REINHOLD ENVIRONMENTAL Ltd.

2012 NOx-Combustion Round Table & Expo Presentation

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Do’s and Don’ts for Catalyst Handling and Operation

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2012 NOx Roundtable

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The Do's and Don'ts for Catalyst Handling and Operation

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The Do's and Don'ts of Catalyst Handling and Operation

or

A Regenerator's "Cabinet of Horror"

A presentation that should entertain and not be taken not too literally but viewed seriously.

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It presents various real world challenges encountered during SCR catalyst handling and operation discovered prior to regeneration

On Site Catalyst Storage

The Challenge: Keeping the catalyst stored on site separate from all the other stuff and out of the weather!

Catalyst Loading

The Challenge: Loading the catalyst onto a trailer that is parked on a hard surface so that it doesn't sink in!

Catalyst Loading

The Challenge: Who can create the prettiest pattern of bent steel?

Catalyst Loading

The Challenge:
Selecting suitable pallets for catalyst module transport!

Catalyst Loading

The Challenge: Making sure the forks go underneath the module rather than into it when trying to pick it up!

Catalyst Handling

The Challenge: Taking the plate boxes out the top of the module rather than to the side!

Catalyst Handling

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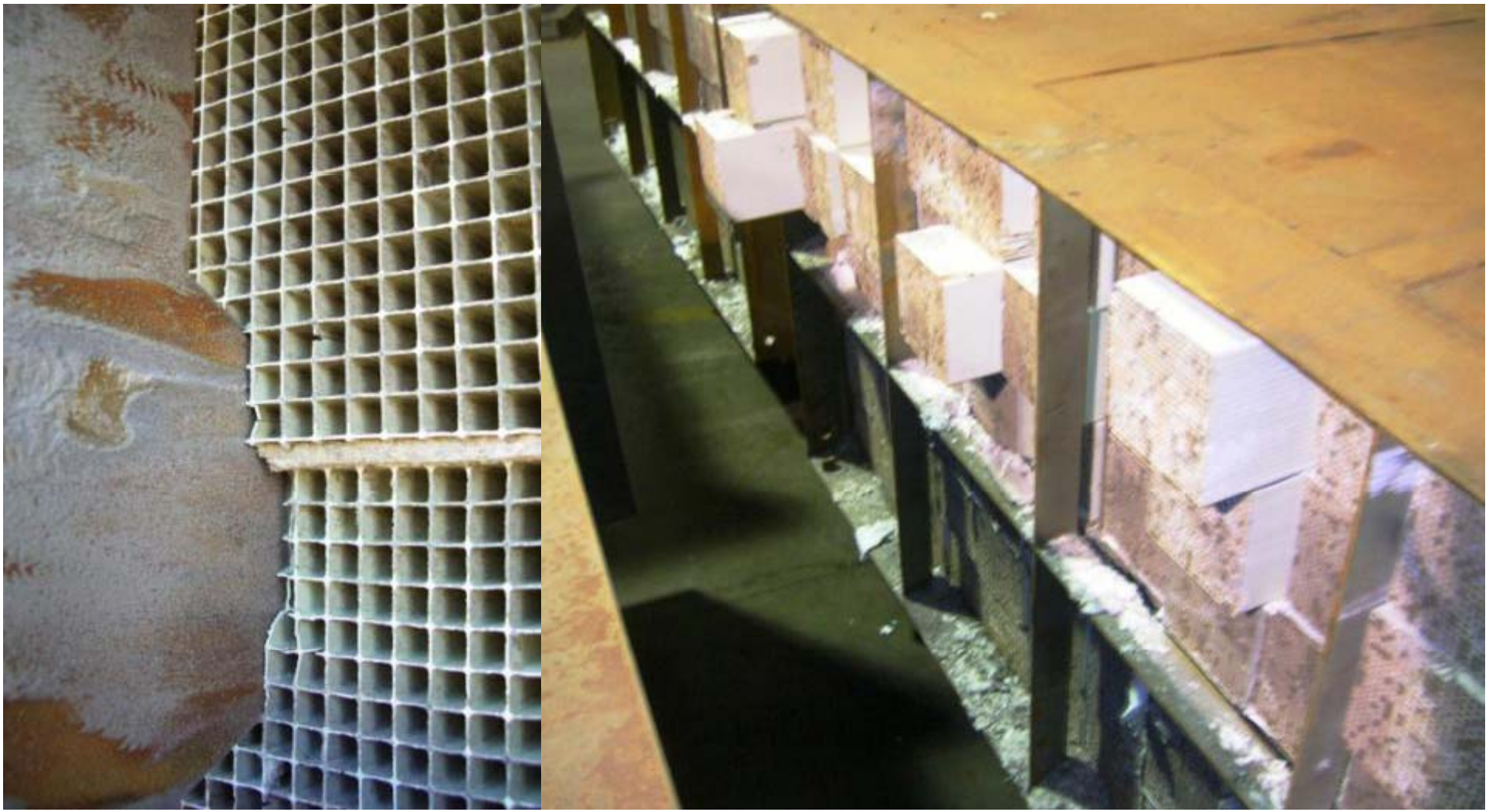
The Challenge: Who can give a plate box the most unique shape?

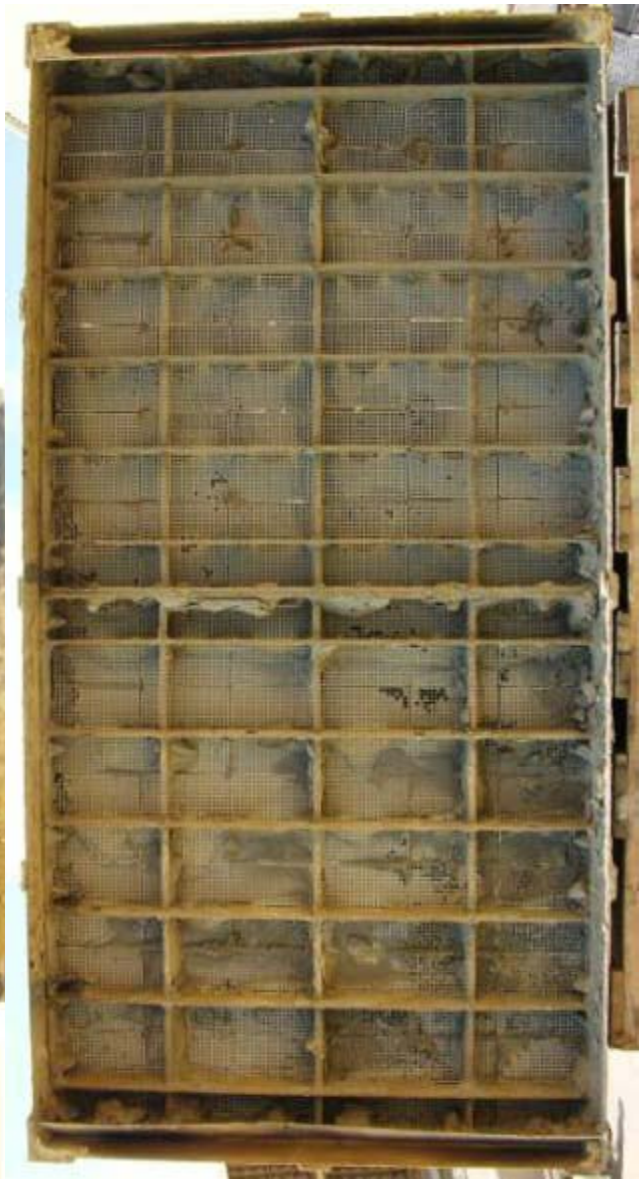
Catalyst Handling

The Challenge: Making sure the logs stay in the module during transportation!



Pluggage

The Challenge: Which side is more plugged, the inlet side (bottom) or the outlet side (left)?

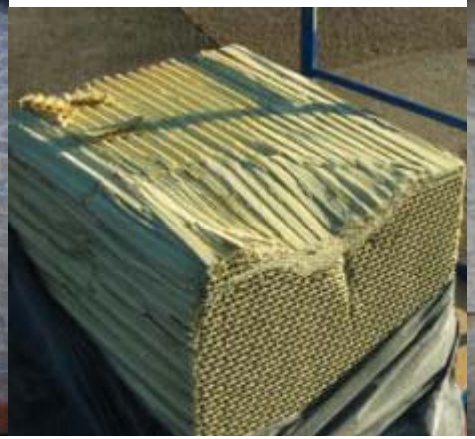


Pluggage

The Challenge: Which is more plugged, the plates (left) or the corrugated (bottom)?

Catalyst Sampling

The Challenge: Taking truly representative samples from the module using the proper tools!



Catalyst Sampling

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The Challenge: Keeping the samples organized and clean / unplugged inside the sample box so that they are truly representative!

Mechanical Damage

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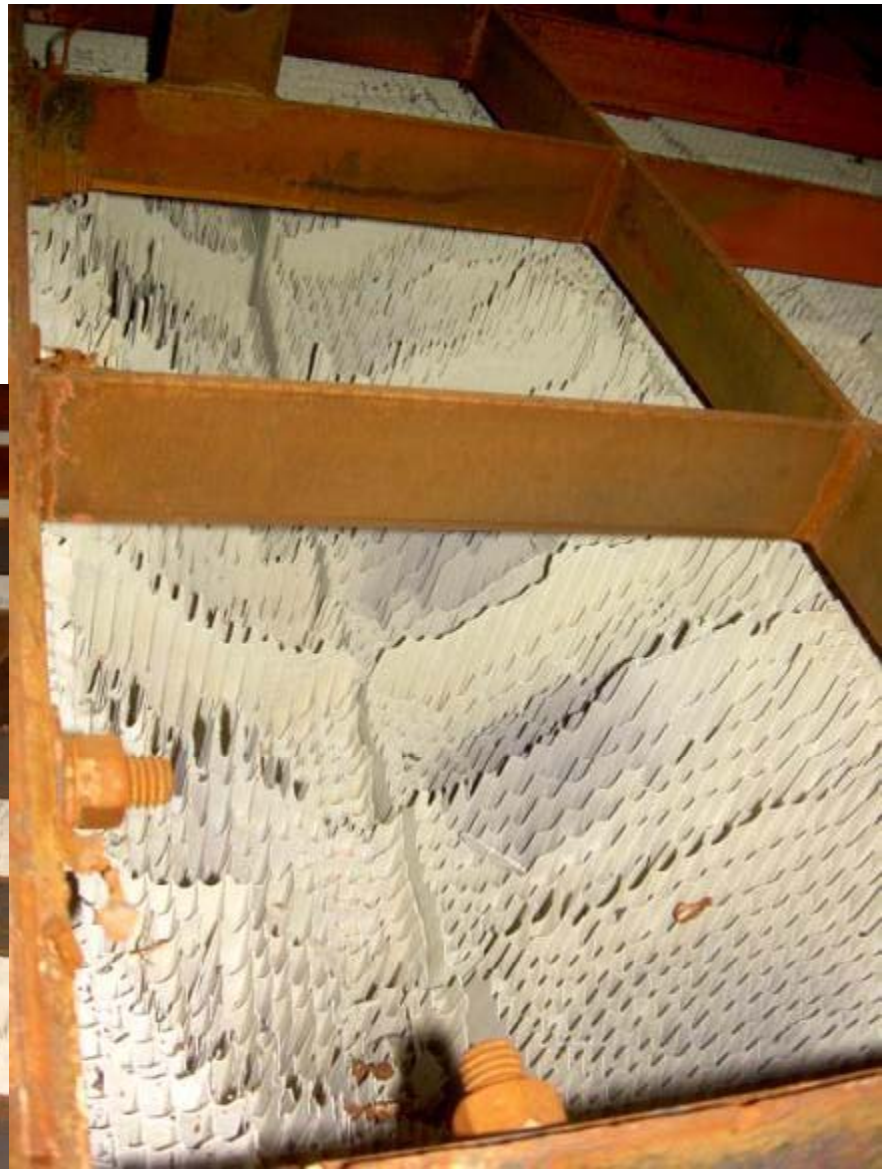
The Challenge: What's left to regenerate?

Mechanical Damage

The Challenge: What to do? Replace all the eroded logs or leave them?



Mechanical Damage

The Challenge: How did that happen?

Mechanical Damage

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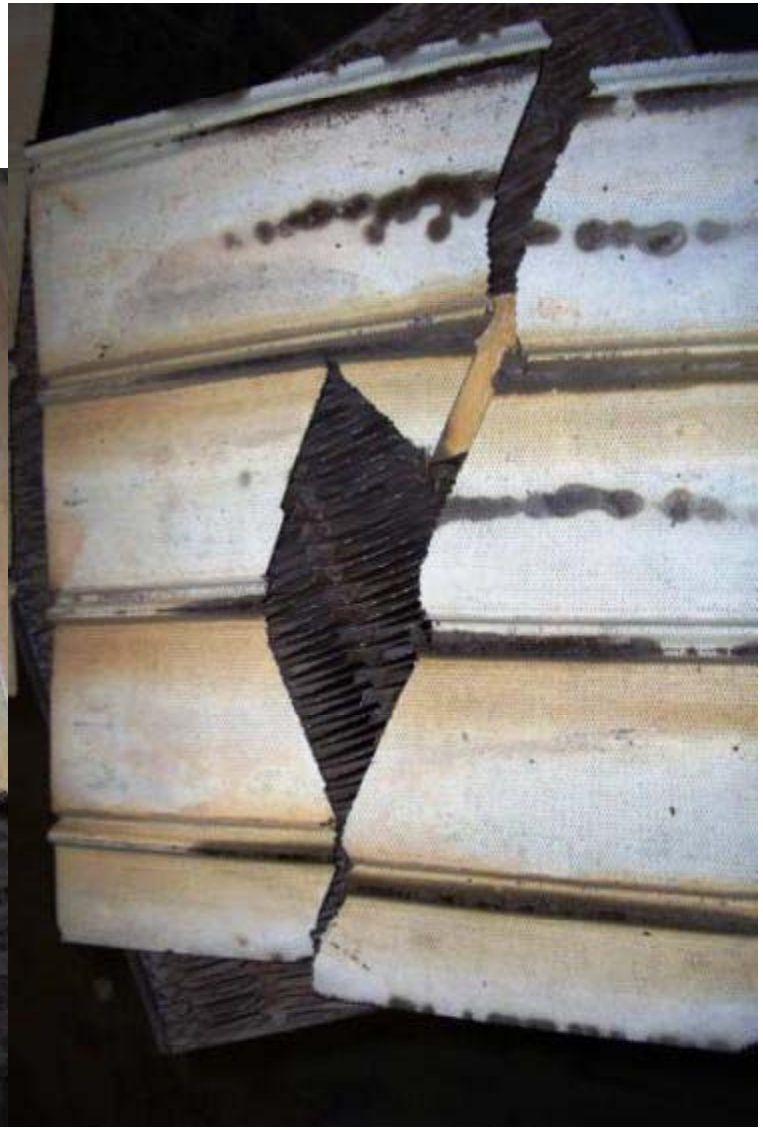
The Challenge: How did that happen?



Catalyst Erosion

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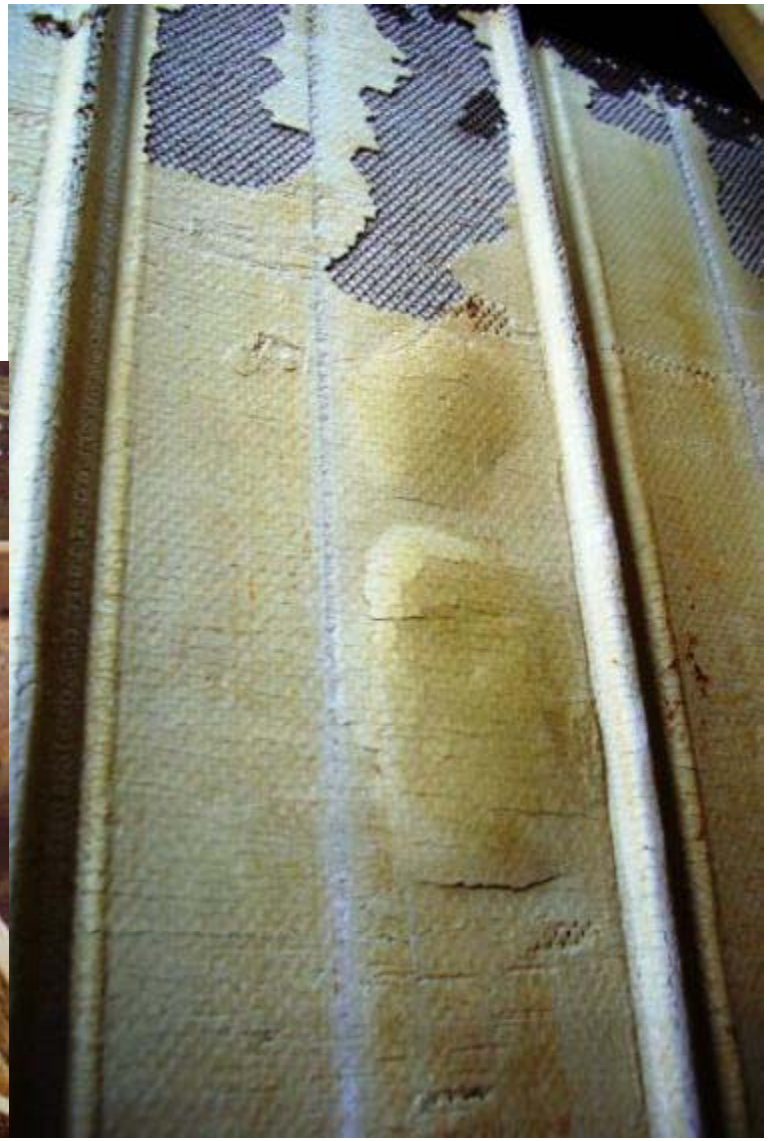
The Challenge: Severely eroding honeycombs on the flue gas outlet side of the module!

Erosion Damage

The Challenge: Erosion - What's left to regenerate?

Erosion Damage

The Challenge: Delamination - What's left to regenerate?



Erosion Damage

The Challenge: Erosion and other mechanical damage in most peculiar shapes and places! How did that happen?

Catalyst Erosion

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The Challenge: Severely eroding plates on the flue gas outlet side of the module!

Thermal Destruction of Catalyst

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The Challenge: Who was the artist who colored the fly ash and the catalyst modules?
Extreme heat!

Thermal Destruction of Catalyst

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The Challenge: How to fuse the plate boxes to the frame? Burn some catalyst and melt the metal inside a catalyst module!

Thermal Destruction of Catalyst

The Challenge: How to get it apart again and what may be found underneath?

Thermal Destruction of Catalyst

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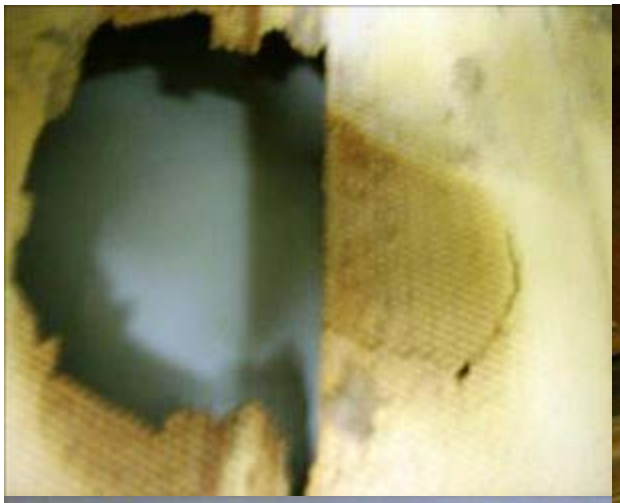
The Challenge: How to fix a hole and lots of rutilized plates!

Thermal Destruction of Catalyst

The Challenge: How to fix many holes in lots of rutilized plates!



Thermal Destruction

The Challenge: Burning up the catalyst parallel to the plate orientation so that at least some of the plates in the box can be salvaged!

Thermal Destruction of Catalyst

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The Challenge: Finding the shark, who feeds on rutilized plate catalyst!

Catalyst Corrosion

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The Challenge: Severely corroded catalyst plates' stainless steel wire mesh!

Catalyst Corrosion

The Challenge: Proving that the stainless steel wire mesh is severely corroded prior to regeneration already!

Catalyst Discoloration

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The Challenge:
How many different colored plates can be found within the same layer from the same reactor or what all did this unit burn?

Catalyst Discoloration

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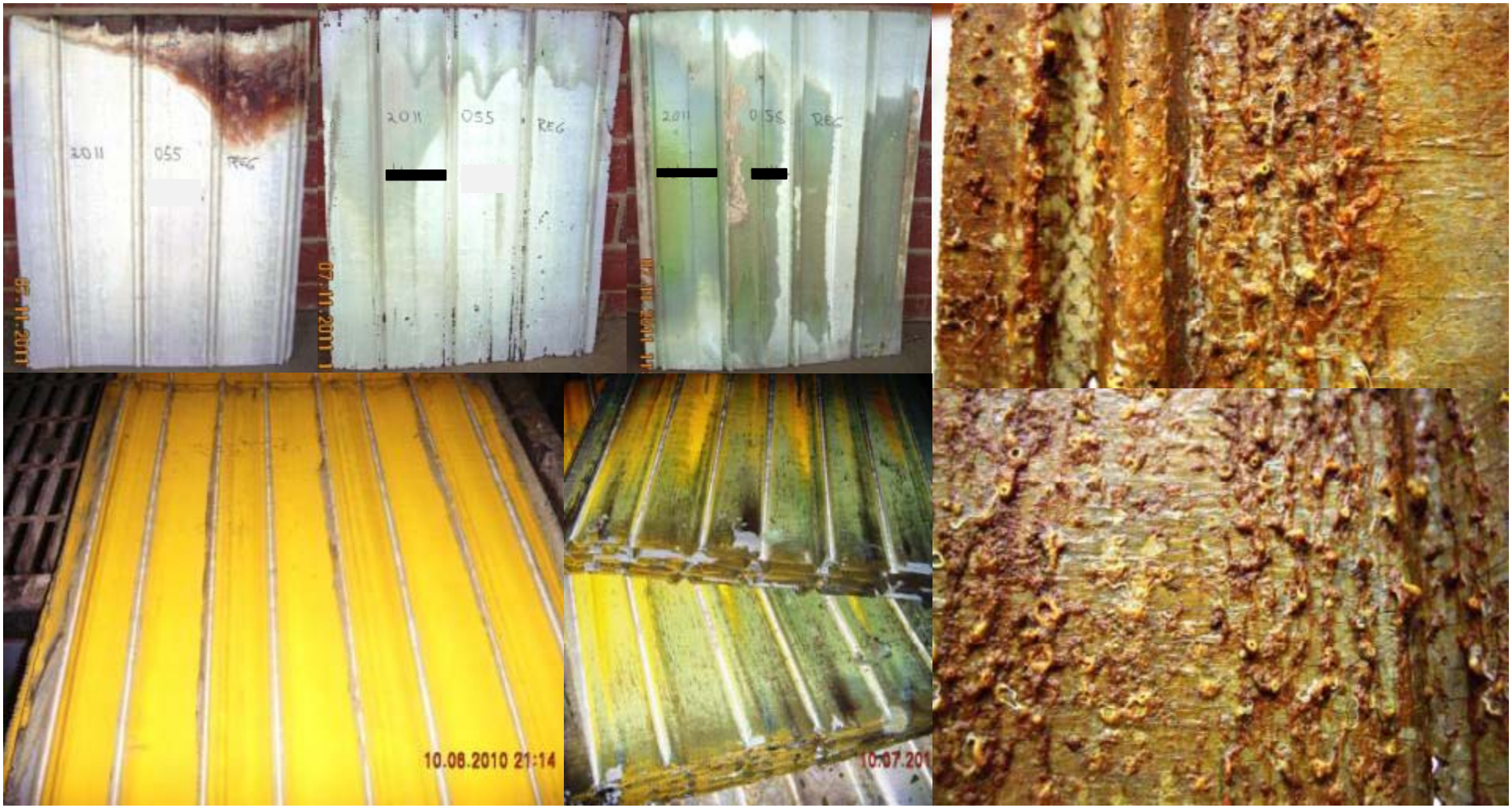
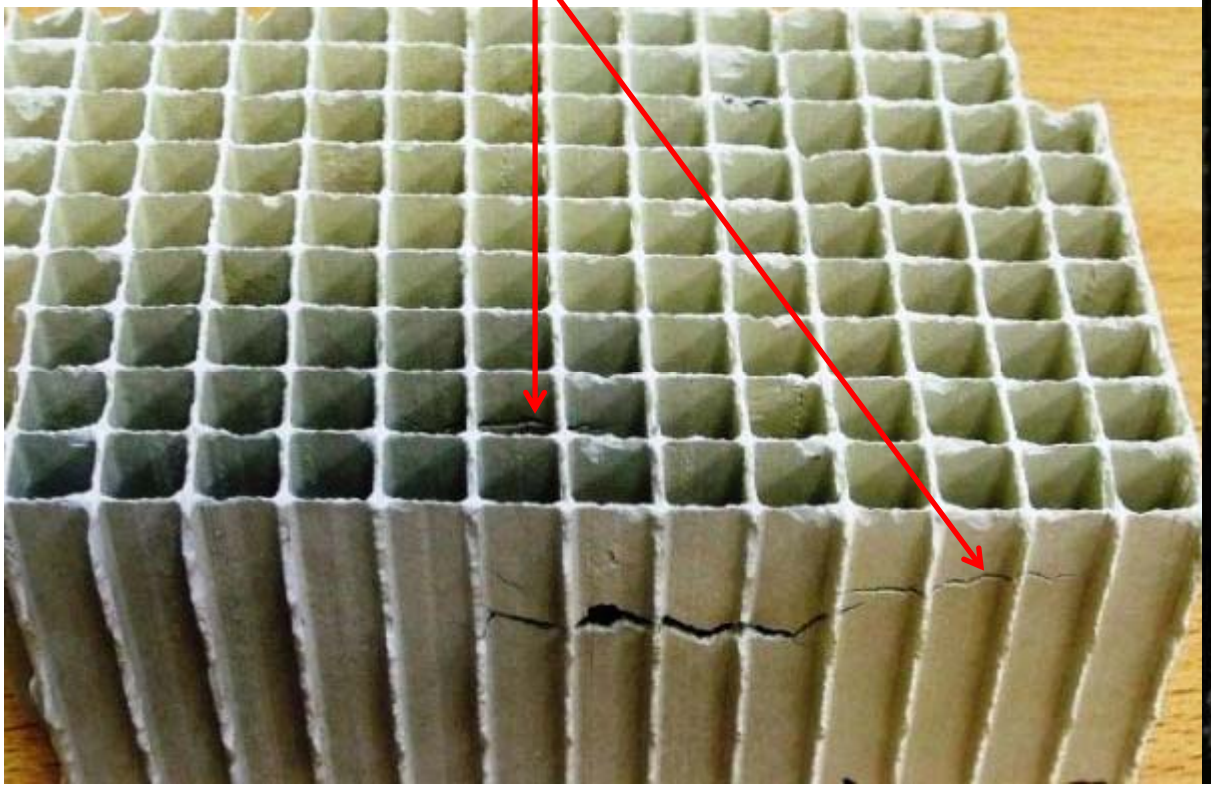
The Challenge: Discoloration of catalyst surfaces in an amazing variety! How did it happen?



Other Peculiarities

The Challenge: Other peculiarities to be discovered such as:

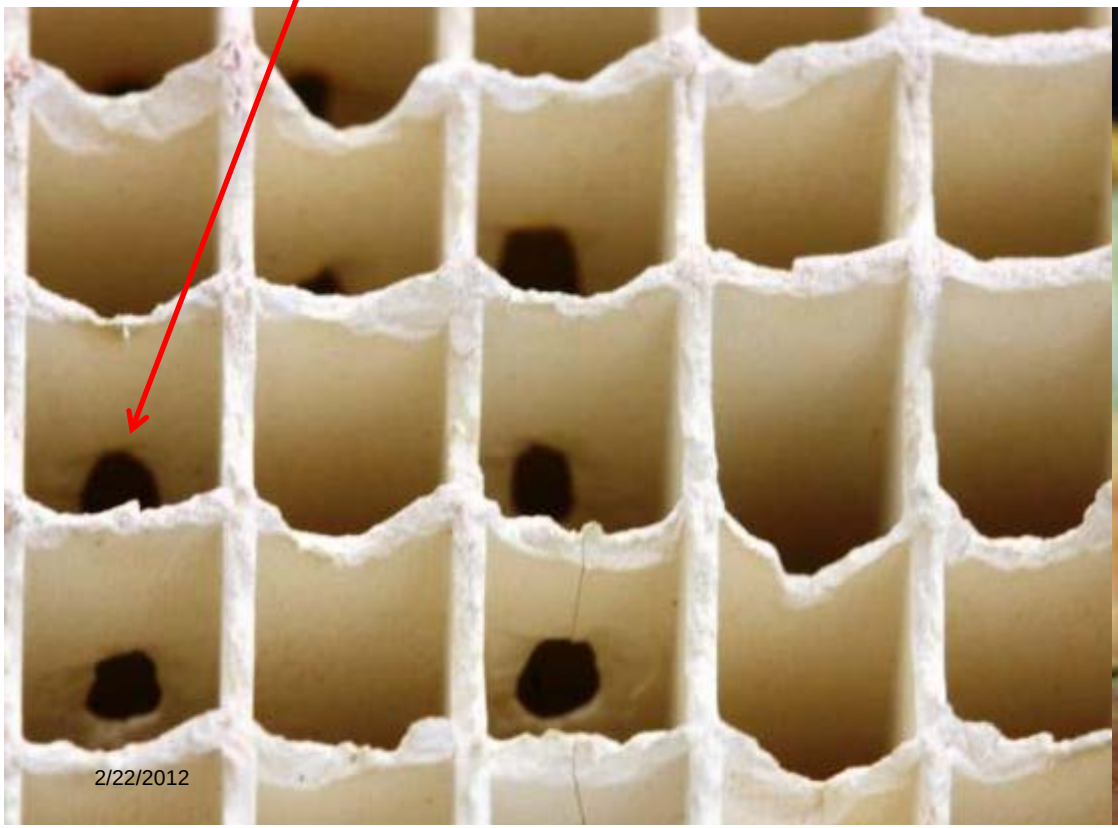
- Metal plates instead of catalyst plates.
- Tears along inside walls impacting mechanical strength.

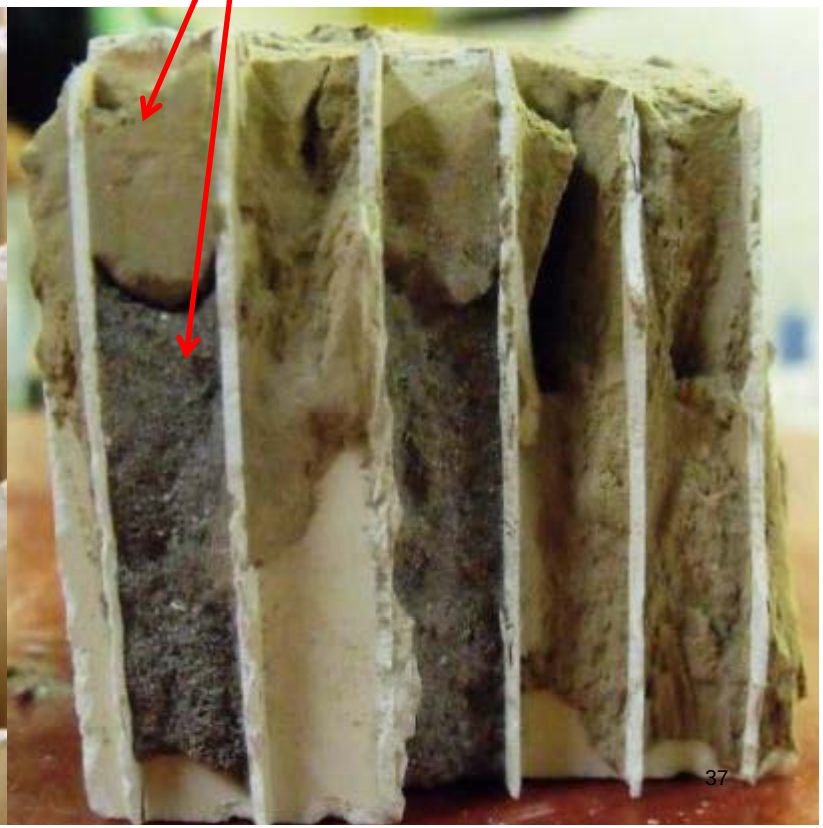


Other Peculiarities

The Challenge: Other peculiarities to be discovered such as:

- Erosion holes well below the flue gas inlet side.
- Two totally different colored and kind of ash pluggages in the same honeycomb.





Other Peculiarities

The Challenge: Other peculiarities to be discovered such as:

- What happens to catalyst sitting outside in the winter weather freezing.
- Catalyst disintegrating despite 100% ash pluggage, which means the cause cannot be erosion.

The Dos and Don’ts for Catalyst Handling and Operation

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Inside, Dry Storage

Good Shipping

The Dos and Don’ts for Catalyst Handling and Operation

Rapping the modules into plastic sleeves

The Dos and Don’ts for Catalyst Handling and Operation

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Proper handling at the plant:

- **Pallets, what else???**


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The Dos and Don’ts for Catalyst Handling and Operation

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The Do’s and Don’ts of Catalyst Handling and Operation in Summary:

1. Store all catalyst after removal inside, keep it dry, out of the weather, frost free and on a hard, clean surface.
2. Load catalyst properly on a truck, which is parked safely and secured on a surface providing sufficient support for the weight.
3. Place catalyst modules on suitable two way pallets large enough to handle the module size and weight.
4. Handle catalyst modules such that mechanical damage by forklift forks and/or collision with other objects is being avoided.
5. Catalyst must be secured and handled such that it remains inside the module frame during handling and transportation.
6. Pluggage should be avoided if at all possible and all loose fly ash must be removed prior to storage and/or transportation.

The Dos and Don’ts for Catalyst Handling and Operation

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The Do’s and Don’ts of Catalyst Handling and Operation in Summary:

7. **Always sample catalyst with the tools designed for catalyst sampling and remove catalyst samples only in the correct form and from the therefore dedicated location within the module.**
8. **Keep the catalyst samples in proper shape, unplugged and handle them with care.**
9. **Avoid mechanical damage of catalyst and modules .**
10. **Minimize catalyst erosion during operation by ensuring proper flow conditions.**
11. **Avoid overheating of the catalyst and thus thermal destruction.**
12. **Ensure that product quality is as expected e.g. stainless steel quality is sufficient to avoid corrosion of plate catalyst’s wire mesh during operation, honeycombs are extruded properly, etc.**