

**Pennsylvania Technical Advisory Committee  
On Diesel Powered Equipment**

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December 3, 2010

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McCaffrey  
Lida  
Anton  
original/Dunn

Joseph Scaffoni, Director  
Bureau of Mine Safety  
Fayette County Health Center  
100 New Salem Road, Room 167  
Uniontown, Pa. 15401

RE: Dry Systems Technologies and Gunther Nash- Permissible Model GN 953 diesel end loader/ mucker utilizing a 185 HP Cummins C8.3diesel engine (MSHA Part 7 approval 07-EPA040001) and a DST M250 (MSHA Part 7A approval 07-FA050001) emission control package for use in the Enlow Fork - Oak Springs Slope Project

Dear Mr. Scaffoni:

Chapter 4 of the "Bituminous Coal Mine Safety Act" (the Act) provides for the use of diesel-powered equipment in underground bituminous coal mines. Section 424 of the act created a Technical Advisory Committee ("TAC") for the purpose of advising the Department regarding implementation of Chapter 4 and evaluation of alternative technology or methods for meeting the requirements of Chapter 4. On October 21, 2010 the Director approved the TAC's recommendations for "Conditions for use of diesel powered equipment in shaft and slope construction".

**Background**

On February 26, 2010 Dry Systems Technologies and Gunther Nash Inc. submitted a request to the Bureau of Mine Safety (BMS) for approval for a Permissible GN 953 diesel end loader/ mucker utilizing a 185 HP Cummins C8.3diesel engine (MSHA Part 7 approval 07-EPA040001) and a DST M250 emission control package for use in the Enlow Fork - Oak Springs Slope Project.

On March 16, 2010 the Director of BMS requested the TAC to evaluate the Permissible Cat 953 diesel end loader/ mucker and to advise the Department regarding the TAC's recommendation as to whether the referenced equipment meets requirements of Section 403 of the Act and conditions for use of diesel powered equipment in shaft and slope construction, as well as access for inspection of permissible components.

On December 2, 2010 the TAC received a request from Gene Davis for Gunther Nash to be able to use the end loader prior to the next TAC meeting on January 12, 2011.

The diesel power package includes the following items:

- 185 HP Cummins C8.3diesel engine (MSHA Part 7 approval 07-EPA040001)
- Diesel oxidation catalyst DST – P/N M90-218-02
- Exhaust DPM filter DST – P/N M30-411-01R (96% efficient)
- Heat exchanger DST- P/N M90-301-11

More detailed information on the specifications of the diesel power package is included on the General Specification Sheet which is attached as Attachment 1.

### **Investigation**

On December 2, 2010 the TAC and DEP traveled to the Enlow Fork -Oak Springs Slope Project to Gunther Nash to inspect the equipment when it became available. The TAC evaluated the engine and exhaust emissions package, as well as procedures to check the permissible joints on the diesel engine and emission control package.

Emissions testing of the engine and after-treatment system were performed, as well as exhaust gas temperature monitoring and stall test procedure. The results of the emission tests showed the engine was performing within MSHA's approval specifications.

The maximum surface temperature observed was 204° F at the turbo flange, the maximum exhaust gas temperature measured was 154° F, and the maximum engine oil temperature observed was 150° F. The maximum engine coolant temperature measured was 170° F. The engine coolant warning was set to 197° F and the shutdown was set to 207° F. These temperatures were in compliance with Section 403 of the Act.

The results of the emissions tests showed the engine was performing within MSHA's approval specifications. The after-treatment system is fitted with an exhaust DPM filter DST – P/N M30-411-01R (96% efficient). The engine and filter extrapolations show that the diesel power package will result in an average ambient concentration of 0.040 mg/m<sup>3</sup> of diesel particulate matter when diluted by 100% of the MSHA approval plate ventilation rate for this engine, which is well below the .12 mg/m<sup>3</sup> requirement of Section 403 (a)(1) the Act, see (Attachment 2).

The TAC also evaluated the procedures to check the permissibility of the joints and gaskets on the engine and emissions control system. Although all joints and gaskets were accessible, it was not clear if the permissible feeler gage developed by DST was able to completely check all of the required locations with certainty. The TAC and DEP agreed that an alternate method was needed to ensure that no leaks were present on the connections. The TAC recommends that the DST feeler gage be used for permissibility on all readily accessible joints and gaskets. The TAC also recommends that on the intake system a gage be installed to measure the turbo boost pressure. If the gage shows less than 25% of the nominal pressure then it may indicate a leak. On the exhaust system the TAC recommends that a gas detector (sniffer) be used to check for leaks around joints or gaskets that are not readily accessible. The gas detector may detect CO, NO<sub>2</sub> or other exhaust gases. When the reading of the specific exhaust gas is above ambient there is indication of a leak. All trained diesel mechanics that do the permissibility checks will be trained in the use of the specific gas detector (sniffer), the procedures to check for leaks using the detector and the training will be recorded. The gas detector will be maintained and calibrated monthly or according to the manufacturer's recommendations.

In addition to the testing that was conducted, our investigation and our observations confirmed that the diesel power package is capable of meeting all the requirements of Section 403 of the Act and the conditions for use of diesel powered equipment in shaft and slope construction.

### **Recommendation**


Our recommendation is based upon the data supplied by DST and Gunther Nash, the results of the tests conducted on December 2, 2010, as well as the data acquired and observations made during our investigation. The TAC has determined that the Permissible Model GN 953 diesel end loader/ mucker utilizing a 185 HP Cummins C8.3diesel engine (MSHA Part 7 approval 07-EPA040001) and a DST M250 (MSHA Part 7A approval 07-FA050001) emission control package for use in the Enlow Fork - Oak Springs Slope Project meets all requirements of Section 403 of Chapter 4 of the Pennsylvania Bituminous Coal Mine Safety Act and the conditions for use of diesel powered equipment in shaft and slope construction. As such, we are recommending approval of the above described diesel power package with the following stipulations. This recommendation is provided with the understanding that the General Specification Sheet (Attachment 1) be strictly adhered to.

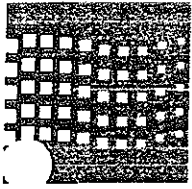
### **Additional TAC stipulations for approval:**

- This approval is site specific to the Gunther Nash Enlow Fork- Oak Springs Slope Project and to the Model GN 953 diesel end loader/ mucker.
- Permissibility testing on the engine and emissions control system shall be done as follows:
  - The TAC recommends that the DST feeler gage be used for permissibility on all readily accessible joints and gaskets.
  - The TAC also recommends that on the intake system a gage be installed to measure the turbo boost pressure. If the gage shows less than 25% of the nominal pressure then it may indicate a leak.
  - On the exhaust system the TAC recommends that a gas detector (sniffer) be used to check for leaks around joints or gaskets that are not readily accessible. The gas detector may detect CO, NO2 or other exhaust gases. When the reading of the specific exhaust gas is above ambient there is indication of a leak. All trained diesel mechanics that do the permissibility checks will be trained in the use of the specific gas detector (sniffer) and the procedures to check for leaks using the detector. This training will be recorded. The gas detector will be maintained and calibrated monthly or according to manufacturer's recommendations.

The TAC received a request for temporary approval for use prior to the next TAC meeting. The TAC recommends temporary approval until the next scheduled TAC meeting on January 12, 2011 at which time permanent approval will be recommended.

  
Paul Borchick

  
Ron Bowersox



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## AMBIENT DPM CALCULATION SHEET

Engine Model	Cummins C8.3 CAT A
MSHA Number	07-EPA040001 (185 hp)
Ventilation Rate	13,000 CFM
Filter Type	Dry System Technologies Model M30-411-01R
Filter Efficiency	96%

CONVERT DPM FROM (grams/hr) to (mg/min)

$$(23.08 \text{ g/hr}) \times (1 \text{ hr}/60 \text{ min}) \times (1,000 \text{ mg/g}) = 384.67 \text{ mg/min}$$

CONVERT VENTILATION RATE FROM (CFM) TO (m<sup>3</sup>/min)

$$(13,500 \text{ ft}^3/\text{min}) \times (.028315 \text{ m}^3 / 1 \text{ ft}^3) = 382.25 \text{ m}^3/\text{min}$$

DIVIDE DPM (mg/min) BY VENTILATION RATE (m<sup>3</sup>/min.)

$$(384.67 \text{ mg/min}) \div (382.25 \text{ m}^3/\text{min}) = 1.006 \text{ mg/m}^3$$

SOLVE FOR AMBIENT DPM LEVEL AT 96% FILTER EFFICIENCY

$$1.006 \text{ mg/m}^3 \times (100\% - 96\% \text{ Filter Efficiency}) = \underline{0.040 \text{ mg/m}^3}$$

ATTACHMENT 2

GUNTHER-NASH INC

MODEL GN 953 LOADER

General Specifications of the Diesel Powered Equipment Package

MSHA Machine Approval	Part 36 Pending
MSHA Diesel Electric	DST, 18-DEA070001
Engine	Cummins C8.3
Horsepower	185 HP (Derated to 150 HP for this application)
Rated Speed	2200 RPM
Manufacturer's Maximum Exhaust Back-pressure	41 inches Water Gage
MSHA Approval (Cat A)	07-EPA040001
MSHA Ventilation Rate	13500 CFM
MSHA Weighted Particulate (DPM)	23.08 gr/hr (384.67 mg/min)
Ambient DPM Exposure	0.040 mg/m <sup>3</sup>
MSHA Power Package Approval	DST, 07-FA050001 PART 7A
Catalyst	DST - P/N M90-218-02
Heat Exchanger	DST - P/N M90-301-11
Exhaust Filter	DST - P/N M30-411-01R (96% efficient)

ATTACHMENT 1