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Bureau of Mine Safety  
Uniontown

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

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August 20, 2010

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

Scaffoni  
Bookshar  
McCaffrey  
Antoon  
Gaida  
original/Dunn

RE: Rhomac Model D242 diesel power rockduster with a Deutz BF3L2011 engine derated to 34.4 HP @ 2300RPM with a RHOMAC INC exhaust conditioning system Model DEC1202 and a Clean Air Assure Model CPD0700BCCN20 oxidation catalyst and Clean Air Permit DPM filter Model FUA126W4CN.

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.

**Background**

On June 2, 2010 Rhomac, Inc. submitted a request to the Bureau of Mine Safety (BMS) for approval for an Rhomac Model D242 diesel power rockduster with a Deutz BF3L2011 engine derated to 34.4 HP @ 2300RPM with a RHOMAC INC exhaust conditioning system Model DEC1202 and a Clean Air Assure Model CPD0700BCCN20 oxidation catalyst and Clean Air Permit DPM filter Model FUA126W4CN.

On June 14, 2010 the Director of BMS requested the TAC to evaluate the Rhomac Model D242 diesel power rockduster and to advise the Department regarding the TAC's recommendation as to whether the referenced equipment meets requirements of Section 403 of the Act.

The diesel power package includes the following items:

- Deutz BF3L2011 engine derated to 34.4 HP @ 2300RPM (MSHA Approval #07-ENA050007)
- RHOMAC INC exhaust conditioning system Model DEC1202
- Clean Air Assure Model CPD0700BCCN20 oxidation catalyst
- Clean Air Permit DPM filter Model FUA126W4CN (85% efficient).

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 August 3, 2010 the TAC traveled to Rhomac, Inc. to inspect the equipment when it became available. The TAC evaluated the engine and exhaust emissions package.

Emissions testing of the engine and after-treatment system were performed, as well as exhaust gas temperature monitoring and stall test procedure. Since this diesel unit is not capable of inducing an engine stall the same as a wheeled transportation unit, an alternate method was needed. The engine stall was achieved by bringing the engine up to operating temperature and then while at full throttle, closing the load test valve on the compressor to divert compressed air to blow off vent line, which was regulated at 60 psi. The results of the emission tests showed the engine was performing within MSHA's approval specifications.

The maximum surface temperature observed was 260° F, the maximum exhaust gas temperature measured was 140° F, and the maximum engine oil temperature observed was 210° F. These temperatures were in compliance with Section 403 of the Act. The exhaust was cooled by using an electric fan drawing air into a mixing chamber to mix with the exhaust before being vented out of the tailpipe. There was some concern regarding a buildup of fines being drawn into the mixing box by the fan. This will be addressed during each 100 hour maintenance check by cleaning out the mixing box.

The results of the emissions tests showed the engine was performing within MSHA's approval specifications. The after-treatment system is fitted with Clean Air Permit DPM filter Model FUA126W4CN (85% efficient). The engine and filter extrapolations show that the diesel power package will result in an average ambient concentration of .0593 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). A smoke dot test will be performed at baseline and during each 100 hour maintenance check, and the results recorded on the 100 hour maintenance check list. Smoke dot test results over a 3 will require the unit to be removed from service until the cause is determined and repairs are made to get test results at a 3 or less.

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.

## Recommendation

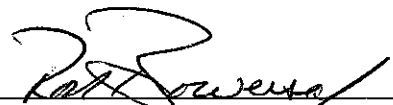
Our recommendation is based upon the data supplied by Rhomac Inc, the results of the tests conducted on August 3, 2010, as well as the data acquired and observations made during our investigation. The TAC has determined that the Rhomac Model D242 diesel power rockduster with a Deutz BF3L2011 engine derated to 34.4 HP @ 2300RPM with a RHOMAC INC exhaust conditioning system Model DEC1202 and a Clean Air Assure Model CPD0700BCCN20 oxidation catalyst and Clean Air Permit DPM filter Model FUA126W4CN meets all requirements of Section 403 of Chapter 4 of the Pennsylvania Bituminous Coal Mine Safety Act. 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:

- The 100 hour maintenance checks as required by Section 416 will include cleaning out the mixing box on the exhaust system and the results recorded on the 100 hour maintenance checklist.
- The operator pre-op checks as required by Section 415 will include a visual check to see if the mixing box fan is operating, free of obstructions or accumulations, and the results recorded on the operator's pre-op checklist. Any necessary cleaning or repairs will be done before the equipment is put into operation.
- The unit must be attended during operation as required in Section 401(b) of the Act.
- The stall test procedure will be posted on the unit and all persons required to perform the 100 hour maintenance checks as required by Section 418 will be trained in how to perform the engine stall.
- The minimum quantities of ventilating air must be maintained at all times during operation as required by Section 404 of the Act.

Should the Director receive a request for temporary approval for use prior to the next TAC meeting, the TAC will recommend temporary approval until the next scheduled TAC meeting on October 13, 2010 at which time permanent approval will be recommended.

  
Paul Borchick

  
Ron Bowersox

## General Specification Sheet

### I. Engine

Manufacturer	Deutz	High Idle (RPM)	3150
Manufacturer Address	3883 Steve Reynolds Blvd Norcross, GA 30093	Particulate Index (PI)	2000
Engine Model No.	BF3L 2011	Gaseous Ventilation Rate (CFM)	4500
Engine Serial No.	10564263	Raw DPM (gr/hr)	3.02
HP/RPM	60.2 / 2800	MSHA Part 7 Approval No.	07-ENA050007
Low Idle (RPM)	900	Type of Aspiration	Turbocharged
Max. Dirty Intake Air Restriction (H <sup>2</sup> O)	22	Turbocharger Boost Pressure (psi)	16.165
Max. Allowed Backpressure H <sup>2</sup> O	25	Fuel Delivery System	Direct Injection

### II. Particulate Filter

Manufacturer	CleanAir Systems
Manufacturer Address	PO Box 23449, Santa Fe, NM 87502
Model Number	FUA126W4CN
System Type	Ceramic non-catalyzed
Efficiency Rating	85%

### III. Catalyst

Manufacturer	CleanAir Systems
Manufacturer Address	PO Box 23449, Santa Fe, NM 87502
System Name	Assure DOC
Model Number	CPD0700BCCN20

### IV. Flame Arrestor

Manufacturer	Enardo
Manufacturer Address	4470 S. 70 <sup>th</sup> E. Ave. Tulsa, OK 74175
System Name	Series 7 Inline Flame Arrestor
Model Number	T-803/C-IL-C4C
MESG	0.65 mm

ATTACHMENT 1

### DPM Calculation Sheet

Engine Deutz BF3L2011  
MSHA Approval 07-ENA050007  
Ventilation Rate 4500 cfm  
DPM Emissions 3.02 g/hr  
Filter Type CleanAIR Permit Non-Catalzed Ceramic  
Filter Efficiency 85 %

#### DPM Unit Conversion

$$\frac{\text{g/hr}}{3.02} * \frac{\text{hr/min}}{60} * \frac{\text{mg/g}}{1000} = 50.333 \text{ mg/min}$$

#### Ventilation Rate Unit Conversion

$$\frac{\text{cfm}}{4500} * \frac{\text{m}^3/\text{ft}^3}{0.0283} = 127.42 \text{ m}^3/\text{min}$$

#### Filtered DPM Emissions Calculation

$$\frac{\text{mg/min}}{50.333} * \frac{\text{min/m}^3}{127.42} * \frac{\text{filter eff}}{100} = 0.0593 \text{ mg/m}^3$$

ATTACHMENT 2