

the DPM exposure of the equipment operators.

*Rogers Group, Jefferson County Mine:* MSHA personnel provided DPM compliance assistance at this mine during a full-day visit in December 2002. Both personal exposure samples and area samples were collected. The highest personal sample, collected on the loader, was 468  $\mu\text{g}/\text{m}^3$ . The loader was operated with the window open. Current operating and equipment maintenance practices were reviewed, along with mine ventilation, diesel equipment inventory, and steps taken to date and future plans to reduce DPM exposures. Mechanical ventilation was provided for the mine. The full range of DPM engineering controls was discussed. The Estimator, MSHA's computer spreadsheet software for evaluating the individual and combined effect of DPM emission sources and controls, was presented, the highest DPM-emitting equipment were identified so that future equipment-specific DPM control efforts could be appropriately focused. Finally, the likely effect of various ventilation system upgrades was discussed.

*Nalley and Gibson, Georgetown Mine:* MSHA personnel provided DPM compliance assistance at this mine during a full-day visit in May 2003. The mine's DPM sampling history was reviewed, along with current operating and equipment maintenance practices, mine ventilation, diesel equipment inventory, and steps taken to date and future plans to reduce DPM exposures. DPM samples were collected to assess improvements since the baseline sampling. Currently, mechanical ventilation provides airflow to the mine. The full range of DPM engineering controls was discussed, an exhaust temperature measurement and data logging system was demonstrated. An easy-to-use computer software for using such data to select appropriate DPM filter systems was presented. A simple approach for measuring the effectiveness of cab air filtering and pressurization systems was demonstrated. The Estimator, MSHA's computer spreadsheet software for evaluating the individual and combined effect of DPM emission sources and controls, was presented. The highest DPM-emitting equipment were identified so that future equipment-specific DPM control efforts could be appropriately focused, and the likely effect of various ventilation system upgrades was discussed.

*Stone Creek Brick Company:* MSHA personnel provided DPM compliance assistance at this mine during a full-day visit in May 2003. DPM samples were

collected on underground workers. The mine's DPM sampling history was reviewed, along with current operating and equipment maintenance practices, mine ventilation, diesel equipment inventory, and steps taken to date and future plans to reduce DPM exposures. The mine uses mechanical ventilation to provide airflow to the mine. The full range of DPM engineering controls was discussed. None of the equipment were equipped with environmental cabs. The Estimator, MSHA's computer spreadsheet software for evaluating the individual and combined effect of DPM emission sources and controls, was presented. The highest DPM-emitting equipment were identified so that future equipment-specific DPM control efforts could be appropriately focused. Also, the likely effect of various ventilation system upgrades was discussed.

*Wisconsin Industrial Sand Co., Maiden Rock Mine:* MSHA personnel provided DPM compliance assistance at this mine during a full-day visit in May 2003. The mine's DPM sampling history was reviewed, along with current operating and equipment maintenance practices, mine ventilation, diesel equipment inventory, and steps taken to date and future plans to reduce DPM exposures. The full range of DPM engineering controls was discussed. The Estimator, MSHA's computer spreadsheet software for evaluating the individual and combined effect of DPM emission sources and controls, was presented. The highest DPM-emitting equipment were identified so that future equipment-specific DPM control efforts could be appropriately focused.

*Gouverneur Talc Company, Inc., No. 4 Mine:* MSHA personnel provided DPM compliance assistance at this mine during a full-day visit in May 2003. DPM samples were collected on underground workers. The mine's DPM sampling history was reviewed, along with current operating and equipment maintenance practices, mine ventilation, diesel equipment inventory, and steps taken to date and future plans to reduce DPM exposures. The full range of DPM engineering controls was discussed, an exhaust temperature measurement and data logging system was demonstrated, and easy-to-use computer software for using such data to select appropriate DPM filter systems was presented. A simple approach for measuring the effectiveness of cab air filtering and pressurization systems was demonstrated, a computer spreadsheet software for evaluating the individual and combined effect of DPM emission sources and controls was presented, the highest DPM-emitting equipment was identified (so that future equipment-

specific DPM control efforts could be appropriately focused), and the likely effect of various ventilation system upgrades was discussed.

*Laboratory Compliance Assistance conducted by MSHA:* In addition to the compliance assistance field tests, MSHA's diesel testing laboratory has been working with manufacturers to evaluate various types of DPM control technologies. Certain of these technologies can be applied in either underground metal/nonmetal or coal mines.

*Evaluating paper/synthetic media as exhaust filters:* MSHA has been evaluating paper/synthetic media as exhaust filters. These filters have shown high DPM removal efficiencies in excess of 90% in the laboratory when tested on MSHA's test engine using the test specified in subpart E of 30 CFR part 7. The laboratory has tested approximately 20 different paper/synthetic media from 10 different filter manufacturers. Even though much of this work is directed to underground coal mine applications for use on permissible equipment, this technology is available for use on permissible equipment that is used in underground gassy metal/nonmetal mines. In addition, some underground coal mine operators have considered adding exhaust heat exchanger systems to nonpermissible equipment in order to use the paper/synthetic filters in place of ceramic filters (a heat exchanger is needed to reduce the exhaust gas temperature to below 302 °F for these types of filters). This could also be an option for metal/nonmetal equipment that would need DPM filter technology, particularly in operations in gassy mines where permissible equipment is required.

*Evaluating Ceramic Filter Systems:* MSHA has worked with six different ceramic filter system manufacturers to evaluate the effects of their catalytic washcoats on NO<sub>2</sub> production. As discussed elsewhere in this preamble, catalytic washcoats on the ceramic filters may cause increases in NO<sub>2</sub> levels. MSHA used its test engine and followed the test procedures in subpart E of 30 CFR part 7. MSHA has posted on its Web site on the Diesel Single Source Page a list of ceramic filters that have significantly increased NO<sub>2</sub> levels. MSHA has also listed the ceramic filters that are not known to have increased NO<sub>2</sub> levels. MSHA also checked the DPM removal efficiencies for these filters during the laboratory tests and the efficiency results have agreed with the efficiencies posted on the Diesel Single Source Page of 85% for cordierite and 87% for silicon carbide. MSHA also worked with NIOSH during these tests