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Pennsylvania Technical Advisory Committee
On Diesel Powered Equipment

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cc: McCaffrey
Gaida
Antoon
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Joseph Sbaffoni, Director
Bureau of Mine Safety
Fayette County Health Center
100 New Salem Road, Room 167
Uniontown, Pa. 15401

RE: Rhomac Model DP 602 Hydraulic Power Pack utilizing a Deutz F4L2011 engine MSHA ID 07-ENA040012 derated to 60.8 HP@ 2800 RPM with a CleanAIR Assure DOC Model CFD0566BCCN oxidation catalyst and an ENK Pure Air DPM filter Model 25-19175. orig. /file

Dear Mr. Sbaffoni:

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 November 2, 2009 Rhomac, Inc. submitted a request to the Bureau of Mine Safety (BMS) for approval for a Rhomac Model DP 602 Hydraulic Power Pack utilizing a Deutz F4L2011 engine MSHA ID 07-ENA040012 derated to 60.8 HP@ 2800 RPM with a CleanAIR Assure DOC Model CFD0566BCCN oxidation catalyst and an ENK Pure Air DPM filter Model 25-19175.

On November 3, 2009 the Director of BMS requested the TAC to evaluate the Rhomac Model DP 602 Hydraulic Power Pack 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 F4L2011 engine MSHA ID 07-ENA040012 derated to 60.8 HP@ 2800 RPM
- Emissions Control System DST Management System
    - CleanAIR Assure DOC Model CFD0566BCCN oxidation catalyst
    - ENK Pure Air DPM filter Model 25-19175-7197 (95% efficient)
    - Enardo Model T-803/C-IL-C4C flame arrestor

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 March 15, 2010 the TAC and DEP traveled to Brookville Equipment Corporation 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, engage both levers to operate both stages of the hydraulic pump. The results of the emission tests showed the engine was performing within MSHA's approval specifications.

The exhaust was cooled by channeling the exhaust gas through a water tank to help cool the exhaust gases. This water tank was equipped with a low level shut off sensor that would shut the engine off before the water level in the tank got too low to fully cover the exhaust port in the tank. It was agreed that part of the pre-op inspection of the hydraulic power pack would be to fill the water tank prior to use, ensuring the maximum availability of the water in the tank. It was also agreed that since this is a skid mounted unit, it must be set up level to ensure the water in the tank is equally distributed. It was also agreed that a diffuser would be added to the exhaust pipe to direct the exhaust air away from blowing directly on the rib or floor. Monitoring of the exhaust gas temperature produced a high exhaust gas temperature reading of 55° F, which is well below the 302° F allowed by Section 403 (b)(4) of the Act. The maximum surface temperature observed was 240° F on the exhaust manifold after conducting all CO testing. The maximum engine oil temperature was 202° F and the maximum engine coolant temperature was 202° F.

The after-treatment system is fitted with an ENK Pure Air DPM filter Model 25-19175-7197 (95% efficient). The engine and filter extrapolations show that the diesel power package will result in an average ambient concentration of .06396 mg/m^3 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^3 requirement of Section 403 (a)(1) the Act. (Attachment 2)

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 March 15, 2010, as well as the data acquired and observations made during our investigation. The TAC has determined that the Deutz F4L2011 engine MSHA ID 07-ENA040012 derated to 60.8 HP@ 2800 RPM with a CleanAIR Assure DOC Model CFD0566BCCN oxidation catalyst and an ENK Pure Air DPM filter Model 25-19175 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 for the Rhomac Model DP 602 Hydraulic Power Pack. This recommendation is provided with the understanding that the General Specification Sheet (Attachment 1) be strictly adhered to.

Additional TAC stipulations for approval:

- The Hydraulic unit must be set up level to ensure equal water distribution in the tank.
- The pre op check will include filling the water tank prior to use and ensuring the tank is setting level.
- After the unit is running the operator should check for exhaust leaks on the water tank cover and filter door gaskets. This will be included in the pre op checklist. This check should also be part of the 100 hour maintenance. Any leaks should be repaired prior to use, since the leaks would be comprised of untreated exhaust gases.
- The unit must be attended during operation as required in Section 401(b) of the Act.
- Since this unit is not a mobile unit, a fire hose and portable foam generator pack must be available at the hydraulic unit.

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 April 15, 2010 at which time permanent approval will be recommended.

Paul Borchick

Ron Bowersox

General Specification Sheet

I. Engine

Manufacturer	**Deutz**	**High Idle (RPM)**	**3100**
Manufacturer Address	**3883 Steve Reynolds Blvd Norcross, GA 30093**	**Particulate Index (PI)**	**4000**
Engine Model No.	**F4L 2011**	**Gaseous Ventilation Rate (CFM)**	**3000**
Engine Serial No.	**TBD**	**Raw DPM (gr/hr)**	**6.52**
HP/RPM	**60.8 / 2800**	**MSHA Part 7 Approval No.**	**07-ENA040012**
Low Idle (RPM)	**900**	**Type of Aspiration**	**Natural**
Max. Dirty Intake Air Restriction (H^2O)	**26**	**Turbocharger Boost Pressure (psi)**	**N/A**
Max. Allowed Backpressure H^2O	**40**	**Fuel Delivery System**	**Direct Injection**

II. Particulate Filter

Manufacturer	**ENK Industrial Filter & Battery Co., Inc.**
Manufacturer Address	**1004 Hoke Ave., PO Box 1004, Dolomite, AL 35061**
Model Number	**25-19175-7197**
System Type	**Washable / Disposable Filter**
Efficiency Rating	**95%**

III. Catalyst

Manufacturer	**CleanAir Systems**
Manufacturer Address	**PO Box 23449, Santa Fe, NM 87502**
System Name	**Assure DOC**
Model Number	**CFD0566BCCN****

IV. Flame Arrestor

Manufacturer	**Enardo**
Manufacturer Address	**4470 S. 70th 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 F4L2011
MSHA Approval	07-ENA040012
Ventilation Rate	3000 cfm
DPM Emissions	6.52 g/hr
Filter Type	ENK Synthetic Fiber
Filter Efficiency	95 %

DPM Unit Conversion

$$\frac{6.52\ \text{g/hr} * 1\ \text{hr/min} * 1000\ \text{mg/g}}{60} = 108.667\ \text{mg/min}$$

Ventilation Rate Unit Conversion

$$3000\ \text{cfm} * 0.02832\ \text{m}^3/\text{ft}^3 = 84.945\ \text{m}^3/\text{min}$$

Filtered DPM Emissions Calculation

$$\frac{108.667\ \text{mg/min} * 1\ \text{min/m}^3 * 5\ \text{filter eff}}{84.945 \quad 100} = \mathbf{0.06396\ mg/m^3}$$

ATTACHMENT 2