

## MDEC 2003

# Dry Systems® Technologies

Presented by:  
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## Facts about DST

- 100% owned by RAG American Coal Holding, Inc.
- Manufacturing facilities located in Chicago, Illinois
- Manufacturing capabilities – 8 to 10 units per month
- Key personnel:
  - Ron Eberhart
  - Norbert Paas
  - Terry McDonald
  - Roger Gibbs
- Filter life under actual operating conditions
  - 40 to >100 hrs.
  - Coal Haulers → Turbo 3306 → 20-ton Locomotives → Gensets
  - Scoops → Tractors ← Road graders → Mantrips

**Dry Systems Technologies®**

Exhaust Emissions from the Diesel Engine

The diagram shows a flow of exhaust emissions from the diesel engine through an Exhaust Manifold, then through a Catalyst, a Heat Exchanger, and finally a Filter. The components are represented by 3D blocks: a blue Exhaust Manifold, a red Catalyst, a blue Heat Exchanger, and a green Filter. A curved arrow indicates the flow path from the manifold through the catalyst and heat exchanger to the filter.

**ITS SIMPLE....  
IT WORKS**

95-99% OVERALL DPM REDUCTION AT ALL MODES AND OPERATING CONDITIONS  
99.9% CARBON SOOT REDUCTION  
96.5% SULFATE REDUCTION  
65% OIL BASED VOF REDUCTION AT OPERATING TEMPERATURE UP TO 275 F  
90% FUEL BASED VOF REDUCTION AT OPERATING TEMPERATURES UP TO 275 F

MINE APPROVED  
AND  
OPERATING ON  
THREE  
CONTINENTS

A small globe icon with a grid pattern, positioned to the right of the performance metrics.

**Wagner Scoop  
with CAT 3306 PCNA**

The left photograph shows a close-up view of the engine compartment, highlighting the blue CAT 3306 PCNA engine and various mechanical components. The right photograph shows the entire yellow Wagner Scoop machine, including its large tires and the engine compartment, in an outdoor setting.

## Goodman 20 Ton Locomotive With CAT 3306 PCNA



### *DST*

vs.

### *Wet Scrubber*

- |   |   |  |
|---|---|--|
| <ul style="list-style-type: none"> <li>➤ No need to fill scrubber with water each shift</li> </ul>  | → | <ul style="list-style-type: none"> <li>➤ Scrubber must be filled with water at least once each shift</li> </ul>  |
| <ul style="list-style-type: none"> <li>➤ On board cleaning system for cleaning of heat exchanger while machine is in operation</li> </ul>         | → | <ul style="list-style-type: none"> <li>➤ Scrubber must be flushed daily to flush soot out of system</li> </ul>   |
| <ul style="list-style-type: none"> <li>➤ No lost production time of equipment</li> </ul>  | → | <ul style="list-style-type: none"> <li>➤ Daily flushing and filling of scrubber results in lost production</li> </ul>  |
| <ul style="list-style-type: none"> <li>➤ Catalyst for CO and hydrocarbon removal</li> </ul>   | → | <ul style="list-style-type: none"> <li>➤ Wet scrubber not catalyzed</li> </ul>   |
| <ul style="list-style-type: none"> <li>➤ No oily film present from the exhaust which allows vehicle and components to stay cleaner</li> </ul>     | → | <ul style="list-style-type: none"> <li>➤ Oily film still present on wet scrubber exhaust, making vehicle, radiator and engine compartment oily and hard to keep clean</li> </ul> |
| <ul style="list-style-type: none"> <li>➤ With no water in the exhaust vehicle does not rust over time</li> </ul>                                  | → | <ul style="list-style-type: none"> <li>➤ Acidity in exhaust causes engine and components to rust</li> </ul>  |
| <ul style="list-style-type: none"> <li>➤ No floats or cam switches to maintain</li> </ul>   | → | <ul style="list-style-type: none"> <li>➤ Floats and cam switches must be maintained and adjusted at regular intervals</li> </ul>   |
| <ul style="list-style-type: none"> <li>➤ No haze or steam present in the exhaust making it safer visually for the operator and workers</li> </ul> | → | <ul style="list-style-type: none"> <li>➤ Bluish yellow haze present on a wet scrubber exhaust especially during high humidity times</li> </ul>                                   |
| <ul style="list-style-type: none"> <li>➤ Filter life prolonged with no water vapor in exhaust</li> </ul>  | → | <ul style="list-style-type: none"> <li>➤ Filter life shortened with water vapor in exhaust</li> </ul>  |

<u><i>DST</i></u>	V/S.	<u><i>Ceramic Trap</i></u>
➤ 15 years of proven mine application with excess of 300,000 operating hours	—————>	➤ Relatively new to the mining market, some with very little experience
➤ On board cleaning system for cleaning of heat exchanger while machine is in operation	—————>	➤ Cumbersome removal from machine or regeneration on board requiring machine to be in close proximity to electrical hookup resulting in lost production time
➤ No lost production time of equipment	—————>	➤ Bake off time of up to 8 hours
➤ Catalyst does not generate NO2	—————>	➤ Platinum based ceramic traps produce NO2
➤ Particulate filters DPM and can be disposed of as normal trash	—————>	➤ Requires filtered vacuum machines to clean up remains after regeneration
➤ Catalyst standard with all DST Systems	—————>	➤ Catalyst is optional with ceramic traps
➤ Sized to horse power application, can be changed from one machine to another	—————>	➤ Sized to duty cycle of machine, if this changes ceramic trap must be changed
➤ No parts that will burn out	—————>	➤ Ceramic traps can burn out and result in purchase of additional traps
➤ One purchase for one machine	—————>	➤ Multiple ceramic traps must be purchased for change out during non-passive regeneration
➤ Multiple arrangements for permissible applications	—————>	➤ Not available for permissible applications

## DST Maintenance Requirements

- Manually activate water injection system under engine full load at least once each operating shift
- Observe recommended engine exhaust backpressure
- Observe recommended engine intake restriction
- Change exhaust and intake filters when indications warrant
- Manually flush heat exchanger weekly
- Weekly permissibility required

## Diesel Equipment Maintenance and Training Critical to the Operation

- Production Enhanced
- Health and Safety of Employee is Increased
- Employee Takes More Pride in His/Her Work
- Machines Run and Last Longer, Reducing Overall Cost
- Communication is Greatly Improved

## Diesel Maintenance Training

Must Include The Following:

- Emission Sampling and Diagnosis
- Engine and Maintenance Specifications
- Fuel Delivery Design
- Cooling System Design
- Emission Control Technology
- Thorough Understanding of Maintenance Procedures and Permissibility Checklists

## Diesel Operator Training

Must Include The Following:

- Emission Sampling
- Engine Specifications
- Mechanical Operational Check Lists
- Machine Operational Instructions
- Emission Control Technology

## RAG/ 20-Mile 13 DST Equipped Machines

- (4) CAT 3306 PCNA 150 HP Permissible Units on Wagner ST5 Scoops
- (2) CAT 3306 PCTA 190 HP Non-permissible Units on Wagner 25X Scoops
- (4) CAT 3306 PCTA 190 HP Permissible Units on Wagner 25X Scoops
- (2) CAT 3304 PCNA 100 HP Non-permissible Units on Wagner Lube Trucks
- (1) CAT 3406 DITA 305 HP Non-permissible Unit on Generator Package

- Currently 10,658 Operating Hours on DST Systems

Average Filter Life of 41 Operating Hours

All Machines Using 16" Dual Element Exhaust Filter

## RAG/ Pennsylvania Operations 30 DST Equipped Machines

- (8) CAT 3306 PCNA 150 HP Non-Permissible Units on 20 Ton Locomotives
- (8) CAT 3304 PCNA 100 HP Non-permissible Units on 11 Ton Mantrip/ Locomotives
- (9) Isuzu C240 56 HP Non-permissible Units on Brookville Jeeps
- (3) Cummins 3.3 65 HP Non-permissible Units on Brookville Jeeps
- (1) C240 56 HP Non-permissible Unit on Bucket/ Fork Truck
- (1) Cummins 5.9 190 HP Non-permissible Unit on 20 Ton Locomotive
  
- Currently 74,989 Operating Hours on DST Systems

Average Filter Life of 44 Operating Hours – 10" Filter

Average Filter Life of 75 Operating Hours – 16" Filter

Average Filter Life of 47 Operating Hours – 8" Filter

## RAG/ Wabash 18 DST Equipped Machines

- (2) CAT 3306 PCNA 150 HP Non-Permissible Units on Supply Tractors
- (1) CAT 3306 PCNA 150 HP Permissible Unit on Wagner ST5 Scoop
- (4) MWM 94 HP Permissible Units on Wagner ST5 Scoops
- (9) MWM 94 HP Permissible Units on Jeffrey Coal Haulers
- (1) MWM 94 HP Non-permissible Unit on Road Grader
- (1) Deutz 190 HP Non-permissible Unit on Generator Package
  
- Currently 159,402 Operating Hours on DST Systems

Average Filter Life of 41 Operating Hours – 10" Filter

Average Filter Life of 50 Operating Hours – 16" Filter

- >125 DST Units Currently Operating in Over 25 Mines and Tunneling Projects in the U.S.
- 20 DST Units Currently in Operation in South Africa and Australia

Over 300,000 Successful  
Operating Hours

Installed on Engines Ranging from 54 to 350 HP

Questions?