Innovative Technology Reduces Power Plant Emissions – Commercialization Success

Presented by

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Overview of Emission Control System Development

- Development of new oxidizer scrubber system to eliminate NOx waste and produce fertilizer
- Technology licensed and a 1 to 3 MWatt-scale prototype installed on power plant
- Development of method to oxidize NO to NO₂
- Experience gained from licensing NASA technology
Development of New Scrubber Liquor
Transformation of Waste to Fertilizer

Nitrogen Tetroxide (N₂O₄)

**Oxidizer Scrubber**
*(pH 14+)*

Sodium Hydroxide (NaOH)

Products are a hazardous waste

- Sodium Hydroxide
- Sodium Nitrate
- Sodium Nitrite
- Nitric Oxide

**Control System**

Hydrogen Peroxide (H₂O₂)

Nitrogen Tetroxide (N₂O₄)

**Oxidizer Scrubber**
*(pH 7)*

Water (H₂O)

Potassium Hydroxide (KOH)

Potassium Nitrate (KNO₃)

Product is high grade fertilizer
New Scrubber Liquor System
Efficiency vs. Scrubber Liquors

![Graph showing efficiency percentages for different scrubber liquors.](image-url)
Efficiency vs. pH at Various Peroxide Concentrations

![Graph showing efficiency vs. pH for different peroxide concentrations](image-url)
NO Oxidation Testbed
Catalyst Support
Catalyst Holder
Laboratory Conversion NO to NO$_2$
Efficiency vs. NO₂ Concentration

Scrubber Efficiency

Concentration NOx, ppm
Hydrogen Peroxide Concentration vs. Scrubber Efficiency

The graph shows the relationship between hydrogen peroxide concentration and scrubber efficiency. The concentration is plotted on the x-axis, ranging from 0% to 6%, while the efficiency is plotted on the y-axis, ranging from 0% to 100%. The line on the graph indicates a nearly constant efficiency across the range of peroxide concentrations tested.
Efficiency vs. Scrubber Pump Rate

![Graph showing efficiency vs. pump rate. The graph indicates a consistent efficiency across different pump rates.](image-url)
Initial Installation
2nd Pilot Plant Installation

Flue Gas From Furnace Exhaust

Blower 40 HP

H2O

Cooler K4'Pot
-6' H
-3' D
-5' Normal Level.

Duct

H2O

Gas

SOx Scrubber
-15' H
-4' D
-100 gal Normal Level.

Drain

SOx Sump Pump
30 HP
200 gpm

H2O

NOx Scrubber
-30' H
-5' D
250 gal Normal Level

Drain

H2O2 Oxidation Pump
40 gph Max.

Need PSV

NASA Controller/Analyzer

H2O2 - 3/8" SST

or 3-way valve here

H2O2 - 3/8" SST

Treated Gas to Furnace Exhaust

Duct

Gas

Drain

CSO

H2O

Treated Gas

Grade

CSO

H2O2

Drain

H2O2 Oxidation Pump

NOx Scrubber
-30' H
-5' D
250 gal Normal Level

NOx Sump Pump

H2O2 Tote

Need PSV
View 2\textsuperscript{nd} Installation
Top View 2nd Pilot Plant
Initial installation of Pilot Plant
Pilot Plant Results
SOx Scrubbing and NO Oxidation

Time, Minutes
Phoenix Systems International, Inc

- Company Information
- Licensing Experience
- NASA Support
- Patent Protection
- Value of NASA Commercialization Efforts
- Teaming with Other Organization