

# DPM Controls used in Underground Coal Mines.

By

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# Tools you can use to control DPM.

- 1. Maintenance.
- 2. Cleaner Engines.
- 3. Alternate Fuels.
- 4. Ventilation.
- 5. Filters
  - A. Disposable.
  - B. Ceramic.
- 6. DOC's

# How do you pick your engines.

## Fact based or emotion based.

1. Reputation.
2. Service.
3. Knowledge of engine family.
4. Know the dealer.
5. Brother in-law works there.
6. Parts availability.
7. Warranty.

# Cleaner Engines. MSHA Web Site.

HP @ RPM at 1000ft Elevation

Ventilation Rate CFM

DPM grams/hr weighted

87 @ 2800	6000	3.7
100 @ 2200	4500	4.14
99 @ 2300	6000	5.57
87 @ 2800	7000	5.95
87 @ 2300	4500	6.66
99 @ 2500	6500	6.8
102 @ 2500	6500	6.8
116 @ 2500	6500	12.74
103 @ 2200	7500	15.27
108 @ 2400	9000	15.29
85 @ 2600	4500	16.14
85 @ 2600	4500	16.14
94 @ 2300	4000	19.54
116 @ 2500	4500	19.54
97 @ 2500	7000	22.09
111 @ 2400	7000	22.09
94 @ 2300	5500	25.49
100 @ 2200	5000	25.49
116 @ 2500	7000	30.59

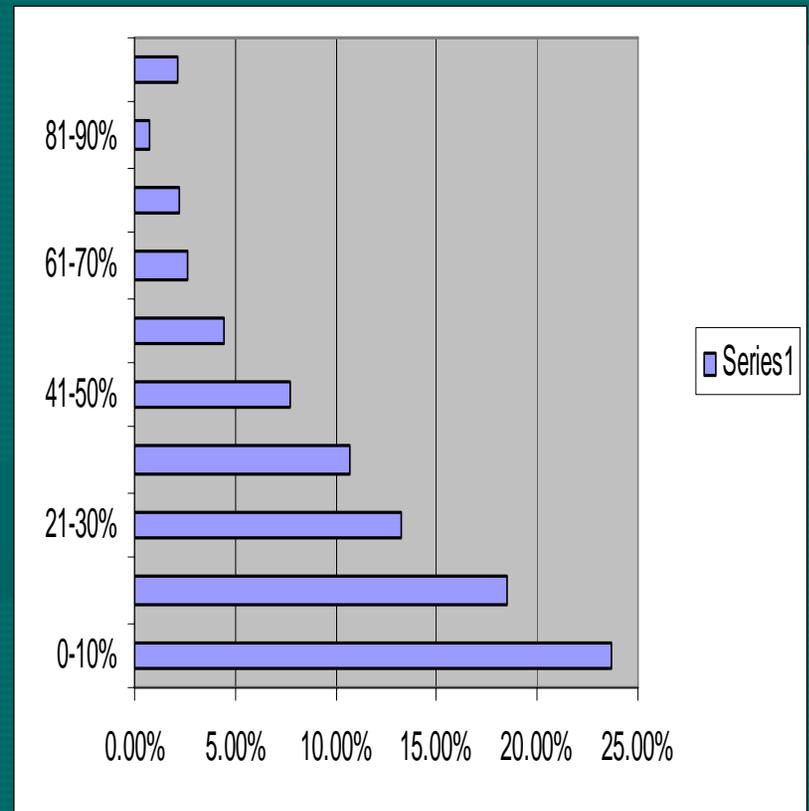
# Ventilation.

1. What does 1 CFM / Year cost?
2. Recent reports show that \$4.50 is the cost of 1 CFM / Year.
3. A 85-116 hp engine can cost between \$20,250 and \$40,500 per year to operate. This is for gasses.
4. For DPM the costs are higher. PI times 6.25.
  - a.  $3.7 \text{ g/hr @ } 160 \text{ ug/m}^3 = 15,625 \text{ cfm}$
  - b.  $30.59 \text{ g/hr @ } 160 \text{ ug/m}^3 = 112,500 \text{ cfm.}$

# Dodge Trucks

## 65% of the time below 4.2 g/hr.

Approval Number	07-ENA040015	07-ENA040015-1
Engine Manufacturer	CUMMINS	CUMMINS
Model	ISB-325	ISB-215
HP @ RPM	325 @ 2900	215 @ 2900
Ventilation Rate CFM	13000	9000
DPM grams/hr weighted	21.32	15.56



# Alternate Fuels & Additives.

1. How do you separate the truth from the B.S.?
2. Always require lab test results using the ISO 8178 non-road test cycle. Keep everything on the same playing field.
3. Testimonials are good for toothpaste and tires but not for alternate fuels or additives.

# Last line of defense.

## Filters and DOC's.

1. Filters. Highly efficient in trapping DPM. Costly and labor intensive.
  - a. Disposable.
  - b. Ceramic.
2. Diesel Oxidation Catalyst. Less efficient in removing DPM. Less costly and labor intensive.
  - a. Old style.
  - b. New and improved style.

# Disclaimer!!!

I am sure there are other devices out there. I am speaking on what we at AWBG are using now.

# Mac's Package for disposable filters.



# Mac's Package for disposable filters.

1. Two heat exchangers.
  - a. 12 volt fan for lower horse power engines.
  - b. Hydraulic driven fan for higher horse power engines.
2. Shut down sensor set to 600F for filter protection.

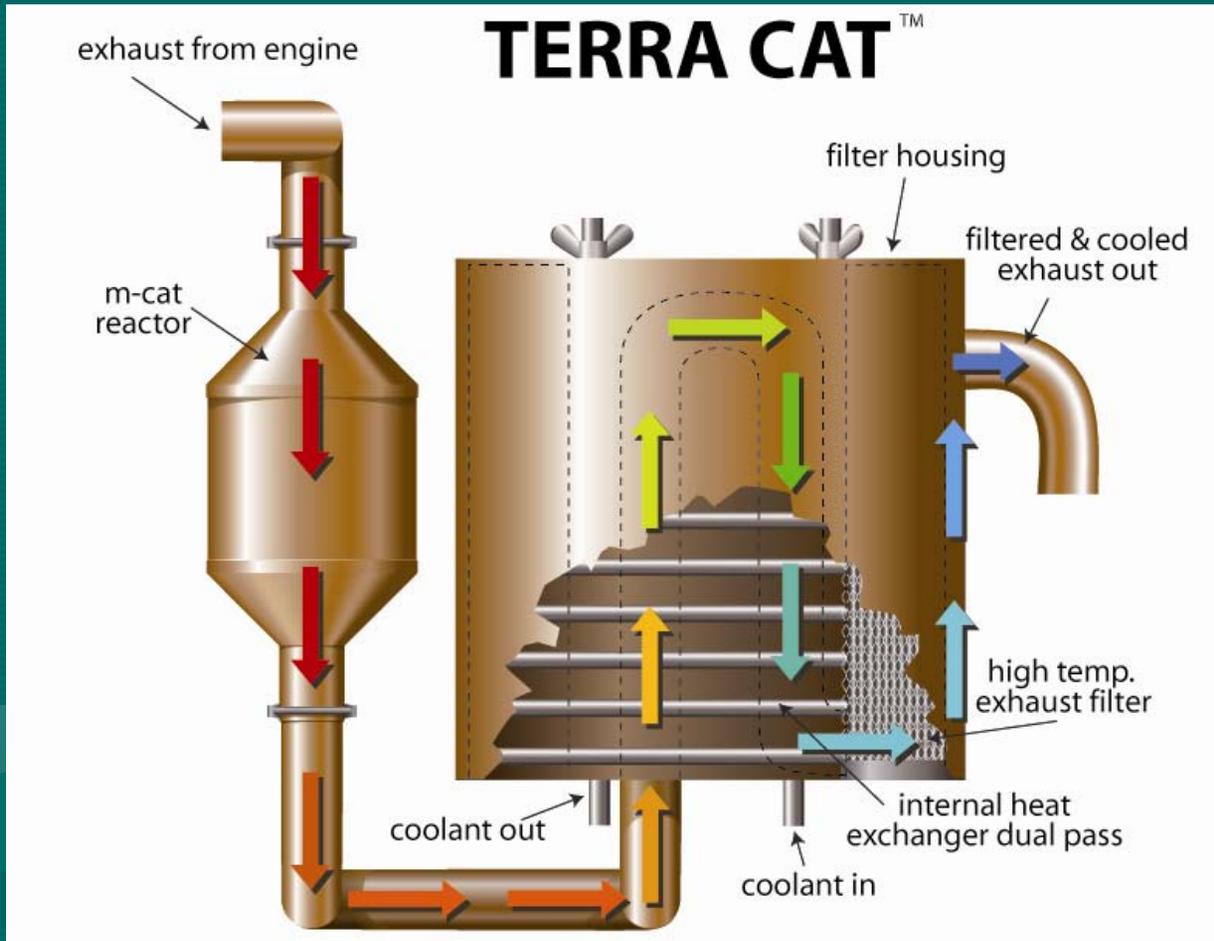
# Donaldson High Temperature.



# Donaldson Filter.

- Reinforced & wire backed filter media
- Filter materials are high temperature &
- non-combustible
- Water resistant
- High temperature gasket insures
- proper sealing
- Open-ended design allows for multiple filter operation
- Filter size maximized performance and minimized cost

# Bunderson Terra Cat



# Bunderson Terra Cat

1. Compact/Custom fit for each vehicle
2. Integrated catalyst/Liquid Cooled Canister & High Temp Filter.
3. Works with D2 fuel, synthetic fuel & ULSD.
4. Reduces (Whole) Diesel Particulate Matter (DPM) by 90%.
5. Greatly reduces CO & HC.
6. Not Duty Cycle dependent.

# Dry Systems Technology “DST”.



# Dry Systems Technology “DST”. Permissible.



# Dry Systems Technology “DST”.

- Dry System<sup>®</sup> reduces Diesel Particulate Matter (DPM) > 95%
- Dry System<sup>®</sup> reduces Carbon Monoxide (CO) as much as 90%
- Dry System<sup>®</sup> does not increase the Oxides of Nitrogen (NOx). Modular design for ease of installation
- Systems available for engines from < 50hp to > 350hp
- Low temperature paper filter technology
- Performs at all duty cycles
- No regeneration process required
- No fuel additives needed
- Performs with minimal routine maintenance

# Getman Chiller.



# Getman Chiller.

- Features
- Easily replaced fire retardant, synthetic composite filter that has a low cost prefilter element
- Exhaust gas cooling package using an air-glycol heat exchanger so easily replaced, relatively low cost filters can be utilized.
- The exhaust gas heat exchanger uses durable finned tubes extract heat from the exhaust stream for a low back pressure, and extended filter life system. Primary goal is a low maintenance, uninterrupted productivity system.
- Separate glycol radiator provides system heat dissipation independent from the engine cooling system.
- Exhaust temperature is monitored, shutting down the engine between 275°-280°F, to prevent damage to the filter.
- Exhaust back pressure monitoring package, consisting of; electronic control module and warning lights (yellow/red) that first indicate moderate back pressure - intermittent yellow illumination and then higher back pressure condition exists.
- Hydraulic powered water pump requiring 2 - 4 gpm
- Exhaust sampling ports for undiluted gas.
- Engines Reviewed for Coal Applications
- Caterpillar 3306 DITA, 200 hp
- Caterpillar 3306 PCNA, 150 hp
- Detroit Diesel OM906, 200 hp
- Detroit Diesel OM904, 147 hp

# ECS-AZ

## Diesel Oxidation Catalyst



# ECS-AZ

- Flow-through system: no soot trapping or regeneration
- PM reduction by oxidizing SOF of the DPM
- California ARB verified (>25%PM reduction)
- US EPA verified (minimum 20-40%PM, 40%CO & 50%HC reduction)

# ECS Combifilter



# ECS

## Combifilter

- >25% above 380°C for Regeneration
- 87% efficiency rating
- Off-Board Regeneration

# EWS MCAT



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# ESW M-CAT

1. High performance Diesel Oxidation Catalyst.  
Hybrid!!
2. Flow Through design.
3. No NO<sub>2</sub> increase.
4. Compact design.
5. Not duty cycle dependent.
6. Fits engines from 30HP to 600HP.

# DCL With the AIT.



# Questions?

