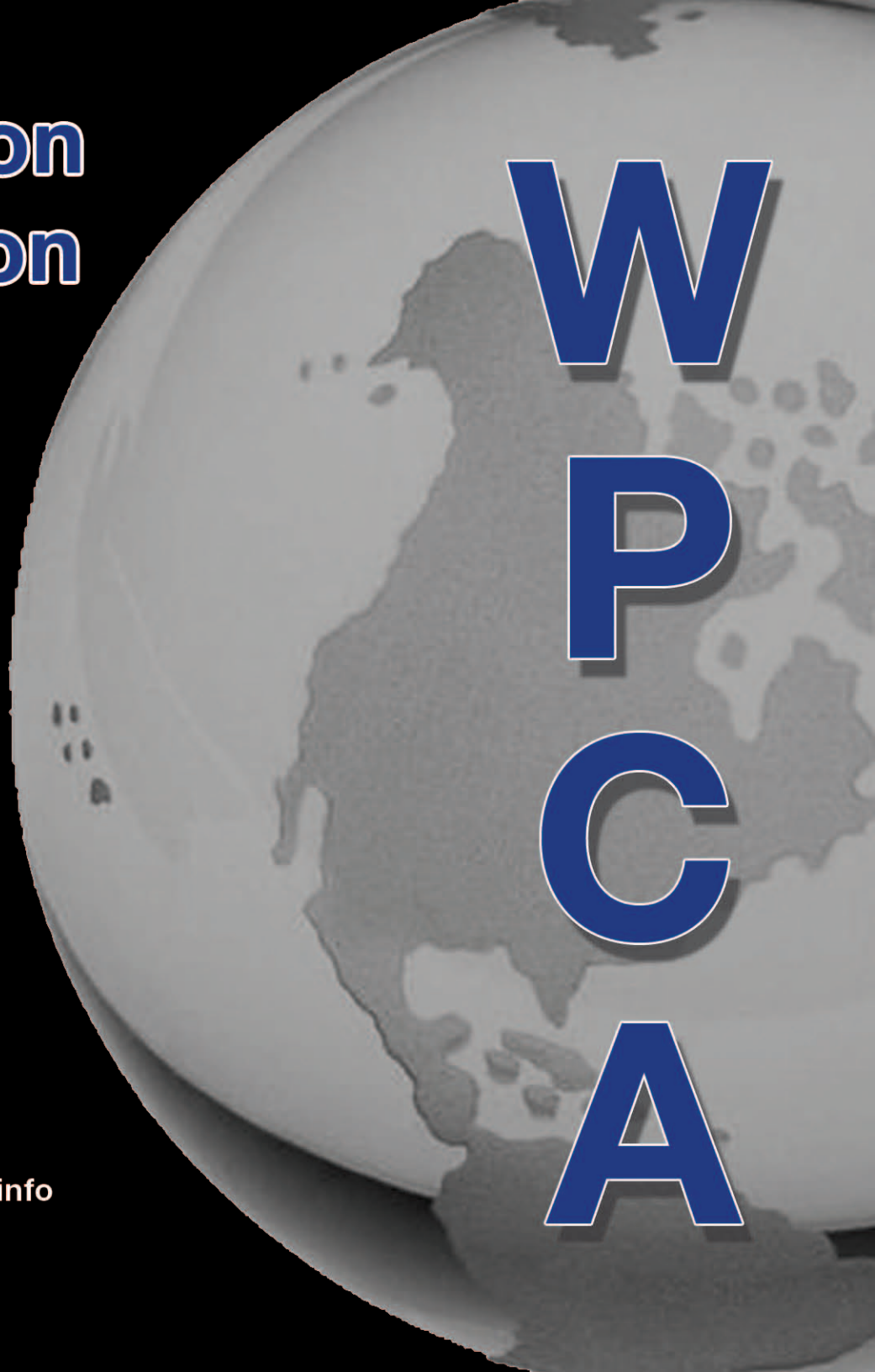
Worldwide Pollution Control Association



Duke Energy Seminar

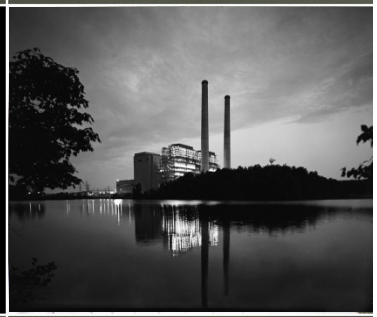
September 3 – 5, 2008

Concord, NC

WPCA

Vist our website at www.wpca.info

Utility Experience with $SCR\ SO_3$ Effects



Duke Energy – Belews Creek Steam Station

Introduction

- **Understanding SO_3 & ABS**
- **Determining T_{min}**
- **Monitoring & Controlling T_{min}**
- **SCR SO_3 Impacts**
- **SCR Low-Temp Operation**
- **APH SO_3 Impacts**

Understanding SO_3 & ABS

Sulfur Trioxide (SO_3)

- > 320ºF Gas Phase SO_3
- ~ 280ºF to 320ºF H_2SO_4 Vapor Phase
- < 280ºF H_2SO_4 Liquid Phase – Acid Dew Point

ABS - Ammonium Bisulfate – (NH_4HSO_4)

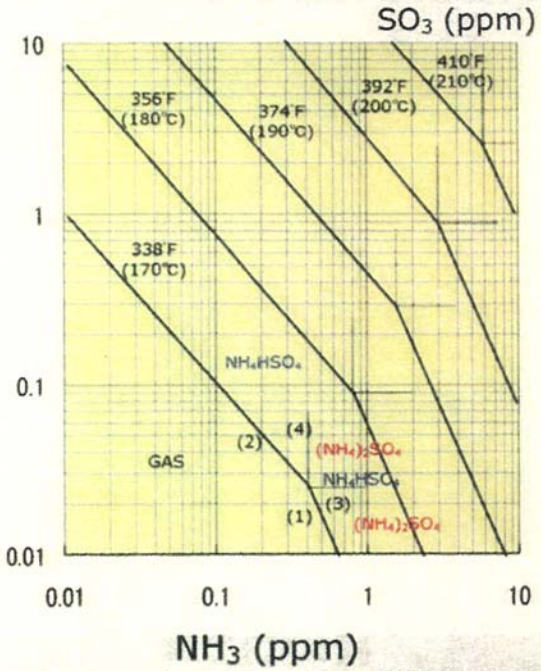
- > 625ºF Dissociates
- ~ 625ºF to 420ºF Vapor Phase
- < 420ºF Liquid/Sticky Solid Phase – ABS Dew Point

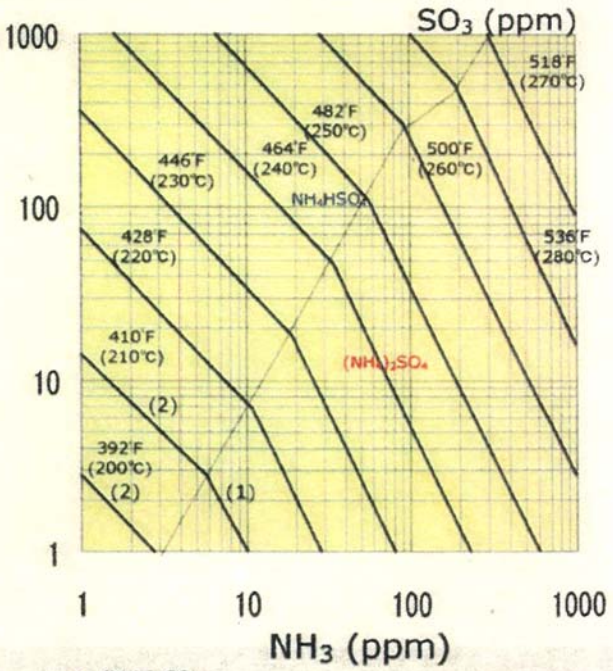
Determining T_{min} - Theoretical

LT-2

SCR Design & Operation Requirement

- Minimum Operating Temperature (Dew Point)





(1) $2NH_3+SO_3+H_2O \rightleftharpoons (NH_4)_2SO_4$

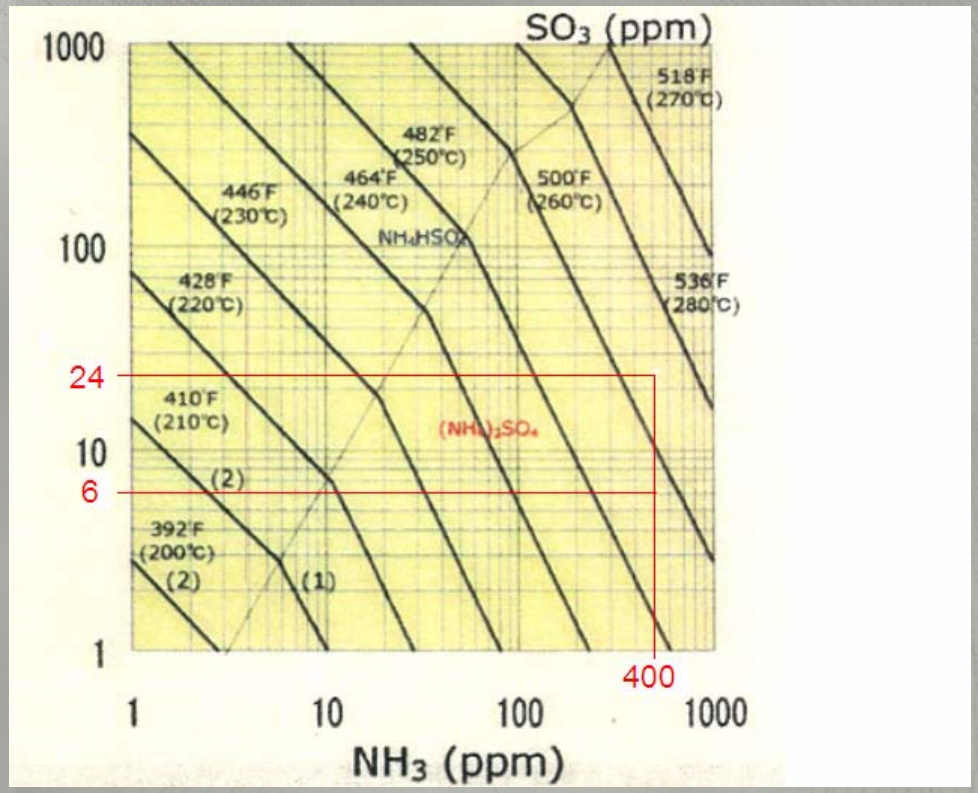
(2) $NH_3+SO_3+H_2O \rightleftharpoons NH_4HSO_4(l)$

(3) $(NH_4)_2SO_4+SO_3+H_2O \rightleftharpoons 2NH_4HSO_4(l)$

(4) $NH_4HSO_4+NH_3 \rightleftharpoons (NH_4)_2SO_4$

[ATM , H_2O:10%]

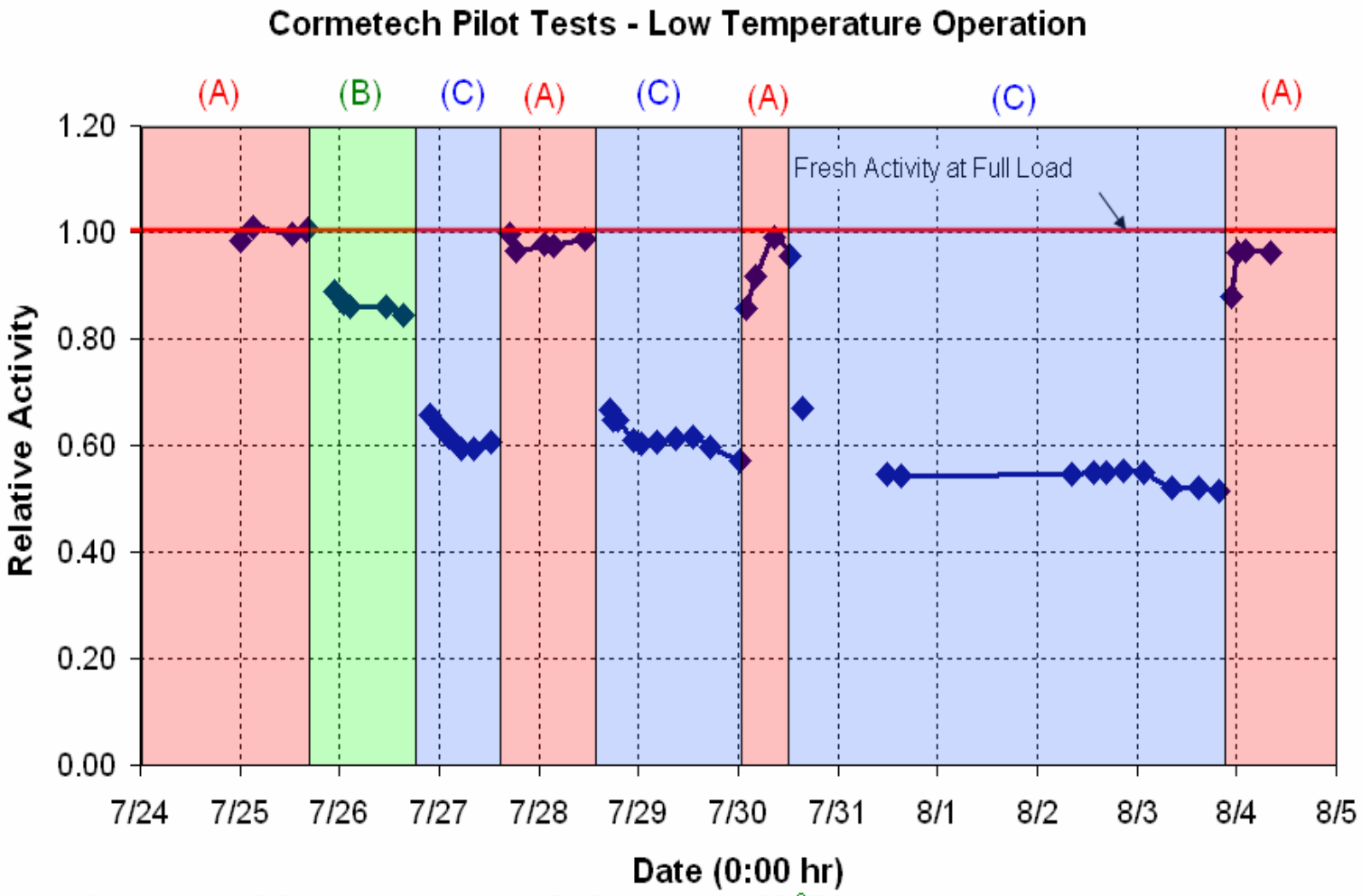
Determining T_{min} – Specific



- NH_3 Concentration = Inlet NOx Concentration
- Furnace $SO_2 \rightarrow SO_3$ Conversion = 1%
- Select Dew Point Temperature from Chart
- Add +60ºF for Capillary Negative Pressure
- Add +10ºF for Temperature Mal-distribution

Monitoring & Controlling T_{min}

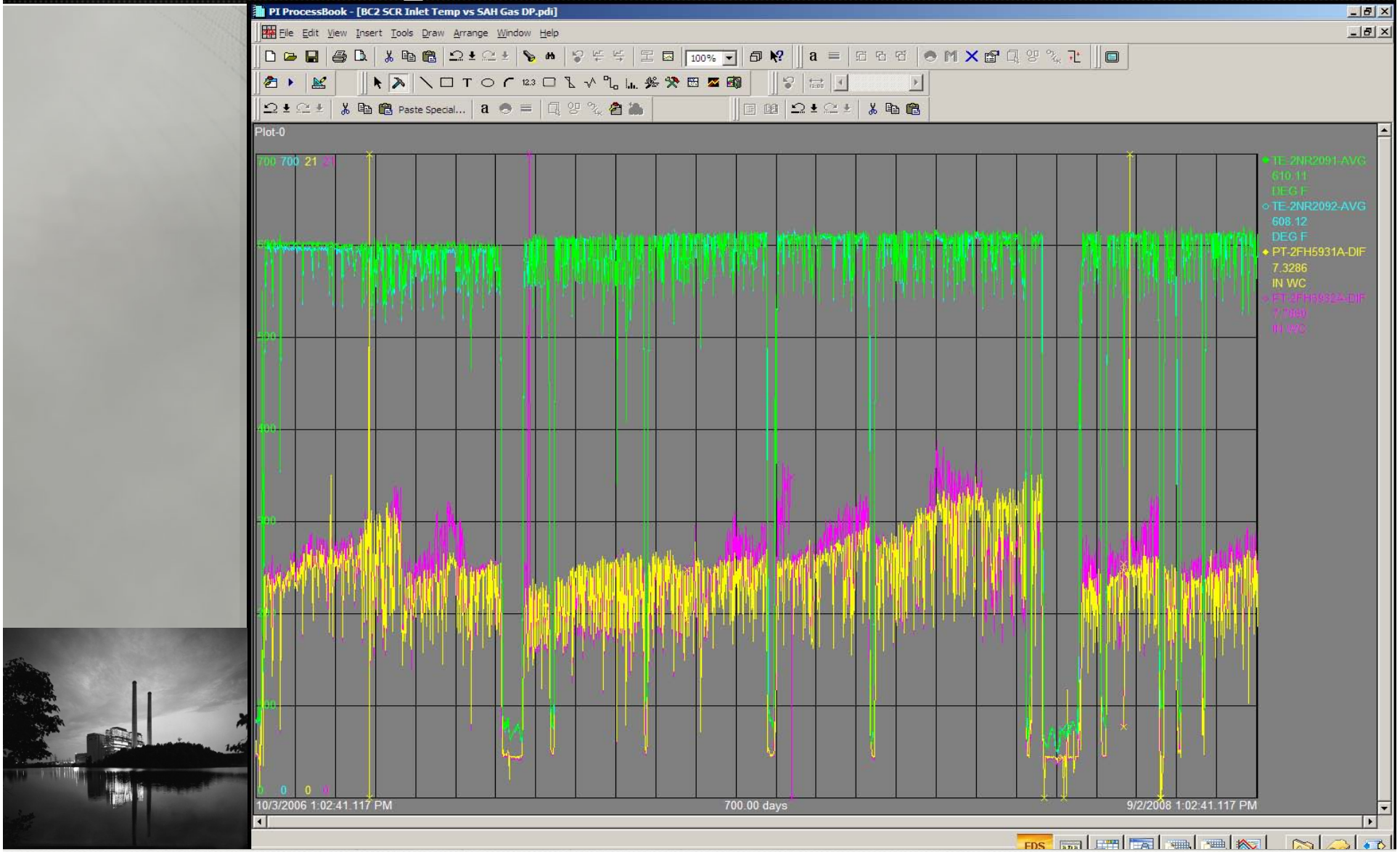
SCR Low-Temperature Operation



(A) Operation at full load temperature. (B) Operation at 25 ^{0}F below minumum injection temperature.

(C) Operation at 65 ^{0}F below minimum injection temperature (MIT).

APH SO_3/ABS Pluggage



Conclusions

- **SCR T_{min} is Unit Specific**
- **Correct Determination of T_{min} is Critical**
- **Low-Temperature Operation Requires Recovery @ > ABS Dew Point Temp**
- **No Permanent Deactivation of Catalyst after Recovery**
- **Extended Period Low-Temperature Operation Requires Slower Ramp-up to Avoid Overwhelming SCR and SAH.**
- **Recovery @ Lower Temperature is Possible with Less or No NH3 Injection**