Reinhold Environmental Ltd.

2009 NOx-Combustion Round Table & Expo Presentation

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SCR O&M

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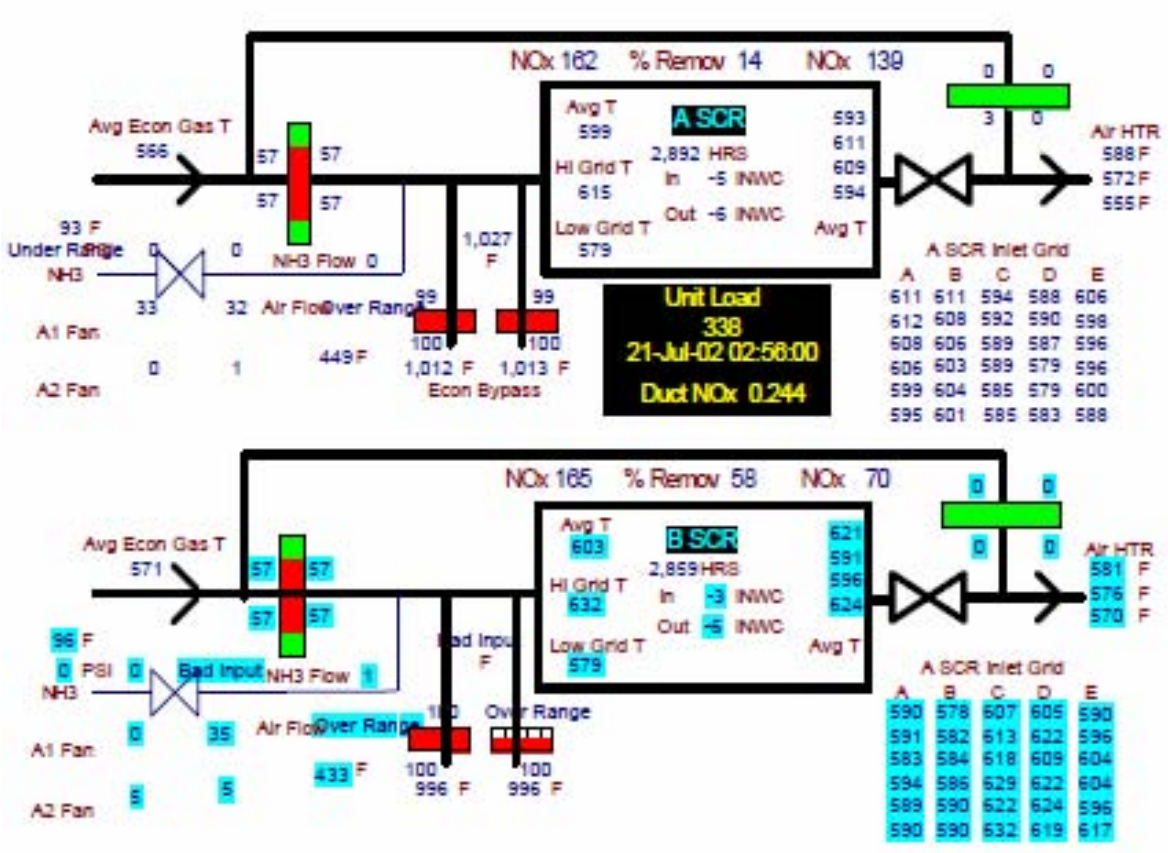
Active Back End Equipment

- The FGD system has pumps, ball mills, tanks, valves and controls that constantly require some sort of interaction between the operators and the equipment.
- The fly ash removal system requires significant operator attention.

Passive Back End Equipment

- The SCR, Precipitator and Bag House systems will run for long periods of time after they are placed in service with minimal operator attention.
- There are few moving parts. One must look at instrumentation to tell what is going on inside the boxes.

Control System Graphic

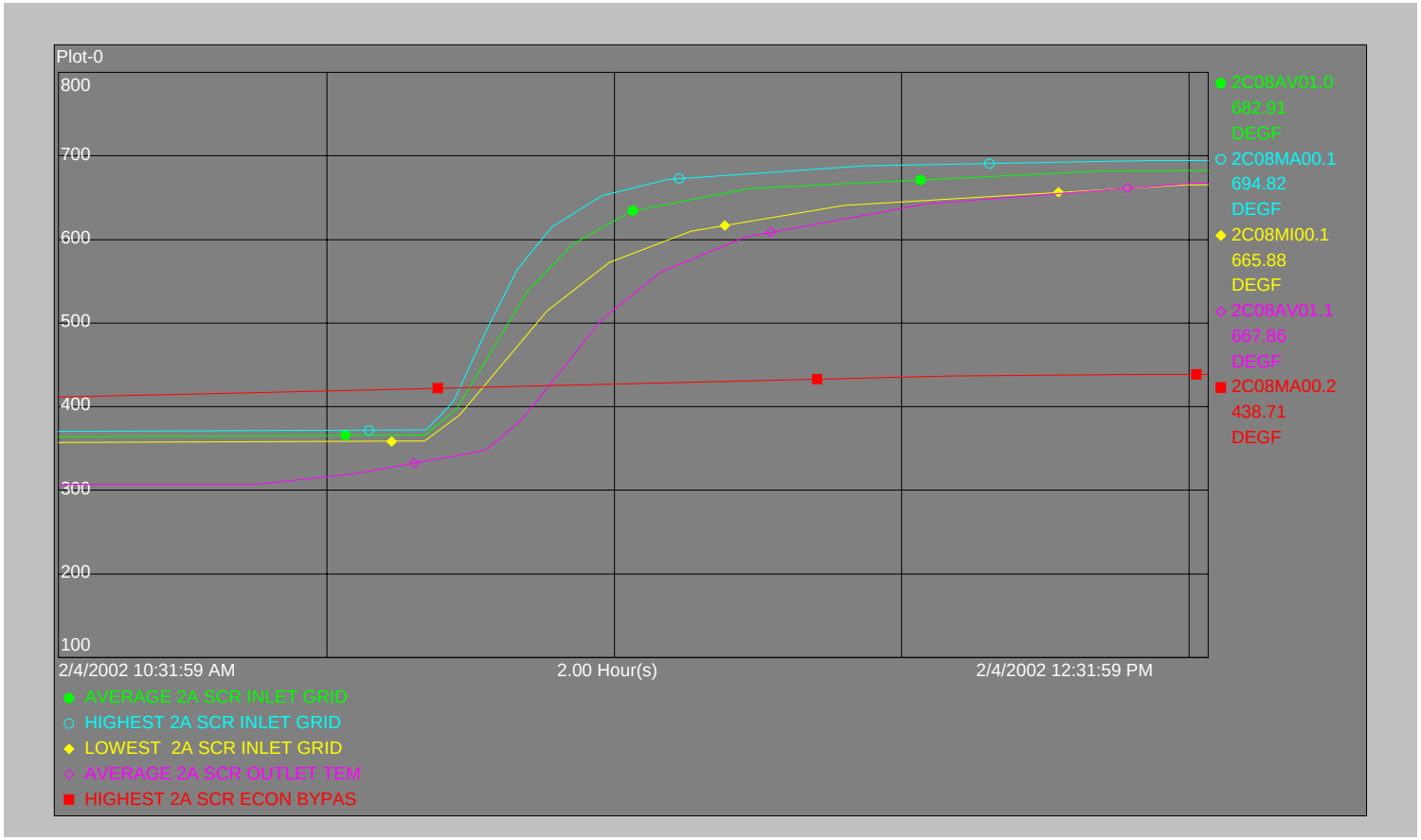


The Gap

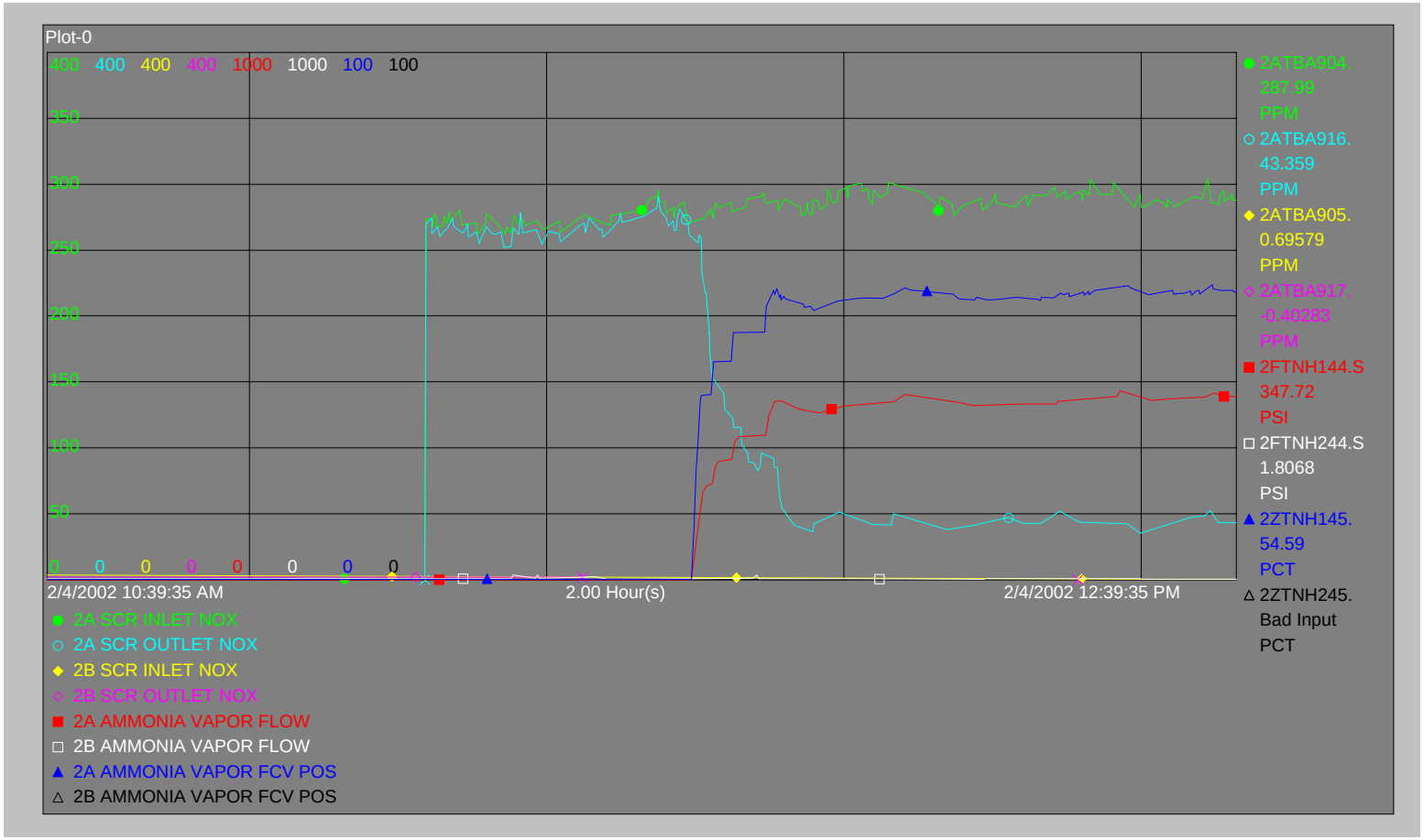
There is a significant gap between optimal operation and the low or high alarm conditions.

One needs to look at the trends that are happening and not just a snapshot of current conditions.

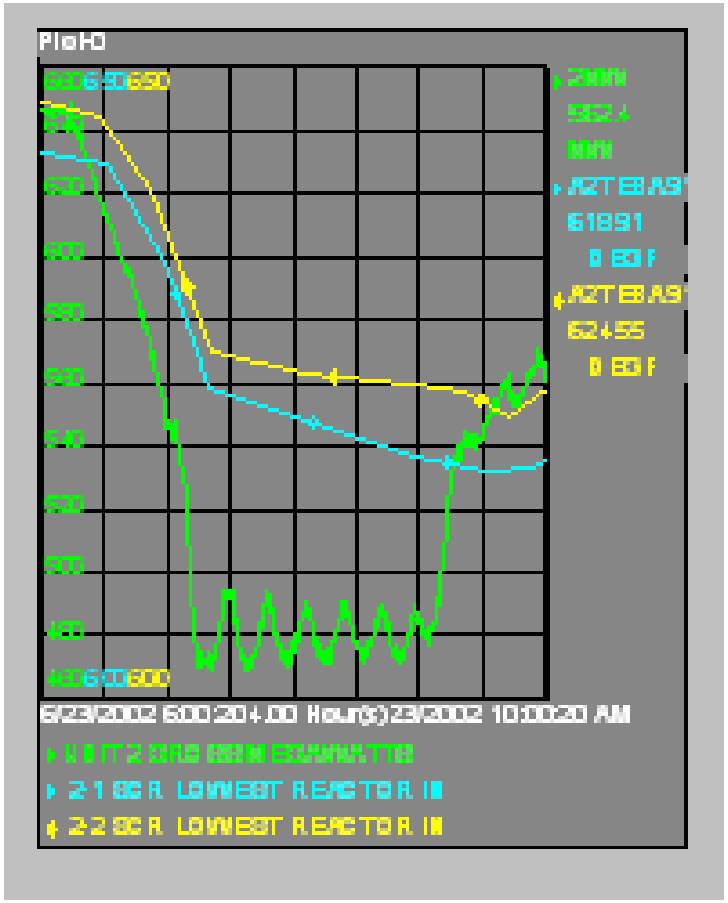
SCR Temperature Graph

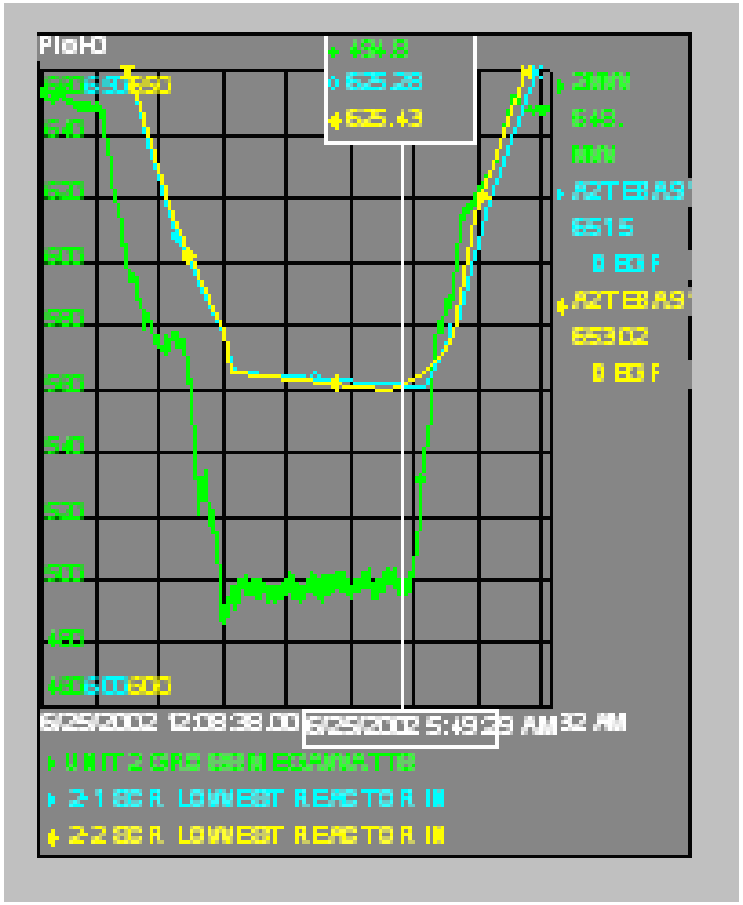


SCR Performance Graphic

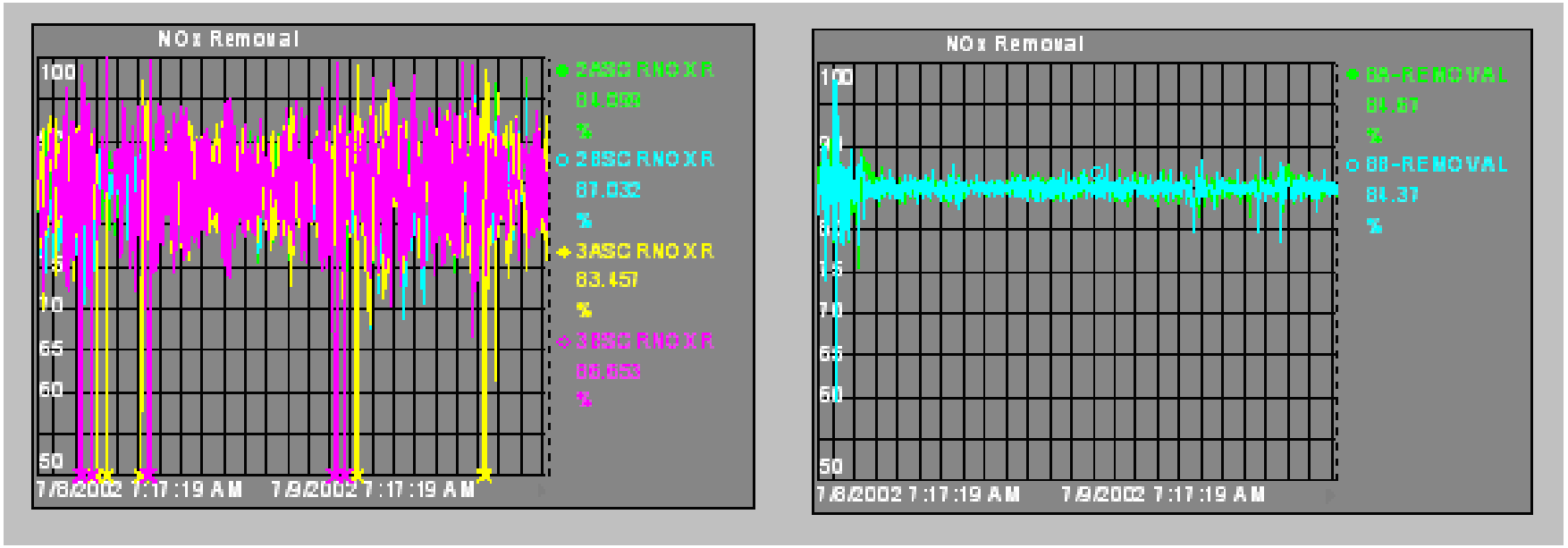


Low Load Inlet Temperatures





NOx Removal Comparison



Operation – Year Round Operation

2.4 is the multiplier

- The hours of operation increase by that amount.
- The ammonia consumption increases by that amount.
- The end of catalyst life comes that much sooner.

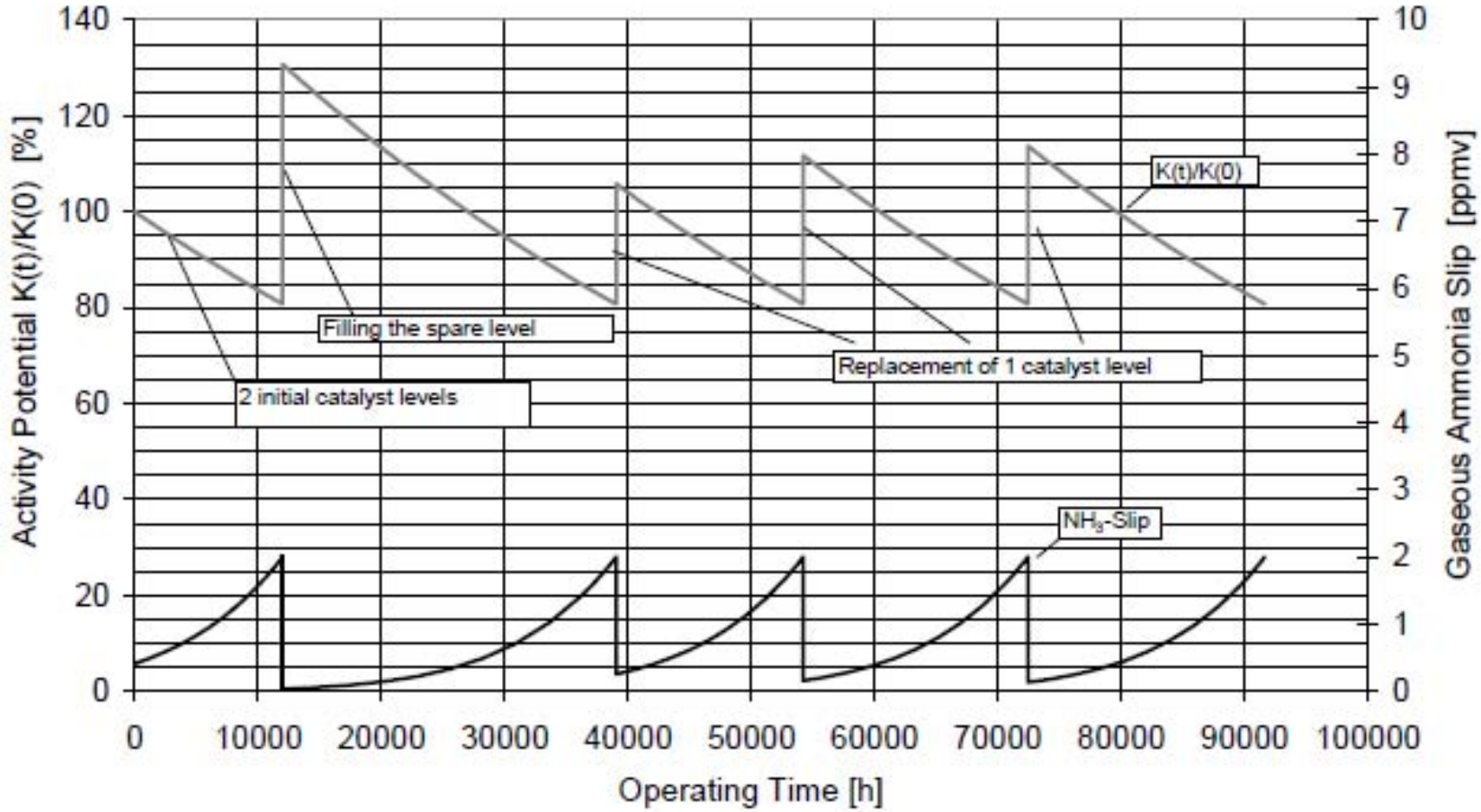
Maintenance – Year Round Operation

The opportunities to access the inside of the SCR reactor will be fewer and will require additional planning.

- The reactor will need to be cooled for entry as the unit comes down. This may prolong the unit shut down.
- This will also prolong the unit restart.

Catalyst Sampling

- The more catalyst sampling points that can be plotted on the catalyst activity graph, the more accurate the catalyst replacement needs can be predicted.
- Catalyst may have to be changed early in order to take advantage of a longer planned outage.


Activity Potential K(t)/K(0) [%]
Gaseous Ammonia Slip [ppmv]
Operating Time [h]
K(t)/K(0)
Filling the spare level
2 initial catalyst levels
Replacement of 1 catalyst level
NH3-Slip
0
20
40
60
80
100
120
140
0
1
2
3
4
5
6
7
8
9
10
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000

What if you don't sample?

- If one doesn't have enough data points to make a good catalyst life prediction, one may have an unpleasant surprise that will either:
  - Cause a several week unplanned outage to replace catalyst or
  - Cause operating the unit for an extended time with higher than allowed NOx emissions or
  - Cause operating the unit for an extended time at higher than desired ammonia slip

Sampling Plate Catalyst

Source: Argillon

Honeycomb Test Element

Ash Issues

- One won't have as much opportunity to remove ash deposits off catalyst layers. The soot blower operation must be optimized.
- If there are any signs of LPA, then LPA screens will need to be installed or repaired.

Ash Issues

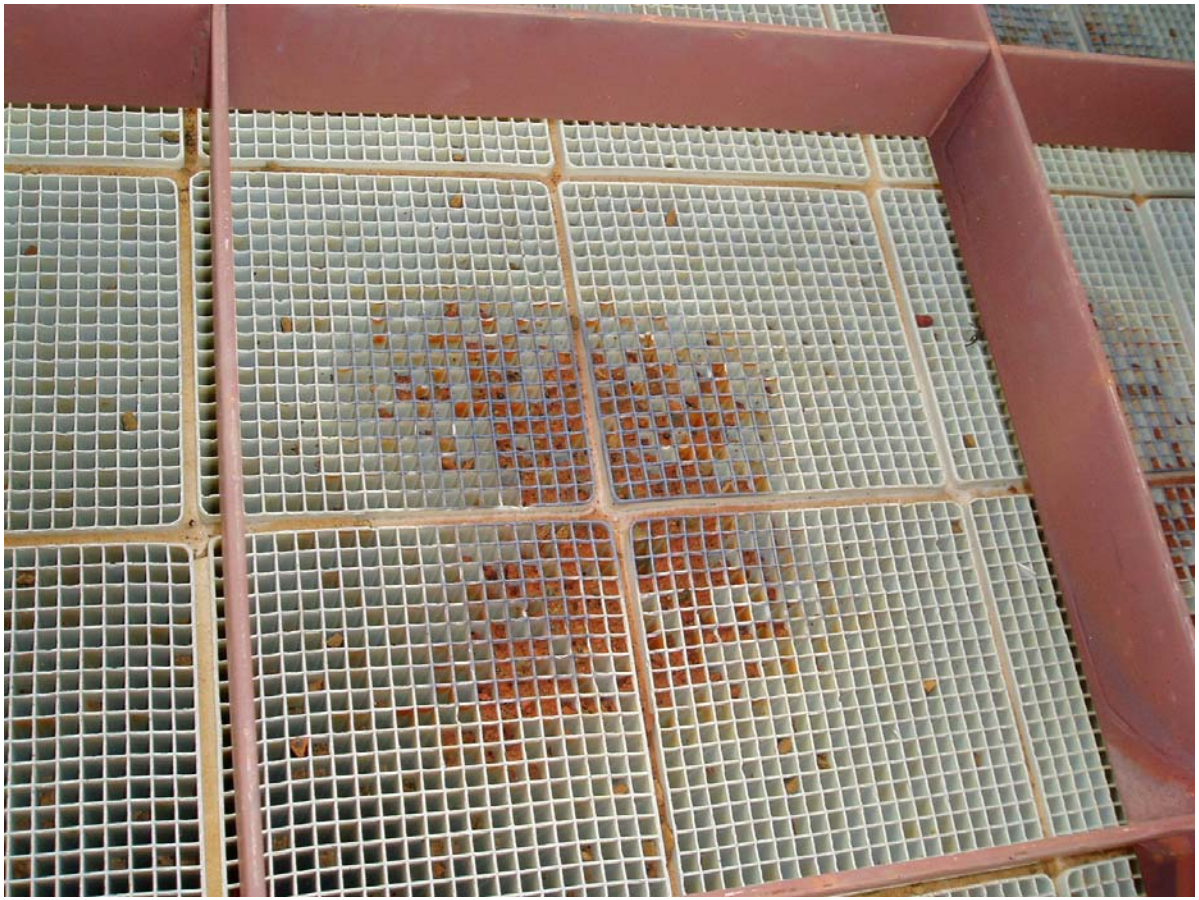
- Any signs of ash build-up in ducts and on turning vanes may be signs of poor gas distribution. One won't have the opportunity to remove ash deposits.
  - Revisit the original flow model results.
  - Take flow data to verify if anything has changed.
  - Do CFD analysis to identify solutions.

Ash Deposits on Vanes

Unburned Carbon

- One needs to minimize the amount of unburned carbon that accumulates on the catalyst since there will be less opportunity to remove it.
- Large accumulations can lead to smoldering deposits or catalyst fires.

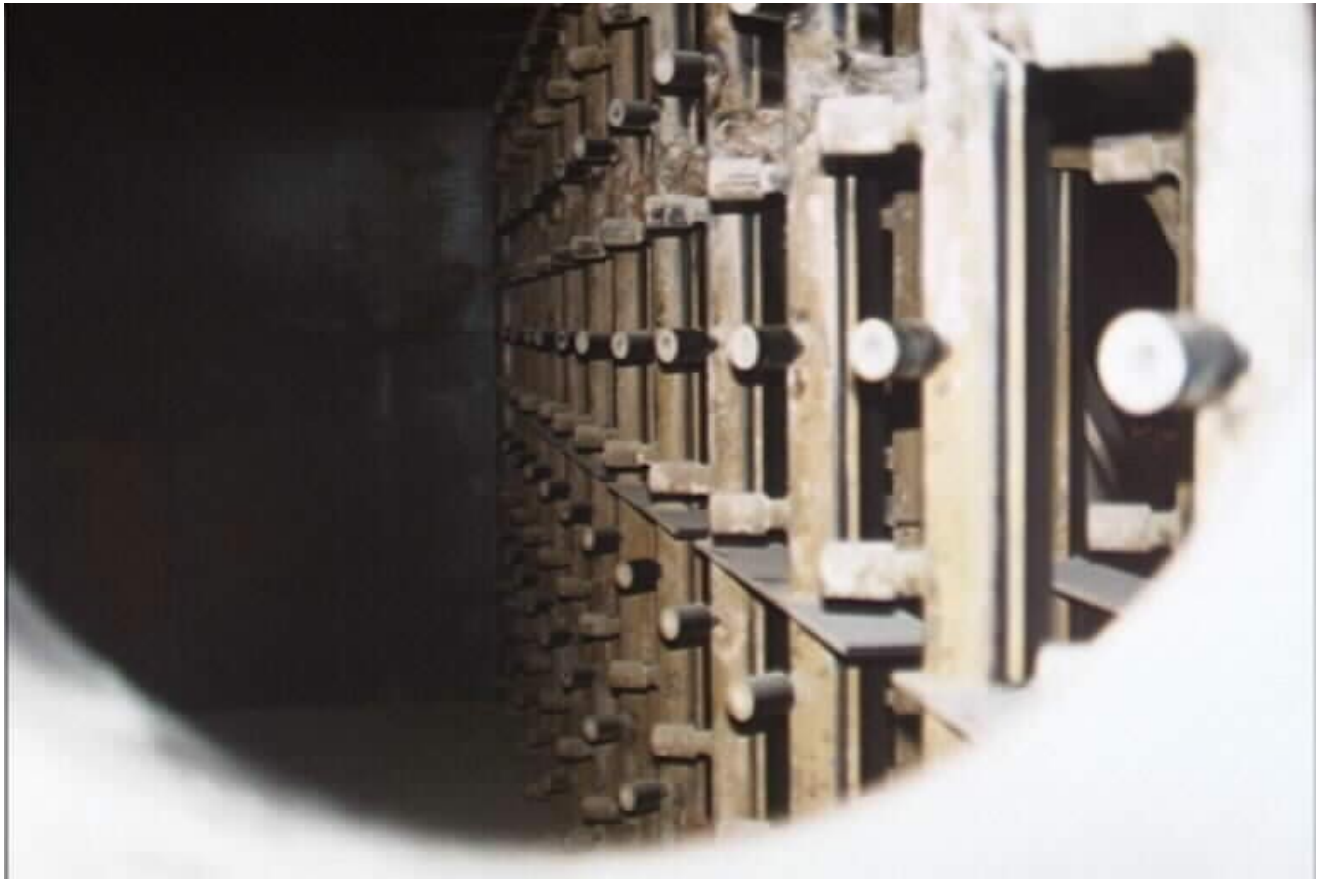
Charred Deposit in Catalyst



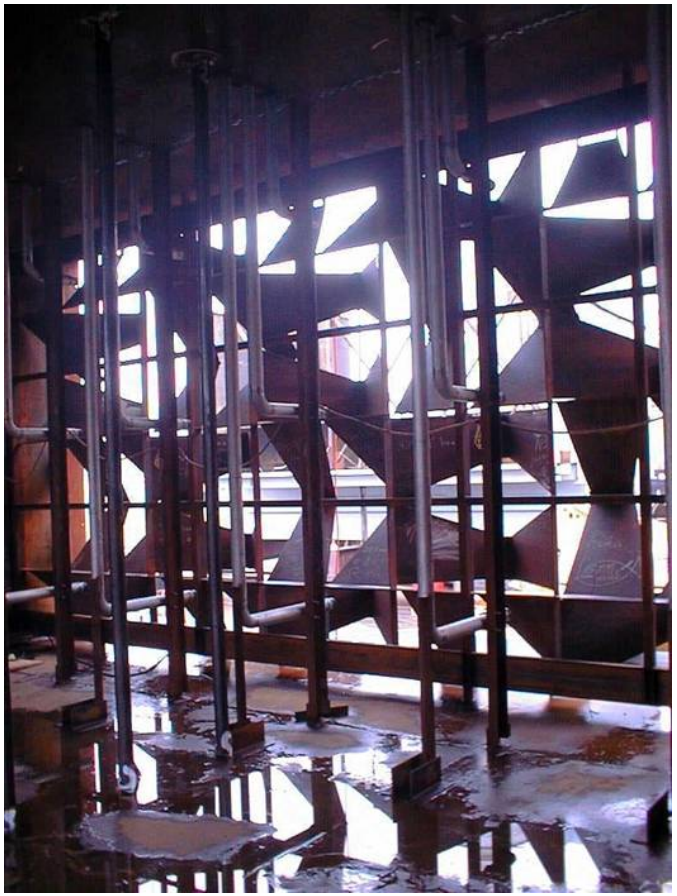
AIG Issues

- Make sure injection nozzles are not plugged with ash or ammonium bisulfate deposits.
- Make sure delta wings or static mixer elements are structurally sound.

Small Injection Nozzles



Static Mixer Injector



AIG Issues

- Tuning of the AIG still needs to be done on a regular basis. It may be more difficult since there may not be the opportunity to assure that the sample grid is open and in good condition.
- It may be more difficult to operate at reduced ammonia flow.

Winterize

- In colder climates, the equipment must now operate in much lower ambient temperatures.
  - Make sure insulation and heat trace are in good condition.
  - The pressure in anhydrous ammonia tanks will be much lower.
  - Urea based systems can have many low temperature issues.

Hydrolyzer

Anhydrous Ammonia Storage

Ammonia Storage Issues

- Many systems share common components with multiple units.
  - There will be no down time to work on common components.
  - There will be no down time to perform required tank inspections and relief valve replacement in the “off season”.

Ammonia Forwarding Pumps

Questions?