

from the analysis. For typical gold mine samples, the interference from elemental carbon (graphite) would be less than  $1.5 \mu\text{m}^3$ . The use of the impactor also eliminates the need to acidify samples, including samples from trona mines. For typical non-acidified trona mine samples, the interference from bicarbonate would be less than  $0.5 \mu\text{m}^3$ . Overload of particulate matter on the impactor substrate to the filter was not observed.

Interference from drill oil mist was found on personal samples collected on the drillers and on area samples collected in the stope where drilling was being performed. Use of a dynamic blank did not eliminate drill oil mist interference. Tests to confirm whether oil mist from ANFO loading operations could be interference were not conclusive. Blasting did not interfere with diesel particulate measurements. MSHA found no reasonable method of sampling to eliminate interferences from oil mist when TC is used as the surrogate.

No reliable marker was identified for confirming the presence of ETS in an atmosphere containing DPM. Use of the impactor does not remove the ETS as an interferent. No reasonable method of sampling was found that would effectively measure DPM levels in the presence of ETS with TC as the surrogate.

#### *Laboratory Analytical Procedures and Sampling Cassettes*

Intra- and inter-laboratory analytical imprecision appear to be in line with other airborne contaminants monitored by MSHA and other regulatory agencies. Each of the samples collected in the study was analyzed twice for TC content. To do this, two standard punches were taken from each exposed and each unexposed (*i.e.*, control) filter. One punch was always analyzed using the same instrument in MSHA's laboratory. The second punch from the same filter was either analyzed in MSHA's laboratory using one of two different instruments or sent out to one of three other laboratories, NIOSH, Natlscs or Clayton.

The supplier has satisfactorily addressed concerns over possible manufacturing defects in the specialized SKC DPM sampling cassette. MSHA believes that the performance of this cassette will be adequate for compliance sampling purposes.

#### *Technological Feasibility*

Technological feasibility for mine operators to achieve compliance with the interim and final DPM concentration limits was assessed for the 31 mines in the study on a mine-by-mine basis using a computerized Microsoft® 7 Excel spreadsheet program called the Estimator, combined with sampling results from the 31 mines. The Estimator mathematically calculates the effect of any combination of engineering and ventilation controls on existing DPM concentrations in a given production area of a mine. The analyses were based on the highest DPM sample result obtained at each mine and all major DPM emission sources at each mine plus spare equipment.

MSHA, however, has limited in-mine documentation on DPM control technology.

Moreover, these sampling results were obtained at a time that few mine operators had implemented controls to reduce DPM concentrations at the subject mines. As a result, MSHA's position on feasibility does not reflect consideration of current complications with respect to implementation of controls, such as retrofitting and regeneration of filters. MSHA acknowledges that these issues may influence the extent to which controls are feasible. The Agency is continuing to consult with the National Institute of Occupational Safety and Health, industry and labor representatives on the availability of practical mine worthy filter technology.

The study found that five mines were already in compliance with the interim concentration limit, and another two mines were already in compliance with the lower, final concentration limit. The Estimator predicted that eleven of the 31 mines could achieve compliance with both limits through installation of DPM filters alone. Ventilation upgrades were specified for only 5 of the 31 mines in this study, and then only to achieve the final concentration limit.

The Estimator predicted that compliance with the interim and final concentration limits would be possible without requiring major ventilation installations (new main fan, repowering main fan, etc.) or requiring environmental cabs as a means of controlling DPM at any of the 31 mines. Industry commentators questioned whether practical mine-worthy filters were available for all engine sizes and whether more expensive controls would be necessary.

#### *Economic Feasibility*

Yearly costs for complying with both the interim and final concentration limits were determined for each of the 31 mines in the study. Cost estimates included the purchase cost of DPM controls specified for that mine in the technological feasibility assessment, plus related installation and operating costs. The aggregate yearly cost for all 31 mines to comply with the interim limit was estimated to be \$2.1 million. Compliance with the final limit was estimated to cost an additional \$1.1 million (in 2002 dollars). The yearly total to comply with both the interim and final concentration limits was estimated to be \$3.2 million. The estimated costs in this report are based on the accuracy of the Estimator as reported in Appendix A, and therefore, do not include consideration of current implementation complications that could increase compliance costs.

MSHA concludes that a regulation is economically infeasible if it would threaten an industry's viability or competitive structure. In rulemaking, economic feasibility, as well as technological feasibility, is not defined for individual firms, but for an industry. As a screening device, MSHA has historically questioned economic feasibility if yearly compliance costs equal or exceed one percent of an industry's annual revenues.

MSHA developed a rough estimate of annual mine revenues using each mine's annual employee work hours and the production value per employee hour for the commodity produced. Summing the

individual revenue figures resulted in an estimate of total revenues for the 31 mines in the study of \$1.8 billion in 2000.

On this basis, MSHA estimates that the 31 mines in the study would incur yearly costs equal to 0.12 percent of their annual revenues to comply with the interim concentration limit and additional yearly costs equal to 0.06 percent of their annual revenues to comply with the final concentration limit. To comply with both the interim and final concentration limits, the 31 mines would incur yearly costs equal to 0.18 percent of their annual revenues. Since estimated yearly compliance costs are less than the screening benchmark of one percent or more of annual revenues, the data in this report supports a finding that the interim and final concentration limits are economically feasible. Industry questions whether all costs for active filter regeneration were considered and whether the proper controls (that is, filters) were used in the cost analysis. In particular, industry questions whether compliance with the interim concentration limit would require some mine operators to make major ventilation upgrades in their mines.

## **V. Compliance Assistance**

### *A. Baseline Sampling Summary*

Under the DPM Settlement Agreement, MSHA agreed to provide compliance assistance to the metal and nonmetal underground mining industry for a one-year period from July 20, 2002 through July 19, 2003. As part of MSHA's compliance assistance activities, the Agency conducted baseline sampling of miners' personal exposures at every underground mine covered by the existing regulation. The results of this sampling were used by MSHA in this preamble to estimate current DPM exposure levels in these mines. These sampling results also assist mine operators in developing compliance strategies based on actual exposure levels. This compliance assistance sampling began in October 2002.

This section summarizes the analytical results of 885 personal DPM samples collected from 171 mines between October 30, 2002 and March 26, 2003 as part of a compliance assistance initiative. Eleven of the 885 samples were invalid samples due to abnormal sample deposits, broken cassettes or filters, contaminated backup pads, or instrument or pump failure. Table V-1 lists the frequencies of invalid samples within each commodity.

The mines that were sampled produce clay, sand, gypsum, copper, gold, platinum, silver, gem stones, dimension marble, granite, lead-zinc, limestone, lime, potash, molybdenum, salt, trona, and other miscellaneous metal ores. These commodities were grouped into