Diesel Particulate Matter Sampling

MSHA Outreach Program

United States Department of Labor
MSHA
Mine Safety and Health Adminstration

Types of Sampling

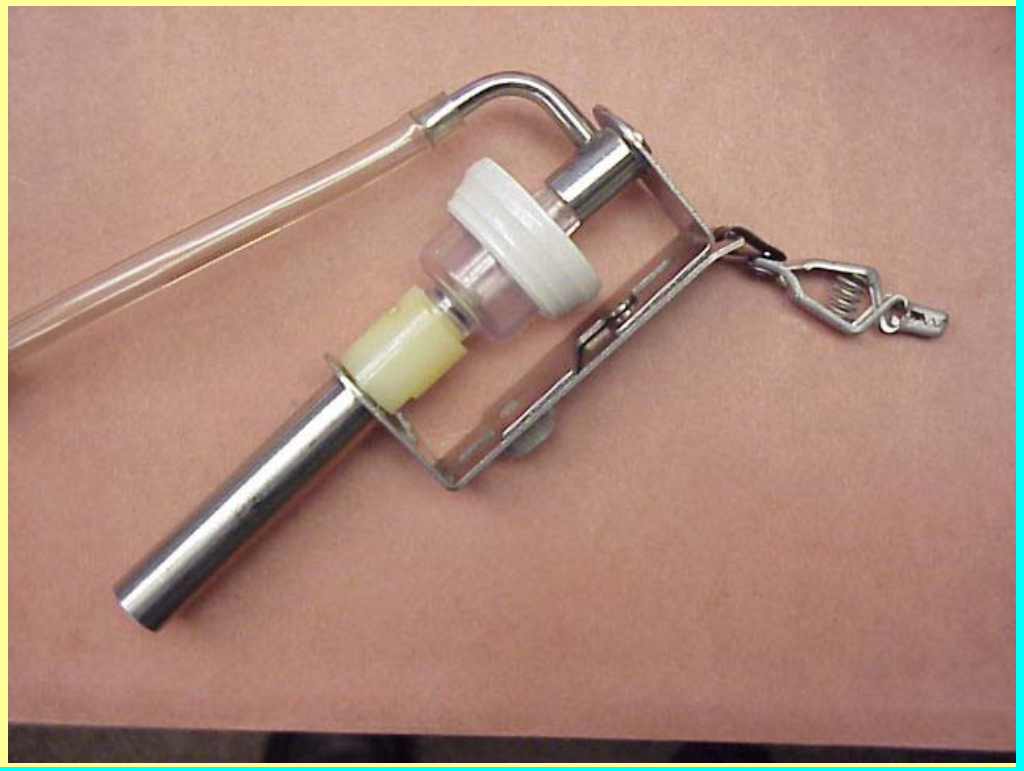
- Compliance Sampling
  - MSHA
  - Sampling/analytical methods spelled out in rule.
- Environmental Monitoring
  - Mine Operator
  - No method specified, but must indicate whether limit exceeded.

Compliance Sampling

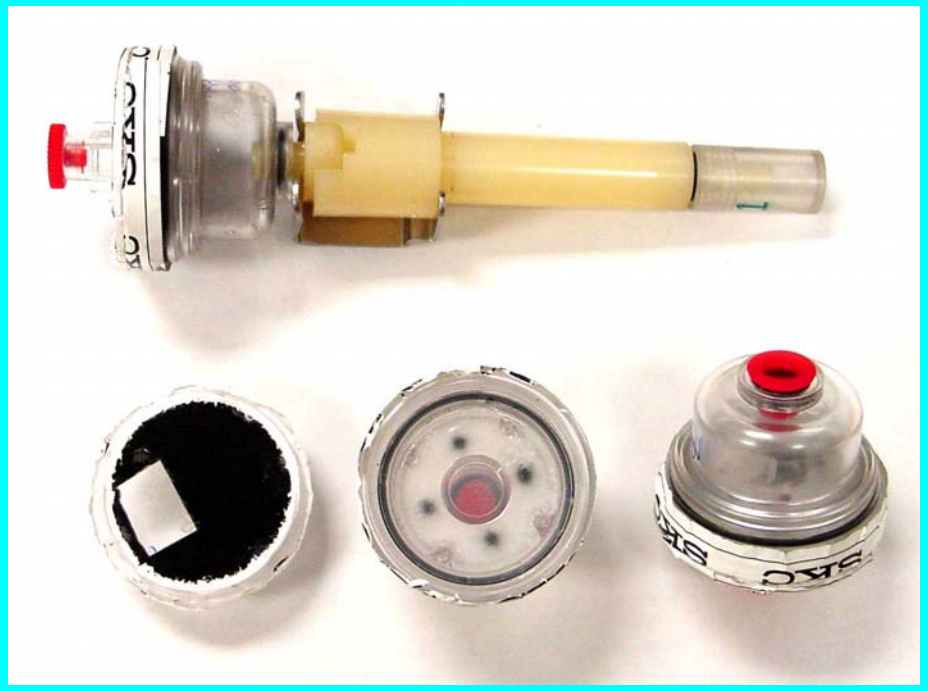
- Do not need to worry about interferences with EC surrogate.
- Personal Sampling
- Sample Time - Full Shift
- Calculate with 480 minutes

DPM Sampling Train

- SKC Submicron Impactor
  (Double Quartz-Fiber, Filter)
- Cyclone
- Breast Plate
- Pump



DPM Sampler



Calibration

- Pre calibration
- Post Calibration
- 1.7 Lpm

Personal Sampling

Environmental Monitoring

- As often as necessary to determine:
  - Whether any miners overexposed,
  - Exposure of persons designated by MSHA.
- Miners/miners' rep must be given opportunity to observe monitoring.
- If overexposure found, must correct.
- Monitoring results must be posted, copy provided to miners' rep.
- Environmental monitoring records.

Method 5040 Analytical Labs

Clayton Group
Detroit, MI
248-344-1770

NATLSCO
Long Grove, IL
847-320-2448

CANMET
Sudbury, Ontario, Canada
705-677-7815

DATACHEM
Salt Lake City, UT
800-356-9135

Mine Ventilation Services
Fresno, CA
559-452-0182

Sunset Laboratory
Forest Grove, OR
503-357-5151

Sample Analysis

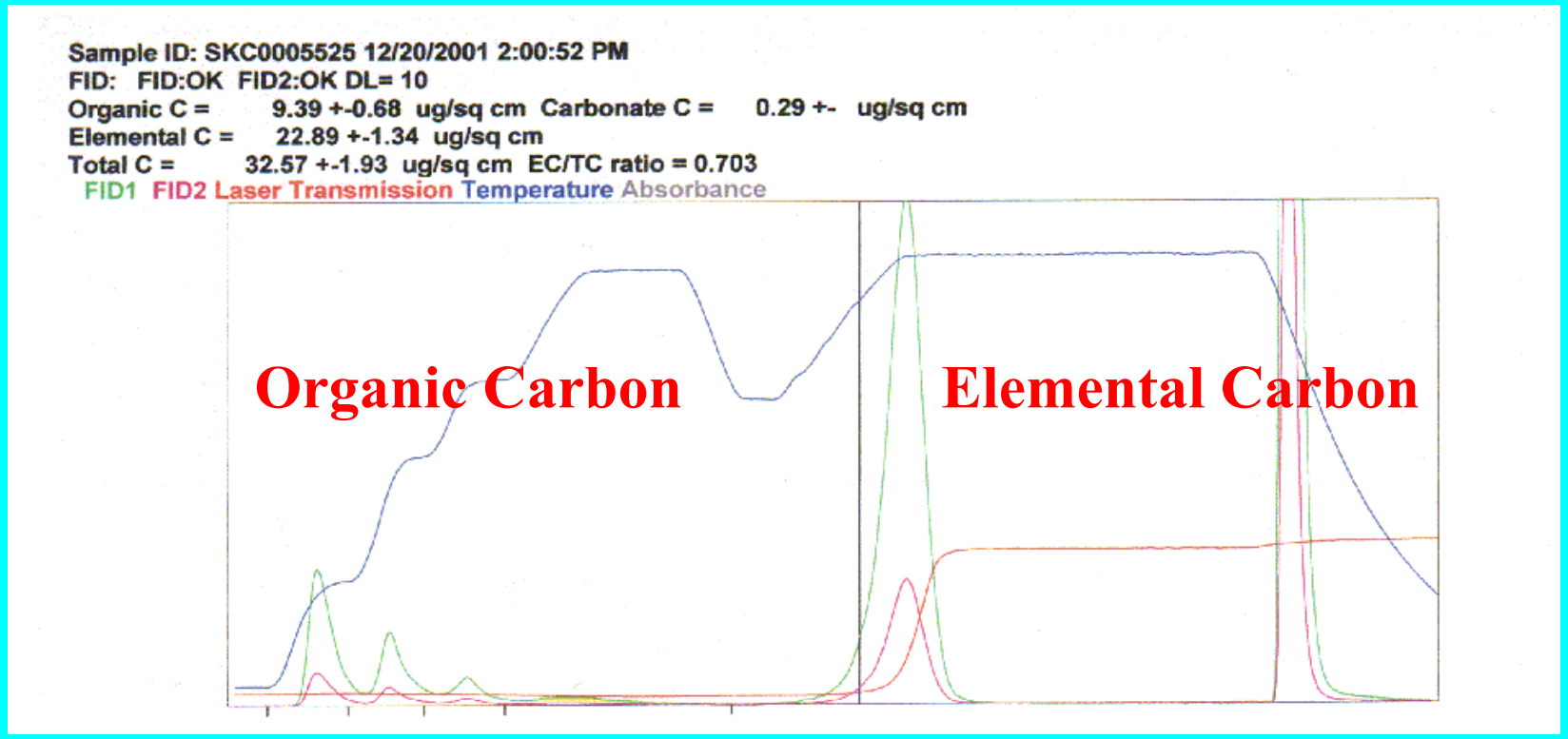
- Submit sample to lab - Make sure lab's procedures followed (handling of sample cassettes, shipping, etc)
- Complete lab paperwork and provide field notes, sampling documentation

Sample Analysis

- Total Carbon (DPM)
- NIOSH 5040 - OC and EC
- Sample - Top Filter
- Control - Double Filter

Carbon Analyzer

Carbon Analysis - Thermogram



TC = OC + EC or TC = 1.3 x EC

Concentration Calculations

- TC = OC + EC
- TC = 1.3 x EC

- OC^* or $EC^* = \dfrac{1000 \times \mu g/cm^2 \times Area}{1.7 \times 480}$

- Area = 9.12 sq. cm.
- *Corrected for control

Concentration Limit

- TC = 400 :g/m^3
- Error Factor
  - TC - 1.14
  - EC - 1.12
- Compliance Ratio

$$R = \frac{\text{Concentration}}{\text{Standard x Error Factor}}$$

Citable Violation

Citable violation only if:

EC + OC exceeds 400 x 1.14 = 456 :g/m^3

AND

EC x 1.3 exceeds 400 x 1.12 = 448 :g/m^3

Remember: MSHA will conduct compliance assistance sampling (no citations) until July 19, 2003

Sampling Results

- Make sure sample result relates to
  - Full shift exposure
  - Shift-weighted to 480 minutes
  - Airborne concentration of TC
- Lab may report :g on punch, :g on filter, TWA instead of SWA, etc.
  - You may need to convert lab results to proper form (SWA :g/m^3)

Analytical Report

Mine Safety and Health Administration
Department of Labor
Pittsburgh Safety and Health Technology Center Laboratory
Cochrans Mill Road, Building 38, Pittsburgh, PA 15236
Phone: 412-386-6893 Fax: 412-386-6948

Diesel Particulate Matter Analytical Report

ID:
(Sample Type - Mine ID - Date Sampled - DateTime printed)

Samples Received: 12/03/2001
Analyzed: 06/13/2002

Collector -AR:
Field Office: Coeur D'Alene, ID
2060 Peabody Road Suite 610
Vacaville, CA 95687

Field Office Code: 7821
District Office: WESTERN DISTRICT

Mine Name:

Flow Rate, LPM: 1.7

SAMPLE INFORMATION						LABORATORY RESULTS			ENFORCEMENT CALCULATIONS				
Lab Number	Field Sample No.	Sample Type	Time Sampled	Remarks	Sample Deposit Area cm2	Analyte	mass per area µg/cm2	Reporting Limit µg/cm2	Total Carbon Concentration 8 hour SWA ug/m3	Concentration Limit ug/m3	EF Error Factor	E (TLV * EF) ug/m3	C/E
2001042231	SKC000518	Control	---		9.12	CARBON-ORGANIC	2.3	---	---	---	---	---	
	SKC000518	Control	---		9.12	CARBON-ELEMENTAL	0.2	---	---	---	---	---	
	SKC000518	Control	---		9.12	CARBON-TOTAL	2.6	3	---	---	---	---	
2001042232	SKC000518	DPM	450 min.	ACTUAL SAMPLING TIME IN MINUTES 450	9.12	CARBON-ORGANIC	8.5	---	95		---	0	
	SKC000518	DPM	450 min.		9.12	CARBON-ELEMENTAL	10.7	---	155 (TC = EC*1.3)	400	1.12	448	
	SKC000518	DPM	450 min.		9.12	CARBON-TOTAL	19.6	3	219 (TC = OC + EC)	400	1.14	456	
2001042233	SKC000519	DPM	520 min.	ACTUAL SAMPLING TIME IN MINUTES 520	9.12	CARBON-ORGANIC	13.3	---	149		---	0	
	SKC000519	DPM	520 min.		9.12	CARBON-ELEMENTAL	38.8	---	564 (TC = EC*1.3)	400	1.12	448	1.26
	SKC000519	DPM	520 min.		9.12	CARBON-TOTAL	52.4	3	586 (TC = OC + EC)	400	1.14	456	1.29
2001042234	SKC000519	DPM	435 min.	ACTUAL SAMPLING TIME IN MINUTES 435	9.12	CARBON-ORGANIC	25.7	---	287		---	0	
	SKC000519	DPM	435 min.		9.12	CARBON-ELEMENTAL	102.2	---	1,485 (TC = EC*1.3)	400	1.12	448	3.31
	SKC000519	DPM	435 min.		9.12	CARBON-TOTAL	128.7	3	1,438 (TC = OC + EC)	400	1.14	456	3.15

PED Report

Mine Safety and Health Administration
Department of Labor

Pittsburgh Safety and Health Technology Center Laboratory
Cochrans Mill Road, Building 38, Pittsburgh, PA 15236
Phone: 412-386-6893 Fax: 412-386-6948

PERSONAL EXPOSURE DATA SUMMARY

ID:
(MIS - Mine ID - Date Sampled - DateTime printed)

MINE NAME:
FIELD OFFICE:
MINE ID:
EVENT No.: 0726816
AR No.: 9158

Analysis Number	Field Sample Number	Loc Code	Job Code	Cont. Code	Contaminant	C 8 hr SWA ug/m3	Exposure Limit	Short Term	Prot. Used	Action	Compl.	Employee	Occupation	Citation Number
2001042240	SKC0005197	01	934	TBD	CARBON-ELEMENTAL	883 TC = 1.3*EC	400	N	N				JUMBO PERCUSS	
				TBD	CARBON-TOTAL	902 TC = OC+EC	400							
2001042241	SKC0005196	01	728	TBD	CARBON-ELEMENTAL	400 TC = 1.3*EC	400	N	N				COMPLETE LHD CYCL	
				TBD	CARBON-TOTAL	416 TC = OC+EC	400							
2001042242	SKC0005198	01	728	TBD	CARBON-ELEMENTAL	1,411 TC = 1.3*EC	400	N	N				COMPLETE LHD CYCL	
				TBD	CARBON-TOTAL	1,327 TC = OC+EC	400							
2001042243	SKC0005199	01	029	TBD	CARBON-ELEMENTAL	1,677 TC = 1.3*EC	400	N	N				MUCKING MACHINE	
				TBD	CARBON-TOTAL	1,653 TC = OC+EC	400							

What Do I Need To Do So I Will Be In Compliance With § 57.5071

- Review All Available DPM Sampling Information On Your Mine
  - Company Records
  - MSHA Sampling History
- Develop and Implement DPM Sampling Strategy
  - Who, What, Where, When ?
  - Do We Perform Sampling, Or Hire Contractor ?
  - Sampling Equipment (Buy, Borrow, Rent) ?
  - Line Up An Analytical Laboratory
  - Conduct Sampling, Analyze Results, Take Action
- Develop A Good Recordkeeping System