

traces to select the DPF systems with the regeneration options that will work for that piece of equipment. Exhaust temperature traces can be analyzed by

mine personnel or given to several DPF suppliers to use to provide the operator with options.

Exhaust temperatures govern the DPF regeneration options. These options are provided in the Table VII-1.

TABLE VII-1.—DPF REGENERATION OPTIONS

Temperature that the exhaust exceeds 30% of the time, degrees C	DPF system (media consists of cordierite or silicon carbide ceramic)	Comments
>550	Uncatalyzed media	Rarely, if ever, occurs.
>390–420	Base metal catalyzed cordierite	No increase in NO ₂ .
>340	Lightly platinum catalyzed ceramic with CDT fuel additive.	Special provisions must be made to ensure additive is always present in fuel and that equipment w/o DPFs cannot be fueled with additive-containing fuel. No increase in NO ₂ .
>325	Platinum catalyzed ceramic	Lab results indicate significant NO to NO ₂ conversion; field results are mixed.
>Any temperature below 325	Active (Manually) regenerated system	Insufficient exhaust temperature to support spontaneous regeneration during shift. DPFs are regenerated in place with equipment off-duty or DPF is swapped out.

As Table VII-1 shows, a DPF system will function successfully at or above an exhaust gas temperature specified by the manufacturer's regeneration temperature, that is, an active regenerating system will work at all exhaust temperatures, and a platinum catalyzed system at any temperature above 325°C. However, these exhaust gas temperatures must be achieved at least 30% of the time during the day to be sufficient for passive regeneration. In addition, the tune of the engine will also be a factor for proper regeneration. If an engine goes out of tune and begins to emit higher DPM concentrations in the exhaust, the exhaust backpressure may increase more quickly. Therefore, it is recommended that mine operators install backpressure devices on machines equipped with filters in order to properly monitor the condition of the filter and regeneration of the filter.

Table VII-1 also provides information in the "Comments" column on the effect of the filters coated with a catalyst on NO₂ emissions. MSHA has tested in their laboratory the types of filters listed and has posted on its Web site a list of the filters that can cause NO₂ increases from the engine and those catalytic formulations that do not significantly increase NO₂.

NO₂ is formed from NO in the engine's exhaust in the presence of the catalyst. This reaction occurs at exhaust gas temperatures at approximately 325°C. This temperature is also the temperature at which the platinum catalyst will allow for passive regeneration. Filter manufacturers have normally wash-coated their filters with large amounts of platinum to make sure that the filters will regenerate. This large concentration of platinum, in combination with longer retention time of the exhaust gas in the filter, results in the formation of NO₂. Manufacturers have been looking at wash-coat formulations containing less platinum loading to lower the NO₂ effects. Catalytic converters are also wash-coated with platinum, however, the loading used on catalytic converters is lower than ceramic filters. Due to faster movement of the exhaust gas through the catalytic converter compared to the ceramic filter, the effect of NO₂ increase is minimized.

MSHA is not aware of overexposures to NO₂ with the use of those catalyzed traps that MSHA has identified. MSHA issued a Program Information Bulletin (PIB 02-04, May 31, 2002) which alerted mine operators that catalyzed traps identified on our Web site could

increase NO₂. Mine operators were advised to conduct sampling for NO₂ when these filters were used to ensure miners' are not overexposed or that the filters were causing a general increase of NO₂ in the mine's ambient environment. Mine operators who use catalyzed filters (which have the potential to increase NO₂) should have ventilation systems that are able to remove or dilute the NO₂ to a non-hazardous concentration. However, operators must be aware of localized areas where NO₂ could build up more quickly and create a health hazard for exposed miners.

As discussed in the Greens Creek report, the use of catalyzed filters on those machines used in the study did not indicate any substantial increase in NO₂. MSHA is continuing to work with filter manufacturers to evaluate catalytic formulations on NO₂ generation from the exhaust.

Active regeneration systems discussed below are normally not catalyzed which would then not produce an increase in NO₂. As stated above, NO₂ is generated when exhaust gas temperatures are normally high enough for passive regeneration. If the filter can passively regenerate, then there is a potential for increases in NO₂ emissions.

TABLE VII-2.—SCENARIOS FOR ACTIVE REGENERATION

System name	Regenerating location	Regenerating controller location	Comments
On-board–On-board	On Equipment	On Equipment	Requires source of electric power, normally 440 or 480 VAC.
On-board–Off-board	On Equipment	Designated and fixed-location	Requires equipment to come to a specific regeneration site.