

method to determine total carbon and elemental carbon concentrations. Results indicate that significant reductions in emissions and worker exposure were obtained for all bio-diesel mixtures. These reductions were in terms of both elemental and total carbon. Preliminary results for the 20% and 50% recycled vegetable oil indicated 30 and 50 percent reductions in DPM emissions and exposures, respectively. Preliminary results for the tests on the 50% blend of new soy bio-diesel fuel, showed about a 30 percent reduction in DPM emissions and exposures.

*Carmeuse North America, Inc., Black River Mine:* Following the success of the bio-diesel tests at Maysville Mine, Carmeuse requested assistance in continuing the bio-diesel optimization testing at their Black River Mine. In this test two bio-diesel blends along with a baseline test were made. For each test personal exposures and the mine exhaust were tested for two shifts. The two bio-diesel blends included a 35% recycled vegetable oil and a 35% blend of new soy oil. Preliminary results for both the 35% recycled vegetable oil and the 35% blend of new soy bio-diesel fuel showed about a 30 percent reduction in DPM emissions and exposures.

*Rogers Group, Jefferson County Mine:* MSHA personnel were invited by the Company to evaluate a fuel oxygenation system. The oxygenator is installed in the fuel line of the diesel equipment. The company was installing the units to increase fuel economy and was interested in determining their effect on DPM. MSHA conducted baseline sampling prior to the installation of the units. Personal samples were collected on production workers and area samples were collected in the mine exhaust airflow. The units were installed on loaders and trucks. The sampling was repeated after the units had accumulated 100 hours of operation. Preliminary results indicated that the use of the fuel oxygenator had no measurable effect on either DPM exposure or emissions.

#### Review of the Technology in Use Assistance

*Martin Marietta Aggregates, North Indianapolis Mine:* MSHA personnel provided DPM compliance assistance at this mine during a full-day visit in March 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. Currently,

mechanical ventilation is used at the mine and an upgrade to the ventilation system was in progress. 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, 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 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.

*Martin Marietta Aggregates, Parkville Mine:* MSHA personnel provided DPM compliance assistance at this mine during a full-day visit in April 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. Mechanical ventilation is currently used at the mine and an upgrade to the ventilation system was in progress. 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, 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.

*Martin Marietta Aggregates, Kaskaskia 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. Currently, natural ventilation is used at the mine. 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, 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.

*Martin Marietta Aggregates, Manheim 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. Currently, natural ventilation is used at the mine. 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, 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.

*Rogers Group, Oldham County Mine:* MSHA personnel provided DPM compliance assistance at this mine during a full-day visit in November 2002. Extensive DPM sampling was conducted at this mine. Both personal exposure samples and area samples were collected. None of the personal samples exceeded 160  $\mu\text{g}/\text{m}^3$ . 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. DPM samples were collected inside and outside equipment cabs. Results from this survey indicate the environmental cabs provided significant reduction in