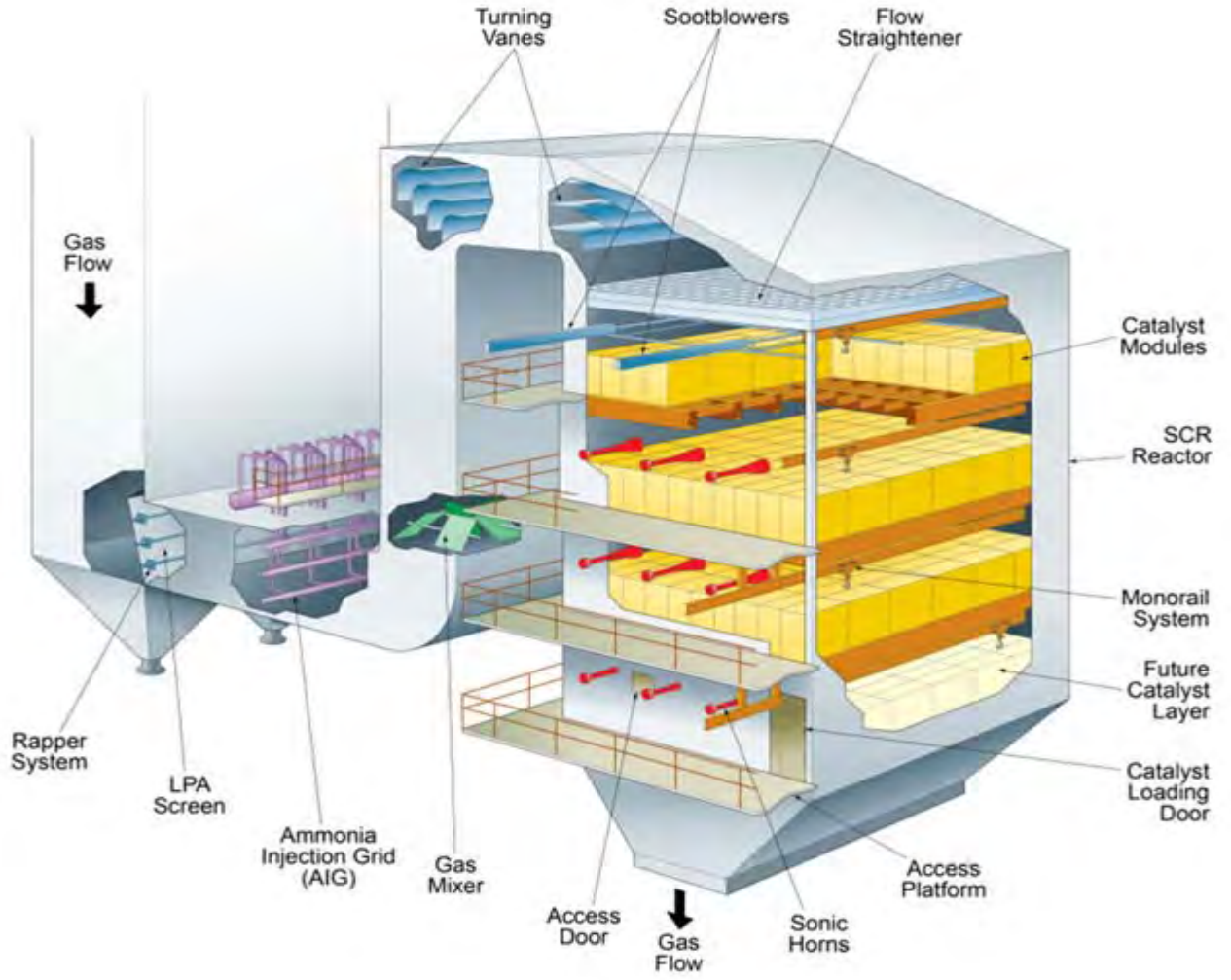
- Acid Gas
- Mercury
- Particulate
- SO2

SCR + FGD Co-benefit For Hg Control



Requirements for Optimal SCR Performance

- Good Flow & Distribution
- Good Ammonia to NOx Balance
- Maximum Catalyst Surface Area for NOx and Mercury Oxidation

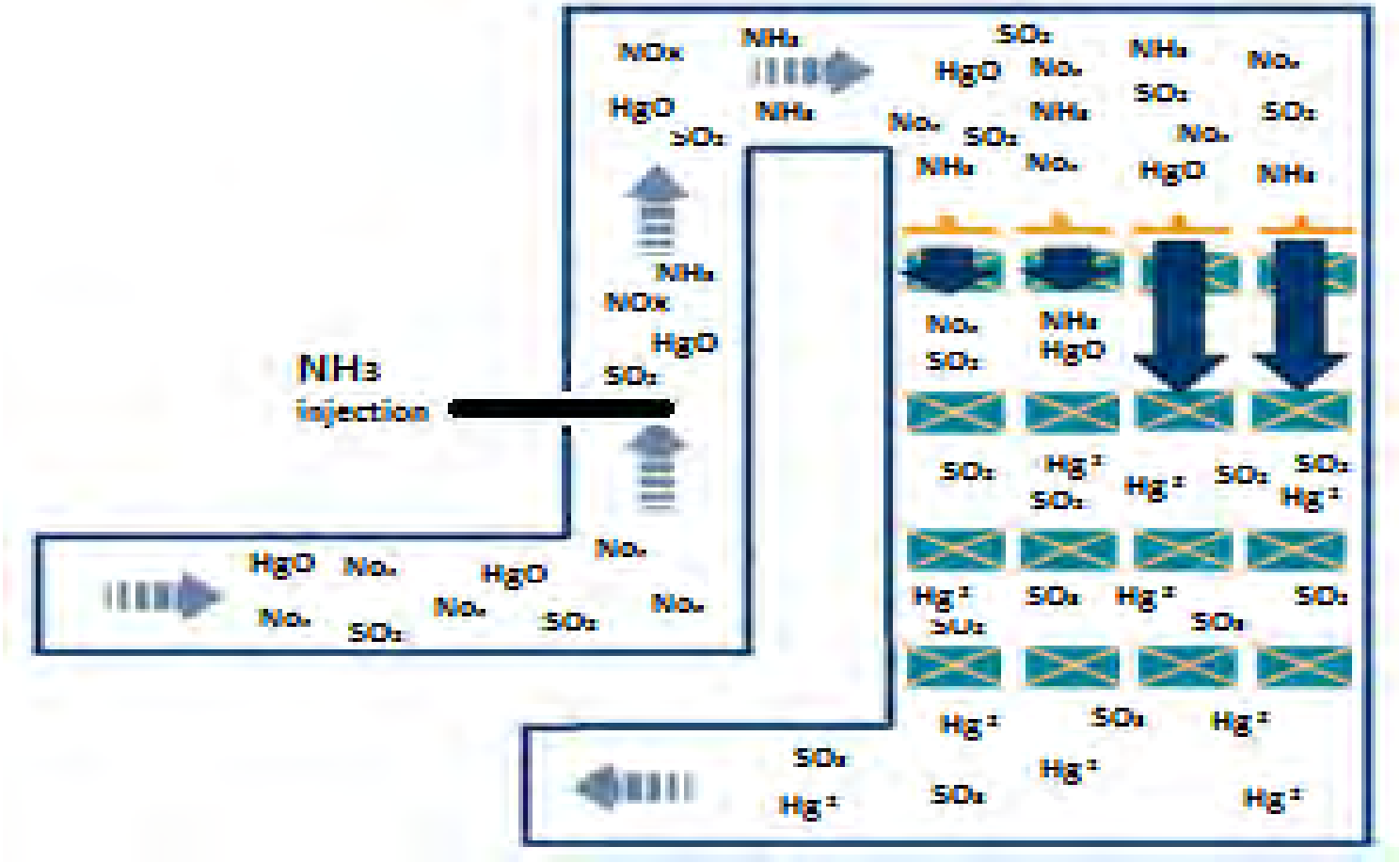


Requirements for Optimal SCR Performance

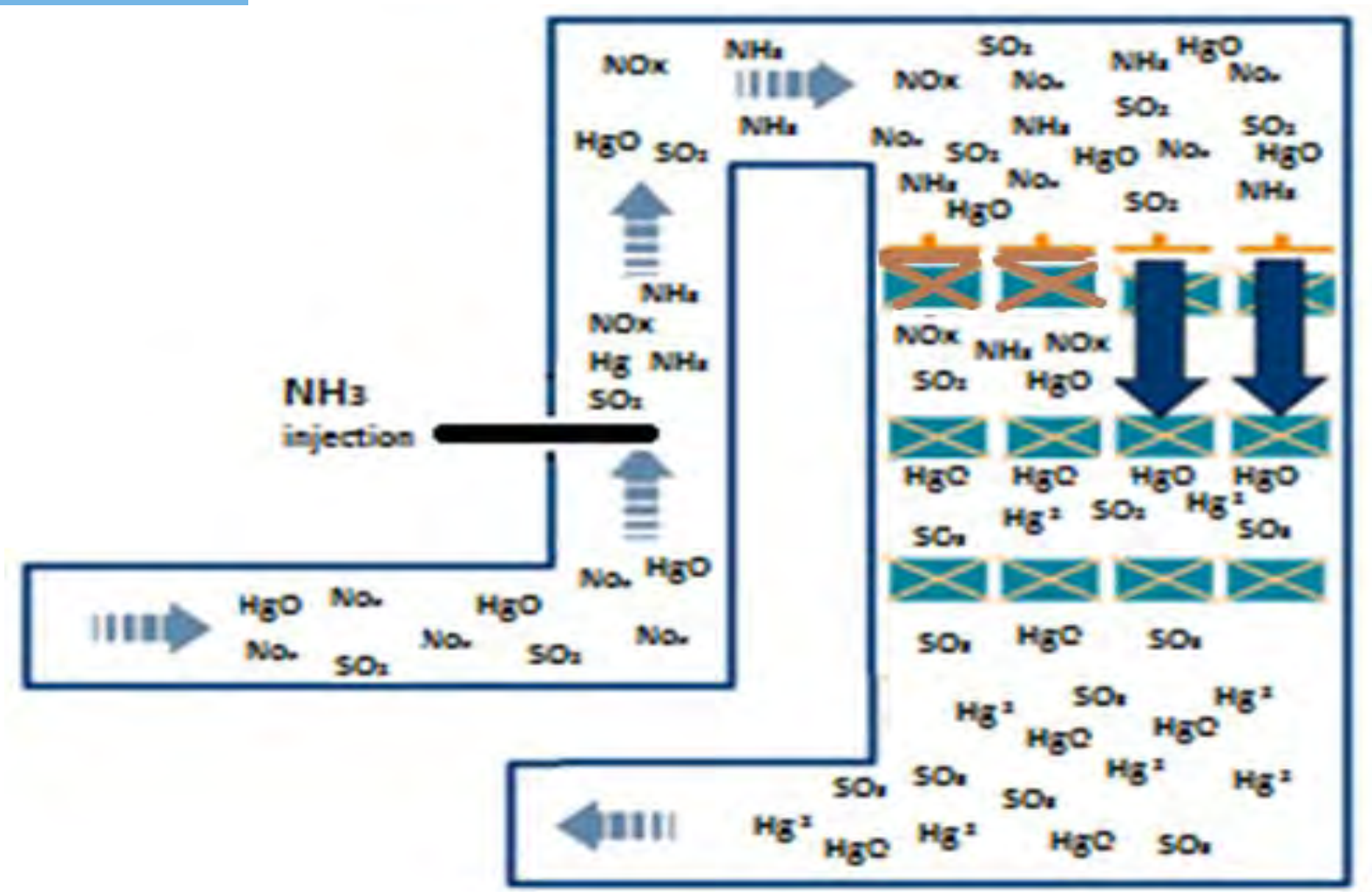
Flue Gas Stream Contains:

- Nitrous Oxide (NO or NO_2)
- Sulfur Dioxide (SO_2)
- Mercury (Hg0)

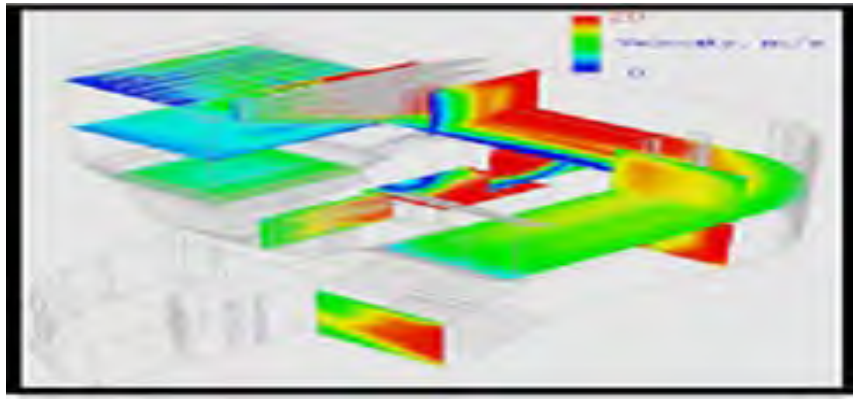
Injected Ammonia (NH_3)



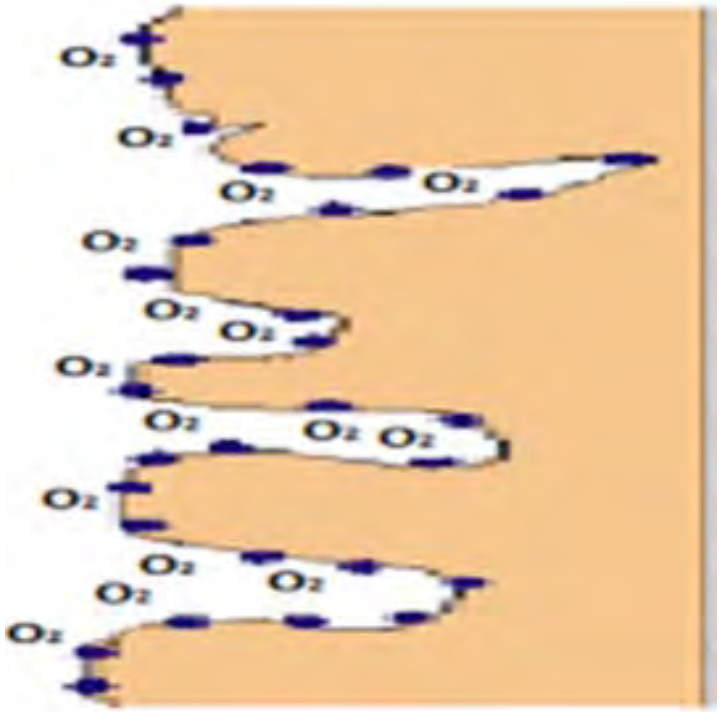
Effects of Catalyst Plugging

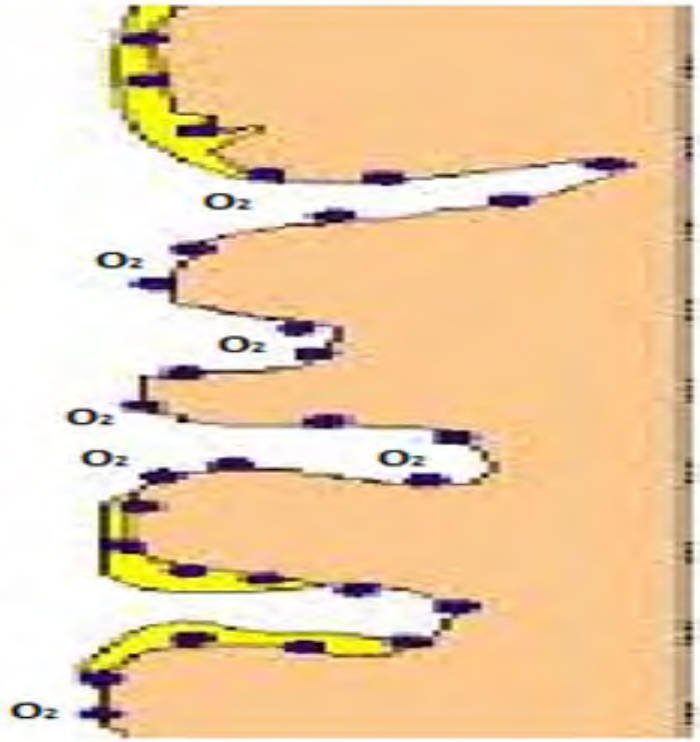


Results From Catalyst Plugging



Catalyst Fouling





Proactive Catalyst Management & Maintenance Strategies will likely be required to meet increasing EPA Regulations

Advanced Online Cleaning Solutions to improve catalyst cleanliness.

-Acoustic Technology to improve overall ash Flow & Distribution.

- Ash sweeper for areas that need additional assistance.

Thorough cleaning of SCR reactor & catalyst during outages is necessary.

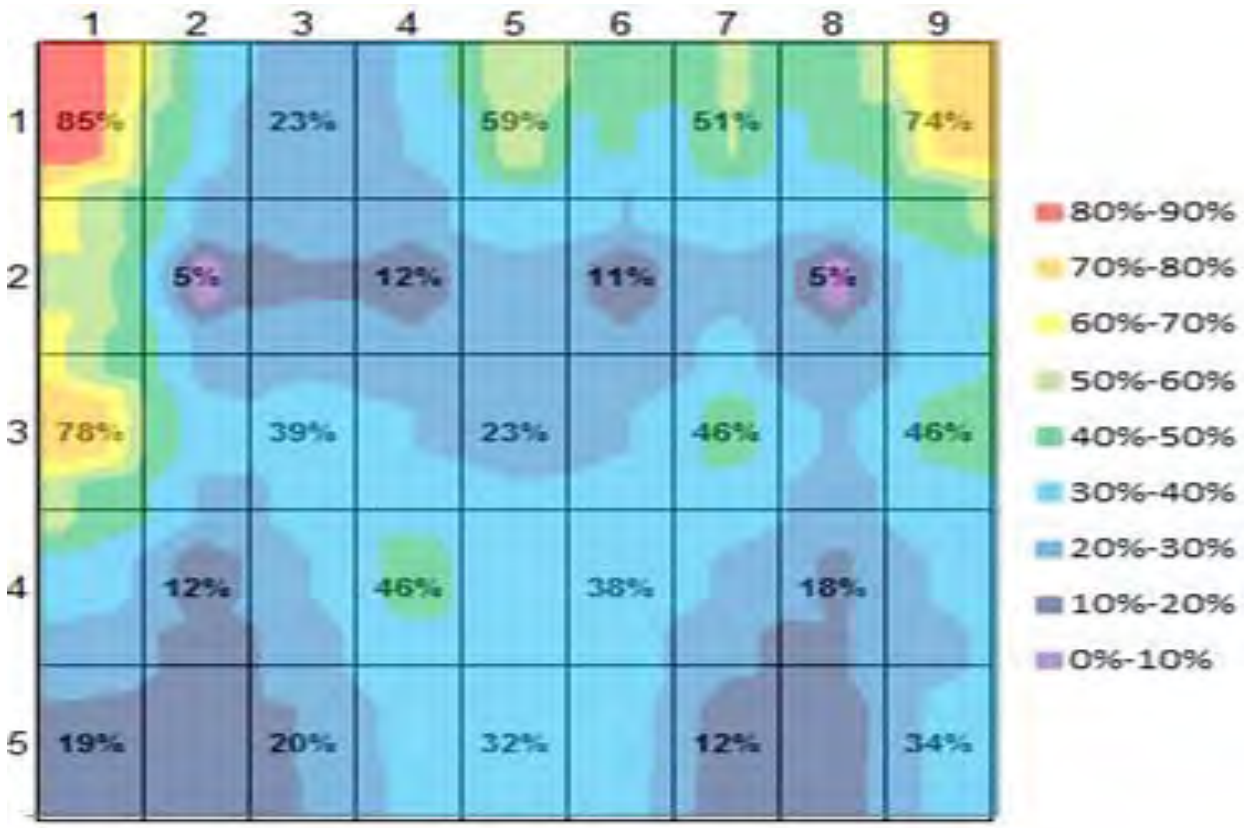
- Simply vacuuming the reactor will likely not be adequate.

-Advanced cleaning methods that effectively clear catalyst opening and cells will improve flow and provide more surface area for catalyst reaction.

Advanced Offline Cleaning

Results from In-situ Vibration Cleaning

TRADITIONAL CLEANING



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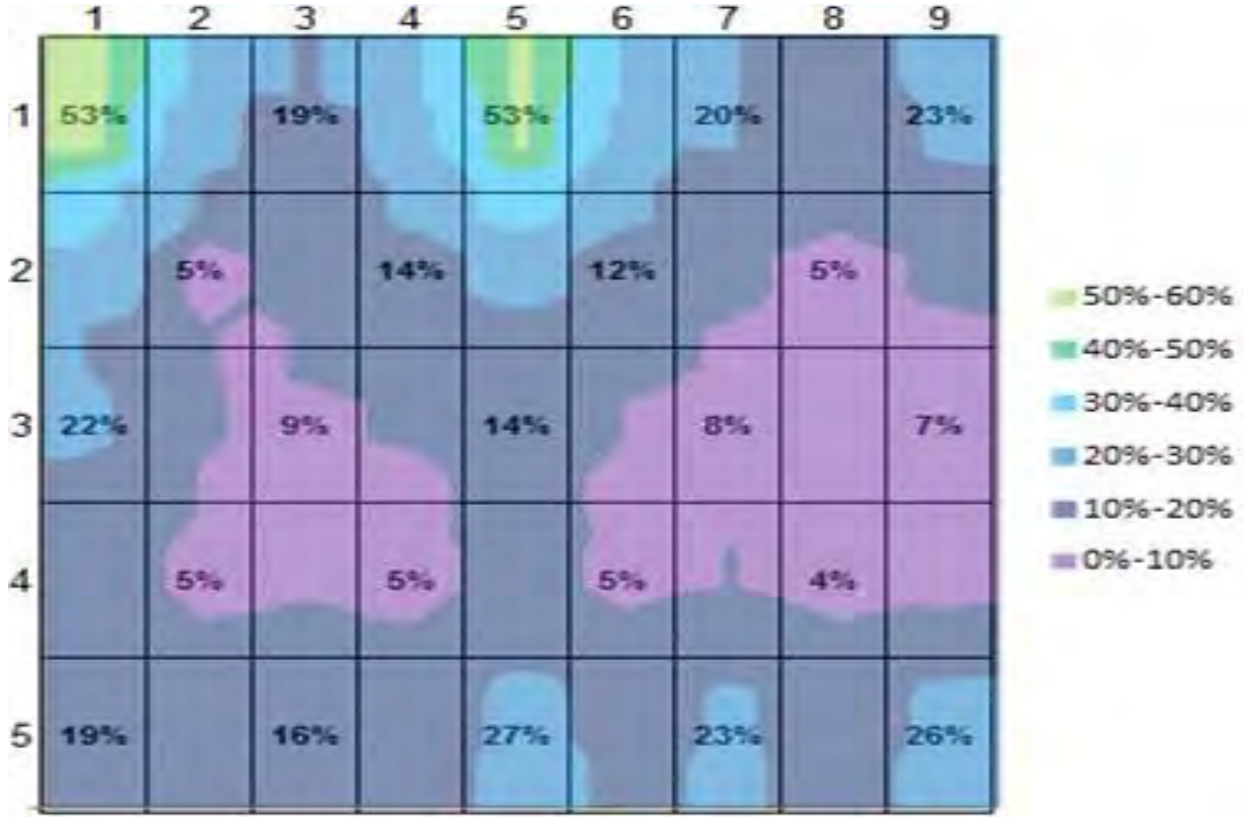

QUESTIONS?

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