pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

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April 14, 2014

Mr. Nate Morris
Irwin Mine and Tunneling Supply
9953 Broadway
P O Box 409
Irwin, PA 15641

RE: Irwin Mine and Tunneling Supply Model RD40AC100DE55.8RC Diesel Source Car utilizing a Deutz BF4L2011 diesel engine (MSHA ID 07-ENA04000004-1 – Part 7) 79HP @ 2800 RPM with an emissions control system using a Clean Diesel Technologies, Inc. Model CT-13#A11-0172 ceramic DPM filter (85% efficient) and a Clean Diesel Technologies, Inc. Model AZ-27 #A16-0032 diesel oxidation catalyst.

Dear Mr. Morris:

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 18, 2013, Irwin Mine Tunneling and Supply submitted a request to the TAC and Bureau of Mine Safety to have this piece of equipment inspected. The DEP requested TAC to do so. On April 4, 2014, the TAC and DEP traveled to Irwin Tunneling Supply in Blairsville, PA to conduct their investigation.

The TAC recommended temporary approval of this equipment in their report of April 7, 2014. Permanent approval was recommended at the TAC meeting on April 9, 2014.

Based on the recommendation of the TAC and the equipment approval staff, your request for approval is granted.

If you have any questions on this request, please contact Joseph Sbaffoni at jsbaffoni@pa.gov or at 724-439-7469.

Sincerely,

Colin C Carson for:
Joseph A. Sbaffoni
Director
Bureau of Mine Safety

cc: Bowersox
Borchick

Enclosure(s)

Pennsylvania Technical Advisory Committee
On Diesel Powered Equipment

Paul Borchick
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April 7, 2014

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

RE: Irwin Mine and Tunneling Supply Model RD40AC100DE55.8RC Diesel Source Car utilizing a Deutz BF4L2011 diesel engine (MSHA ID 07-ENA0400004-1 - Part 7) 79HP @ 2800 RPM with an emissions control system using an Clean Diesel Technologies, Inc. Model CT-13#A11-0172 ceramic DPM filter (85% efficient) and a Clean Diesel Technologies, Inc. Model AZ-27 #A16-0032 diesel oxidation catalyst.

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 October 18, 2013 Irwin Mine and Tunneling Supply submitted a request for evaluation of their Model RD40AC100DE55.8RC Diesel Source Car utilizing a Deutz BF4L2011 diesel engine (MSHA ID 07-ENA0400004-1 - Part 7) 79HP @ 2800 RPM with an emissions control system using an Clean Diesel Technologies, Inc. Model CT-13#A11-0172 ceramic DPM filter (85% efficient) and a Clean Diesel Technologies, Inc. Model AZ-27 #A16-0032 diesel oxidation catalyst.

On January 29, 2014 the Director of BMS requested the TAC to evaluate the Irwin Mine and Tunneling Supply Model RD40AC100DE55.8RC Diesel Source Car engine and emission package 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 engine and emissions control package has not been previously approved under Section 403 of the Act.

The diesel power package includes the following items:

- Deutz BF4L2011 diesel engine (MSHA ID 07-ENA0400004-1 - Part 7) 79HP @ 2800 RPM
- Emissions control system:
    - Clean Diesel Technologies, Inc. Model CT-13#A11-0172 ceramic DPM filter (85% efficient)
    - Clean Diesel Technologies, Inc. Model AZ-27 #A16-0032 diesel oxidation catalyst
    - NETT Technologies Inc. Model # NETT-20FD-10020-WA-030 heat exchanger

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 April 3, 2014 the TAC and DEP traveled to Irwin Mine and Tunneling Supply in Blairsville, PA 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. The results of the emission tests showed the engine was performing within MSHA's approval specifications.

The TAC addressed a few special concerns and considerations based on the nature and design of this type of equipment (compressor and hydraulic pump):

- The stall test procedure had to be established by inducing the proper lug on the engine using the air compressor. This was accomplished using the air compressor to discharge through a filter at a specific pressure just below the pressure relief setting. Instructions for the proper stall test will be included in the written Stall Test Procedure.
- Irwin Car intends to mount an electric cooling fan over the intake for the exhaust diffuser with the necessary safety shutdowns to insure it meets the requirements of the Act.
- The TAC recognized that the fire alarm cannot be clearly seen or heard by the operator unless he was positioned at the controls, which is not likely for this specific type of equipment. Irwin proactively addressed this and installed a strobe type light that could be visible from around the equipment to comply with Section 408(d).
- The TAC and DEP questioned the placement of the exhaust exit on the underside of the belly of the car. Irwin Car agreed to mount a deflector plate to deflect the exhaust from direct contact with the mine floor.

Monitoring of the exhaust gas temperature produced a high exhaust gas temperature reading of 270° F, which is well below the 302° F allowed by Section 403 (b)(4) of the Act. The maximum surface temperature observed 275° F on the bottom of the exhaust diffuser can, which is below the 302° F allowed by Section 403 (b)(3) of the Act. The maximum engine oil temperature observed was 220° F.

The after-treatment system is fitted with Clean Diesel Technologies, Inc. Model CT-13 #A11-0172 ceramic DPM filter (85% efficient). The engine and filter extrapolations show that the diesel power package will result in an average ambient concentration of 0.054 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 0.12 mg/m^3 requirement of Section 403 (a)(1) the Act. (Attachment 2)
The results of the smoke dot test was a #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 Irwin Mine and Tunneling Supply, the results of the tests conducted on April 3, 2014, as well as the data acquired and observations made during our investigation. The TAC has determined that the Deutz BF4L2011 diesel engine (MSHA ID 07-ENA0400004-1 - Part 7) 79HP @ 2800 RPM with an emissions control system using an Clean Diesel Technologies, Inc. Model CT-13#A11-0172 ceramic DPM filter (85% efficient) and a Clean Diesel Technologies, Inc. Model AZ-27 #A16-0032 diesel oxidation catalyst 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.

This recommendation is provided with the understanding that the General Specification Sheet (Attachment 1) be strictly adhered to.

Should the Director receive a request to use this equipment prior to the next scheduled TAC meeting, the TAC recommends temporary approval until the next regular scheduled TAC meeting on April 9, 2014 at which time permanent approval will be recommended.

Paul Borchick

Ron Bowersox

General Specification Sheet

EQUIPMENT MANUFACTURER IRWIN MINE AND TUNNELING SUPPLY | **MODEL** RD40AC100DE55.8RC | **DATE** 9/13/13

I. Engine

Manufacturer	DEUTZ	Particulate Index (PI)	2,500 CFM
Manufacturer Address	3883 STEVE REYNOLDS BLVD., NORCROSS, GA 30093		
Engine Model No.	BF4L2011	Gaseous Ventilation Rate (CFM)	6,000
Engine Serial No.	1129672	Raw DPM (gr/hr)	3.7
HP/RPM (rated)	79 / 2,800	MSHA Part 7 Approval #	07-ENA0400004-1
Low Idle (RPM)	900	MSHA Part 7 Ventilation Rate (CFM)	6,000
Max. Dirty Intake Air Restriction H^2O	26	Type of Aspiration	TURBOCHARGED
Max. Allowed Backpressure H^2O	30	Turbocharger Boost (psi)	18.7
High Idle (RPM)	3,100	Fuel Delivery System	DIRECT INJECTION
Water-jacketed components	☐ Yes ☒ No	Engine Cooling via	INTEGRATED OIL

II. Particulate Filter

Manufacturer	CLEAN DIESEL TECHNOLOGIES, INC.		
Manufacturer Address	83 COMMERCE VALLEY DRIVE EAST, THORNHILL, ONTARIO L3T 7T3 CANADA		
Model Number	CT-13 #A11-0172	System Type	PASSIVE CERAMIC
MSHA Efficiency Rating	85 %	MSHA Approved	☒ Yes ☐ No
Treated DPM mg/m^3 when diluted w/100% Part 7 ventilation rate *(show calc on seperate sheet)*	0.054 mg/m^3		

III. Catalyst

Manufacturer	CLEAN DIESEL TECHNOLOGIES, INC
Manufacturer Address	83 COMMERCE VALLEY DRIVE EAST, THORNHILL, ONTARIO L3T 7T3 CANADA
System Name	RD40AC100DE55.8RC EXHAUST SYSTEM
Model Number	AZ-27 #A16-0032

IV. Flame Arrestor

Manufacturer	DRY SYSTEM TECHNOLOGIES		
Manufacturer Address	104 RISING COURT, WOODRIDGE, IL 60517		
System Name	RD40AC100DE55.8RC EXHAUST SYSTEM		
Model Number	M241-401-01	MESG	0.064"

V. Heat Exchanger

Manufacturer	NETT TECHNOLOGIES INC.	Model or Part #	NETT-20 FD-10020-WA-030

VI. Fire Suppression System

Manufacturer	ANSUL	Model or Part #	A-MF-497

ATTACHMENT 1

IRWIN MINE AND TUNNELING SUPPLY

DPM CALCULATION SHEET

Engine Model:	Deutz BF4L2011
MSHA Number:	07-ENA0400004-1
Ventilation Rate:	6,000 CFM
Filter Type:	CDTI CATTRAP CT-13 #A11-0172
Filter Efficiency:	85%

CONVERT DPM FROM *[g/hr]* TO *[mg/min]*

[3.7 g/hr] * [1 hr / 60 min] * [1,000 mg/g] = [61.7 mg/min]

CONVERT VENTILATION RATE FROM *[CFM]* TO *[m^3/min]*

[6,000 CFM] * [0.028315 m^3/ 1 ft^3] = [169.89 m^3/min]

DIVIDE DPM *[mg/min]* BY VENTILATION RATE *[m^3/min]*

[61.7 mg/min] / [169.89 m^3/min] = [0.363 mg/m^3]

SOLVE FOR AMBIENT DPM LEVEL AT 96% FILTER EFFICIENCY

[0.363 mg/m^3] * [100% - 85% Filter Efficiency] = **[0.054 mg/m^3]**

ATTACHMENT 2