DPM Workshop

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Diesel Particulate Filter Application
Case Study

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- Multi pronged approach for DPM control
  - Corrective Measures for Existing Ventilation
  - Engine Replacement
  - Exhaust Filtration
  - Upgrade Mine Ventilation Volumes
  - Alternative Fuel Trials
Exhaust Filtration

- Assess equipment fleet as to primary sources for DPM
- MSHA listing for Particulate Index (P.I.)
- P.I. is based on Ventilation Rate to normalize emissions to $1000 \, \mu g/m^3$
- Some of your larger engines may not be your biggest polluters
Diesel Particulate

MAJOR EQUIPMENT FLEET

- 40D Truck 6 475 HP
- 450/1250 Loader 4 300 HP
- 420 Teletram 6 225 HP
- 436 Teletram 2 375 HP
- Wagner ST3.5D 4 200 HP
- Elphinstone Loader 1 165 HP
- Getman Carriers 11 150 HP
- Normet Carrier 2 150 HP
- Jumbos 10 75 HP
- Tractors 25 53 HP
Exhaust Filtration

- Target Equipment Requirements for Passively Regenerated Filters
  - 4 Cycle Engines
  - High Duty Cycle
  - High Exhaust Gas Temperatures
Exhaust Filtration

- Temperature profiling is imperative
- Data logging over several days to gain a good perspective of operating conditions
- Test each piece of equipment in a given production cycle
  - Eg; Two LHD’s, similar configuration, one in remote mucking, the other in manual mucking
  - One configuration was successful, the other, marginal
4 Channel Data Logger
6” K type Thermocouple
Data Logger, Probe and Case
Toro 40 D Installation
Greens Creek Mining Company

Toro 40 D Installation
Getman A64 Scissors Truck
Getman A64 Installation
Getman A64 Installation
Greens Creek Mining Company

Getman A64 Installation
Kubota M5030 Tractor
Kubota M5030 Installation
Temperature Profile

LR 46 Temperature 09/11/02

LR46 Exhaust deg C

Deg C

6AM 9AM 12PM 3PM 6PM 9PM 16 Mon 3AM 6AM

15 Sun Sep 2002  LR460913.PL1
Temperature Profile

HT 39 Backfill Truck

Ambient Compensation
Exhaust Temp

Deg C

Oct 2002
325
Diesel Particulate Filter Selection Criteria

- **Catalyzed Cordierite Filter**
  - 20 % Duty Cycle exceeds 325 Degrees F

- **NIOSH Filter Guide**
  - [http://www.msha.gov/nioshmnmfilterselectionguide/temp_analysis.htm](http://www.msha.gov/nioshmnmfilterselectionguide/temp_analysis.htm)
Temperature Histogram

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Temperature Histogram
10-degree C increments

Count=Num of times exhaust is within T 10-deg "bins"
Percent of time that exhaust is greater than T

LR46
Temperature Histogram

10-degree C increments

Count=Num of times exhaust is within T 10-deg "bins"  Percent of time that exhaust is greater than T

HT37
Temperature Histogram

Count=Num of times exhaust is within T 10-deg "bins"

Percent of time that exhaust is greater than T

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Temperature Histogram
10-degree C increments

HT39
Temperature Histogram

PT 14 - Mercedes 904 LA

- Count=Num of times exhaust is within T 10-deg "bins"
- Percent of time that exhaust is greater than T

Temperature, Deg C

Percent

Count
Passive Filter Installation
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Active Filter Installation
Getman A64 Powder Truck

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Active Filter
Mounted on Getman Powder Truck

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LR46 - 6 Weeks - Filtered Exhaust
LR46 - 1 1/2 Shifts with no Filter
Pre & Post Filter Samples
Failing Filter
Discharge Side - Soot Ghosting, Rotation
Failed Ceramic - Exhaust Bypass
Active Regeneration Filters
Left – Clean Filter, Right - Soot Loaded Filter
Active Regeneration Station
Control Panels
Thermograph
Heat Plume of Heating Filter
Thermograph
Discharge side of Regenerating Filter
Greens Creek Mining Company

MSHA Cooperative Test
DPM Sampling - Jan 2003

- Average Stope Sample - Total Carbon
- Stopes tested 675 / 704 / 490 / 446 / 30

- Sampler mounted on LR46, outside cab
  - Filtered Equipment : 205 ug/m³
  - Unfiltered Equipment : 1,233 ug/m³
MSHA Cooperative Test
DPM Sampling - Jan 2003

- Average Stope Sample - Total Carbon
- Stopes tested 675 / 704 / 490 / 446 / 30

- Sampler mounted on LR46, inside cab
  - Filtered Equipment : 49 ug/m³
  - Unfiltered Equipment : 271 ug/m³
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