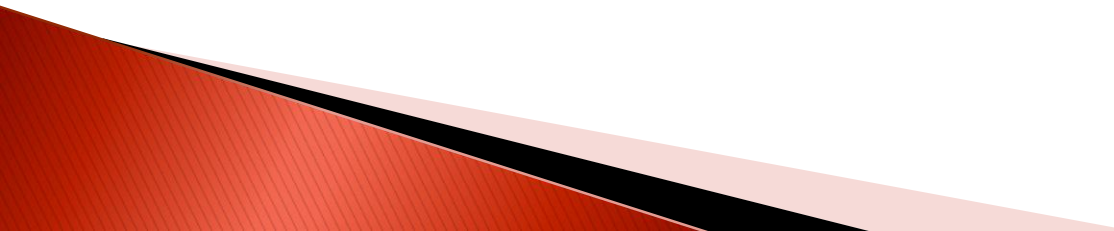


An Update on the FMC NOx Abatement Technology Using Hydrogen Peroxide


**Robert (Bob) Crynack
FMC Corporation**

**McIlvaine Hot Topic Hour – April 7, 2011
New FGD and DeNOx Approaches**

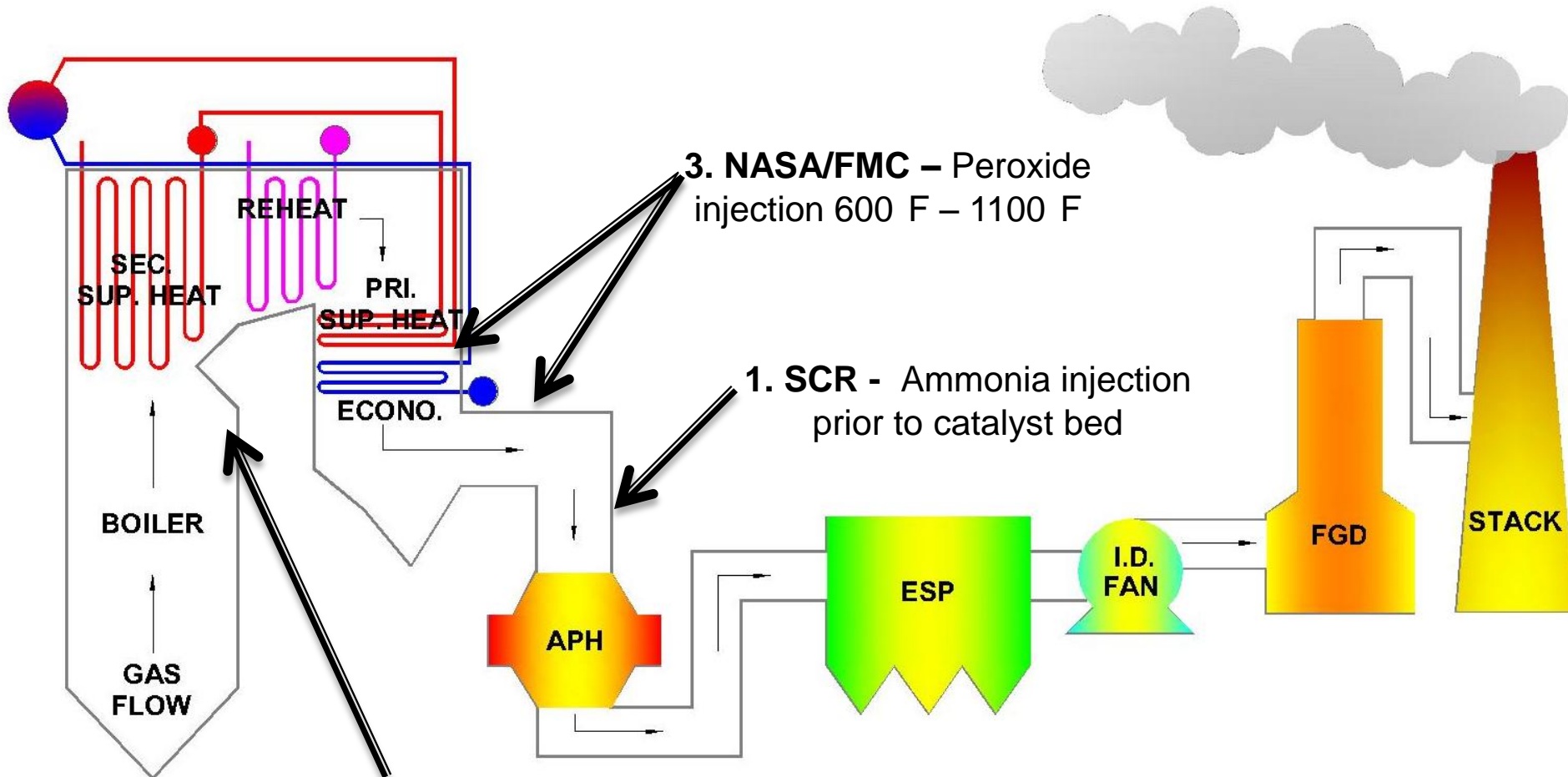
Agenda

- ▶ **Introduction**
 - ▶ **Hydrogen Peroxide (H₂O₂)**
 - ▶ **Status of technology**
 - ▶ **Full scale demonstration equipment**
 - ▶ **Path Forward**
- 

Introduction

- ▶ **Regulatory requirements are creating a need for coal fired boilers to further reduce NO_x emissions**
 - ▶ **A technology void exists for units seeking NO_x reductions of 40-80% with minimal capital investment**
 - ▶ **FMC is developing a cost effective NO_x control technology that also reduces Hg**
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NO_x Control Technologies



3. NASA/FMC – Peroxide injection 600 F – 1100 F

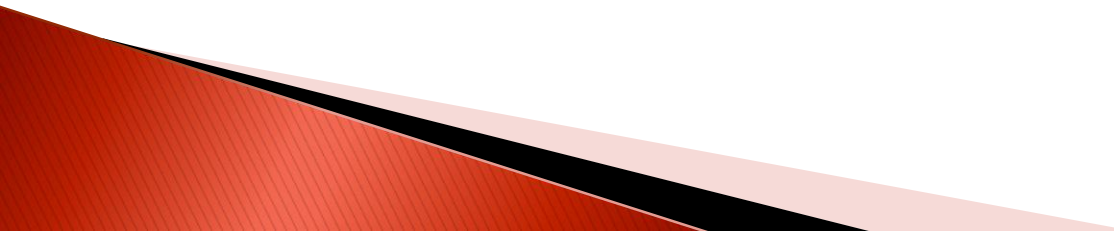
1. SCR - Ammonia injection prior to catalyst bed

2. SNCR - Ammonia or Urea injection into the boiler

FMC NO_x Technology

- ▶ **NASA Kennedy Space Center (KSC) developed an air pollution control technology with University of Central Florida**
- ▶ **FMC Corporation is the exclusive licensee for US Patent # 6,676,912**
- ▶ **Use of hydrogen peroxide (H₂O₂) to oxidize NO and Hg⁰ to forms for capture in downstream equipment**

Hydrogen Peroxide (H_2O_2)

- ▶ **Strong, environmentally friendly oxidizing agent**
 - ▶ **Major end uses: pulp & paper, chemicals, food, hair treatment, antiseptic, and electronics**
 - ▶ **Product provided in various grades and concentrations**
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Hydrogen Peroxide Chemistry

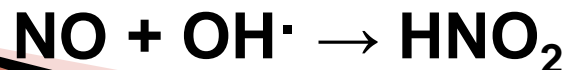
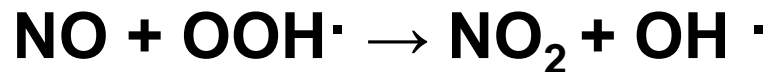
(1) Decomposition Reaction



(2) Catalytic activation



(3) **Simplified** radical reactions with NO_x in the flue gas



Nitrogen Species Capture Options

- ▶ **Wet lime/limestone/sodium scrubbers**
- ▶ **Circulated Fluidized Bed (CFB) scrubbers**
- ▶ **Spray dryer absorbers (SDA)**
- ▶ **Other dry/semi-dry scrubbers**
- ▶ **Dry injection (lime/trona) with ESP or FF**

Summary of Results

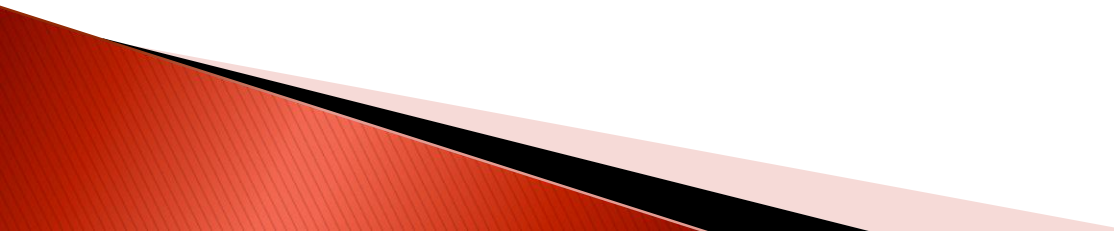
- ▶ **Oxidation of NO up to 80% has been achieved in laboratory, pilot, and full scale demonstrations**
- ▶ **Key to technology is capture of nitrogen species in downstream FGD equipment**
- ▶ **Further evaluation in on-going**

FMC NO_x Capture Program



- ▶ **URS project focused on NO₂/NO₃ and Hg⁺² capture (wet chemistry)**
- ▶ **EERC project focused on NO₂/NO₃ and Hg⁺² capture (dry chemistry)**
- ▶ **Working to identify additional trial sites, particularly to demonstrate dry and semi-dry capture**

FMC Trial Scope

- ▶ **Peroxide storage tank & containment**
 - ▶ **Chemical delivery system**
 - **Pumps**
 - **Valves**
 - **Controllers**
 - **Interconnecting piping**
 - ▶ **Spray lances and nozzles**
 - ▶ **Contracted testing services**
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Storage Tank



Injection Skid and Control



Spray Lances



Injection Ports



Summary

- ▶ **Significant progress has been made towards commercialization of the technology**
- ▶ **Final technical hurdle is NO_x capture. Getting results from R+D programs with final results expected by end of Q2 2011**
- ▶ **Optimistic that technology can fill the void for units seeking 40-80% NO_x reduction with minimal capital investment**

Applications

- ▶ **Stand alone system**
- ▶ **In conjunction with**
 - **Low NOx burners (LNB)**
 - **SNCR**
 - **Over-fired air systems**
 - **SCR**
 - **FMC has a patent application on destruction of NH₃ using hydrogen peroxide**

Thank you !

Questions ?

Bob Crynack

robert.crynack@fmc.com

412-551-0925