

smaller engines. In regard to larger horsepower engines, again, at the workshops filter vendors stated that most had experience with larger horsepower engines. They referred to installations that were greater than 500 hp. As stated by the manufacturers, this is normally accomplished with multiple filters to accommodate the larger engines' higher exhaust flow rates. Again, either passive or active regeneration systems have been identified as being available for these large engines.

As discussed elsewhere in this preamble, the work conducted at the Greens Creek mine in Alaska showed that large horsepower engines, 475 hp used at this mine, could be equipped with ceramic filters and these DPFs were regenerated through passive regeneration. A filter rotation issue was identified at the beginning of this study, however, after further discussions with the filter vendor, it was determined that the problem was a manufacturing issue and was being worked out between the mine and the vendor. Even with the observed cracks due to the rotation of the filters, the results of tests showed that the filters continued to significantly reduce DPM from the engine, thus lowering the DPM in the test area.

A commenter also related a filter scenario that failed. This was reported as a cooperative effort between the machine manufacturer, engine manufacturer, and filter manufacturer for selection of a filter system for a 300 hp truck. The commenter stated that with this group working together, the filter system installed failed. MSHA was aware of this situation and understands that the problem was related to regeneration of the filter and not a filtration issue. MSHA believes that even with this cooperation, a vital piece of information concerning the duty cycle and exhaust gas temperatures generated from this truck was not properly communicated to the parties involved. This would lead to a failure where the system would have been set up to regenerate through a passive method, but in actuality, the machine needed an active system or active/passive system. As stated elsewhere, accurate information on the duty cycle/exhaust gas temperature of a vehicle is critical for successful filter installations. The condition of the engine and backpressure monitoring is also essential in choosing and installing a filter system.

As discussed previously in this preamble, MSHA and NIOSH developed the filter guide which makes mine operators and machine manufacturers aware of the issues that must be

addressed to successfully engineer a filter to work on a machine. MSHA believes that if mine operators and equipment manufacturers utilize this guide, many of the problems identified with regeneration would be eliminated.

Other commenters stated that the existing limits are not feasible unless MSHA allows mine operators to use administrative controls and personal protective equipment, both of which are prohibited under the existing DPM rule. Consistent with the DPM settlement agreement, MSHA proposes to require its long-standing hierarchy of controls for engineering, administrative, and personal protective equipment. Some commenters stated that if elemental carbon (EC) is used, periodic diagnostic emission tests similar to those required under MSHA's existing standards for underground coal mines at § 75.1914(g) should be required for metal and nonmetal underground mines in order to compare emissions against an engine baseline to determine if elevated organic carbon levels are actually DPM rather than an interferent. These commenters also stated that OC and EC may not increase proportionally in an engine that is in a state of deterioration.

Section 75.1914(g) for underground coal mines requires weekly emission checks on the engine to determine the tune of the engine. The CO concentration must be measured during a repeatable loaded engine test, namely at torque stall. By measuring the CO on a weekly basis, a baseline is established for each engine. Any changes to the baseline of the CO concentration when the repeatable engine test is performed could be an indication that the engine is out of tune. This could be the result, for example, of a clogged intake air filter or a faulty injector. Whereas MSHA agrees that this type of engine testing could be useful as a diagnostic tool to determine the tune of the engine, MSHA noted in its ANPRM as well as in this proposal that the scope of this rulemaking is limited to the terms of the settlement agreement. However, MSHA requests specific comments from the mining community as to whether this test should be required in the final rule. Commenters should include whether or not any aspects of the current provision at § 75.1914(g) should be adopted or revised as part of the final rule.

It is well documented that an engine that is not in tune will emit higher levels of gaseous emissions and DPM emissions. An engine that is not tuned could have an immediate effect on miners' personal DPM exposures. The same commenter stated that the out-of-tune engine could be dismissed in the results of the ambient Method 5040

sampling as an interferent instead of an increase in DPM. The effects of individual engines would be very hard to localize with ambient testing. MSHA agrees that maintenance procedures that could detect any increases in exhaust emissions would aid in limiting miners' DPM exposures. The Agency's current DPM standard at § 57.5066 addresses both maintenance and tagging of equipment for out-of-tune engines. Poor engine performance will most likely result in black smoke that must be the reported to the mine operator and promptly given attention by a mechanic.

The Agency is aware of another diagnostic tool to determine the effectiveness of a ceramic filter. In a diagnostic "smoke test," a sample of DPM is collected as a smoke dot on a filter paper and visually compared against a colorimetric scale. The test would be conducted while the diesel powered equipment is in a torque stall condition, which is a repeatable, high engine load condition for making this comparison. Normally, the raw exhaust before a filter would give a black spot. A sample taken after the filter should be basically white, indicating that the filter was working at its highest efficiency. Any cracks or defects in a ceramic filter would give a darker, grayish to black spot. This would be an indication to the mine operator of the current condition of the filter and of possible filter deterioration.

Smoke dot tests were conducted at the Greens Creek mine as a part of DPM compliance assistance activities at that mine. On one particular filter, the smoke dot produced after the DPM filter appeared to be as dark as the smoke dot before the DPM filter. Visual examination of the DPM filter showed cracks along its outer edges. When quantitative analysis of the dots was conducted using the NIOSH Method 5040 analysis, DPM filter efficiency was determined to be 92%. The efficiency of a different filter without any visual cracks was determined to be 99%. This demonstrates the value of the smoke dot test to detect a filter problem before filter performance has deteriorated significantly. However, even though defects in the DPM filter can affect its efficiency, this may or may not affect a miner's personal exposure to DPM. The smoke test can be done with a commercially available ECOM AC gas analyzer or a Bacharach/Bosch smoke test Apparatus. MSHA believes that this also is a good diagnostic tool for DPM filters. Running this test on a routine basis would give indications with any changes in the filter media. However, changes in the color of the smoke dot may not indicate that miners would be