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Exposure of Underground Miners to Diesel Exhaust

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Exposure of Underground Miners to Diesel Exhaust

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Comment from Gene Davis, NA

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General Comment

See attached file(s)

Attachments

Proposed Diesel Rule Comments

Comments:
Exposure of Underground Miners to Diesel Exhaust

Docket No. MSHA-2014-0031,

Allow me to introduce my self, my name is Gene Davis. I have worked as member of the original Technical Advisory Committee on Diesel Powered Equipment in Pennsylvania as well as a third party consultant for underground diesel powered equipment in Pennsylvania, West Virginia and Ohio for the past 20 years. I have previously made comment on the last round of rule making for diesel powered equipment in underground coal in 1999. The comments I will make today will be similar to my previous comments. I also petitioned MSHA in 2010 to re-evaluate and revise its health and safety standards for diesel powered equipment in underground coal mines. The agency's response to my 2010 petition was "MSHA believes it has sufficient authority under existing Agency regulations to address any hazards associated with the use of diesel powered equipment underground". Since this response statement to my petition does not seem to be true any more I am happy to make comment on the proposed rule making.

Comments:

A 1 – You ask: **Is there evidence that non-permissible, light-duty, diesel-powered equipment currently being operated in underground mines emits 2.5 g/hr of DPM or less? If so, please provide this evidence.**

- The agency has the answer to this request. A quick look at the National Diesel Inventory will show that out of approximately 3400 pieces of light duty equipment only about 90 have engines that are listed as emitting less than the 2.5 g/hr standard. The exception to this is the light duty equipment being used in Pennsylvania, West Virginia and Ohio where all equipment must include a diesel aftertreatment system. All light duty equipment in these three states do emit less that 2.5 g/hr by state law not by MSHA regulation.
- This brings me to the point of the 2.5g/hr standard. To limit a diesel engine to 2.5 g/hr is not a standard it allows lower horsepower (hp) engines to emit more DPM that higher hp engines. To institute a DPM standard you must include the approved vent plate quantity of a given engine and extrapolate the DPM into mg/m^3. This then becomes a standard. The chart below will illustrate this:

Approval no.	Hp rating	G/Hr DPM output	DPM output mg/minute	Vent Plate cfm	DPM output mg/m³
07 ENA 040011	48@2800rpm	4.89	81.5	2000	1.44 mg/m³
07 ENA040010	30.2@2800rpm	3.26	54.33	1500	1.28 mg/m³
07ENA040004-1	78@2800rpm	3.7	61.66	6000	.36 mg/m³
07ENA040002	100@2500rpm	4.51	75.16	6000	.44 mg/m³

(Figure 1)

- Although this chart is a small sampling you can see that 2.5 g/hr is not a standard. This approach allows the smaller hp engines to emit 3 to 4 times as much DPM per cubic meter of air than their higher hp counterparts. Since the reason for this round of rule making is to curtail miner's exposure to DPM we must apply the vent plate air quantity to the DPM output of the engine to achieve a DPM standard. This is the approach that Pennsylvania, West Virginia and Ohio have adopted. After all we must never assume that our coal miners will have more than vent plate quantity in an area that a piece of diesel powered equipment is being operated.

A-2- You ask- **What administrative, engineering, and technological challenges would the coal mining industry face in meeting a 2.5 g/hr DPM emissions level for non-permissible, light-duty, diesel-powered equipment?**

- Most of the equipment that has come into Pennsylvania, West Virginia and Ohio over the past 20 years with exhaust after-treatment systems have been built by OEM's that also provide equipment for the nation and there have been no problems retrofitting aftertreatment systems into this equipment for the three States listed above so there should be no reason most if not all equipment can be retrofitted with an aftertreatment system.

A-3 –You ask- **What costs would the coal mining industry incur to lower emissions of DPM to 2.5 g/hr or less on non-permissible, light-duty diesel-powered equipment? What are the advantages, disadvantages of requiring that light-duty diesel-powered equipment emit no more than 2.5 g/hr of DPM?**

- From my experiences I believe that most equipment can be fitted with an aftertreatment system for a cost of 12,000 to 25,000 dollars per equipment. While this may sound expensive you must remember that most light duty mining equipment cost between $90,000 and $140,000 and the cost of the aftertreatment systems has not kept equipment out of the three states.

B-8 – You ask- **What would be the advantages, disadvantages, safety and health benefits, and costs of testing non-permissible, light-duty, underground diesel-powered equipment on**

a weekly basis for carbon monoxide as required for permissible diesel-powered equipment and non-permissible, heavy-duty, diesel-powered equipment?

- If we are serious about minimizing miner's exposure to DPM we must include light duty equipment into our regular weekly emissions testing. This testing will alert you of potential engine problems that will cause the engine to emit higher concentrations of DPM. In the chart listed above (Figure 1) you must understand that the concentration of DPM has been extrapolated using data from a pristine engine if we allow the engine to operate in a state of deterioration the DPM concentration will be higher. The weekly testing of light duty equipment should not pose any problems for the mining community as they are already performing this test on all heavy duty and permissible equipment, which means that the mine operators must already have the exhaust gas analyzers and the trained people needed to perform this testing. Since all equipment, including light duty equipment must be checked weekly for safety reasons the addition of the test would only add about 5 to 7 minutes of additional time to each piece of light duty equipment.

9-B- You ask- **Reducing the emissions of nitric oxide (NO) and nitrogen dioxide (NO_2) is one way that engine manufacturers can control particulate production indirectly. What are the advantages, disadvantages, and costs of expanding exhaust emissions tests to include NO and NO_2 to determine the effectiveness of emissions controls in underground coal mines? Please provide data and comments that support your response.**

- While I am not opposed to including the NO and NO_2 concentration during and engine emissions test I do not believe in field work that these two gases will give a clear indication of how the engine is operating. As you state the engine OEM's will use the production of NO and NO_2 to control DPM production but this is being done in a laboratory setting where changes to engine timing and other factors can be evaluated. However, once the engine has been approved these types of changes are no longer permitted to be preformed on a given engine. The approved engine must be maintained in approved condition. Therefore while the concentration of NO and NO_2 are helpful to know I do not believe they can be used to curtail the production of DPM in the field.

B-10- You ask- **Should MSHA require that diagnostics system tests include engine speed (testing the engine at full throttle against the brakes with loaded hydraulics), operating hour meter, total intake restriction, total exhaust back pressure, cooled exhaust gas temperature, coolant temperature, engine oil pressure, and engine oil temperature, as required by some states? Why or why not?**

- In question 9 you ask about using NO and NO_2 concentrations during testing you now ask weather it is necessary to include engine speed and load on the engine. To answer

these questions we will have to take a look at the test that is currently being preformed on a weekly basis for heavy duty and permissible equipment.

- First the emissions test that is that is being used is refereed to in slang as a stall test, but in actuality it is a" Repeatable Loaded Engine Operational Test". The repeatable nature of this test must include the intake restriction and backpressure of the engine as well the operating temperature of the the engine. The intake restriction and backpressure of the engine must be within the engine OEM approval spec prior to performing the test, also the engine operating temperature must show that the engine is running at normal operating temperature. While the operating temperature does not have to be exactly the same for each test it must show that the engine has met normal operating temperature prior to testing. These are the repeatable factors of the test. The loaded factor of the test can be measured by the O_2 or CO_2 concentration during the test. This loading of the engine is critical for proper testing. The CO concentration is what tells us if the engine is operating properly but the CO concentration of any engine is dependent upon the load on the engine. In other words the O_2 or CO_2 concentration validates the CO concentration of an engine. So as you have asked what should be included in the testing the answer is all of the above. All diesel emissions test should include a check list to be filled out prior to testing that includes, Engine make and model, intake restriction, backpressure, engine operating temperature, prior to testing and O_2 or CO_2 concentration during testing and finally the CO concentration. While the CO concentration is the important factor it can be skewed if the other parameters of the test are not in the proper range for a given engine.

This brings us to a point that I must make. In your prelude to Part B of this announcement you reiterate a statement from the current regulation that says: "carbon monoxide concentration must not exceed 2500 parts per million". This statement has no place in the current regulation. This has been taken from the engine approval criteria in 30 CFR Part 7. While it is necessary for engine approval it should never be listed in the regulation pertaining to field testing of diesel engines. During engine approval testing, the engine is placed on a dynamometer and operated throughout its operational range and if at any point the engine produces any more than 2500 ppm of CO the engine fails and will not be approved in its present state. However once the engine has been approved and placed into a piece of equipment it should never even remotely approach 2500 ppm of CO. Most approved engines working in the field today will have CO concentrations of about 80 to 300 ppm of CO. during emissions testing. This statement can be construed to allow a given diesel engine to operator at 8 to 30 times the CO approval concentration! We also know that as CO concentration increases in an engine the DPM concentration also increases. If this rule is going to minimize the DPM exposure to miner's this statement must be removed. So to allow

a diesel engine any diesel engine even pre EPA tier engines to emit upwards of 2500 ppm are ludicrous and certainly detrimental to the health of miners.

C 14 thru 23 – You ask about what types of aftertreatment systems are being used and their effectiveness. Since I live and work mostly in Pennsylvania I will relate some of the systems that I have used and are currently operating in Pennsylvania. We have a mixture of paper filters (which must include exhaust gas cooling to be used) and ceramic based (both cordierite and silicon carbide) DPM filters in operation in Pennsylvania. As mentioned early in my comments it will cost approximately 12,000 to 25,000 dollars to retrofit a DPF system into a current piece of equipment. I also must say that a large majority of the underground fleet in Pennsylvania is made up of EPA tier II and Tier III engines, I know of no Tier IV engines currently being used in Pennsylvania. But if an EPA tier II engine and aftertreatment system is maintained in proper operating condition this approach will rival the DPM output of even the newest EPA tier IV engines. See the chart below.

EPA Tier	Engine approval no.	HP	DPM G/hr output	Vent Plate CFM	Filter efficiency	DPM mg/m³
IV	07ENA150011	175@2300rpm	.84 with system	5500 cfm	?	.005 mg/m3
II	07 ENA040007-1	173@2300	6.2 raw no system	7000	Ceramic 93%	.004 mg/m³

The chart above shows two diesel engines that are very similar in hp ratings and vent plate quantity while the engine listed first is an EPA tier IV engine and has been approved with an after treatment system, the DPM output is very low at .005 mg/m³ but the other engine is one that is currently being used in Pennsylvania and is EPA tier II, by rule the State agency requires an aftertreatment system to be included on all diesel powered equipment. As you can see the system that is being extrapolated for this engine is a ceramic based filter that has been tested by MSHA and awarded an efficiency rating of 93%, when this system is applied to the older EPA tier II engine the results are even lower that the newer costly EPA tier IV engine at .004 mg/m³. So with so many older diesel engines operating in the nations coal mines should we press for newer engines or simply install and properly maintain available systems onto our current diesel fleet. This seems to be the prudent approach to me.

The last comment I would like to make is, to include an oxidation catalyst in all DPF aftertreatment systems. The proper use of and oxidation catalyst will will do two things for the underground coal miner. First it will greatly reduce the CO concentration in the exhaust and it will also burn up approximately 20 to 30 % of the OC factor of DPM. The uses of these items are required by Pennsylvania, West Virginia and Ohio. They are not very costly and do not require a lot of engineering to install, and if maintained properly give a great return on your expenditure.