

The background of the slide is a photograph of a diesel engine's exhaust system. A large, dark, cylindrical pipe is shown emitting a thick plume of white smoke or steam that rises and fills the right side of the frame. The engine components are metallic and show signs of use.

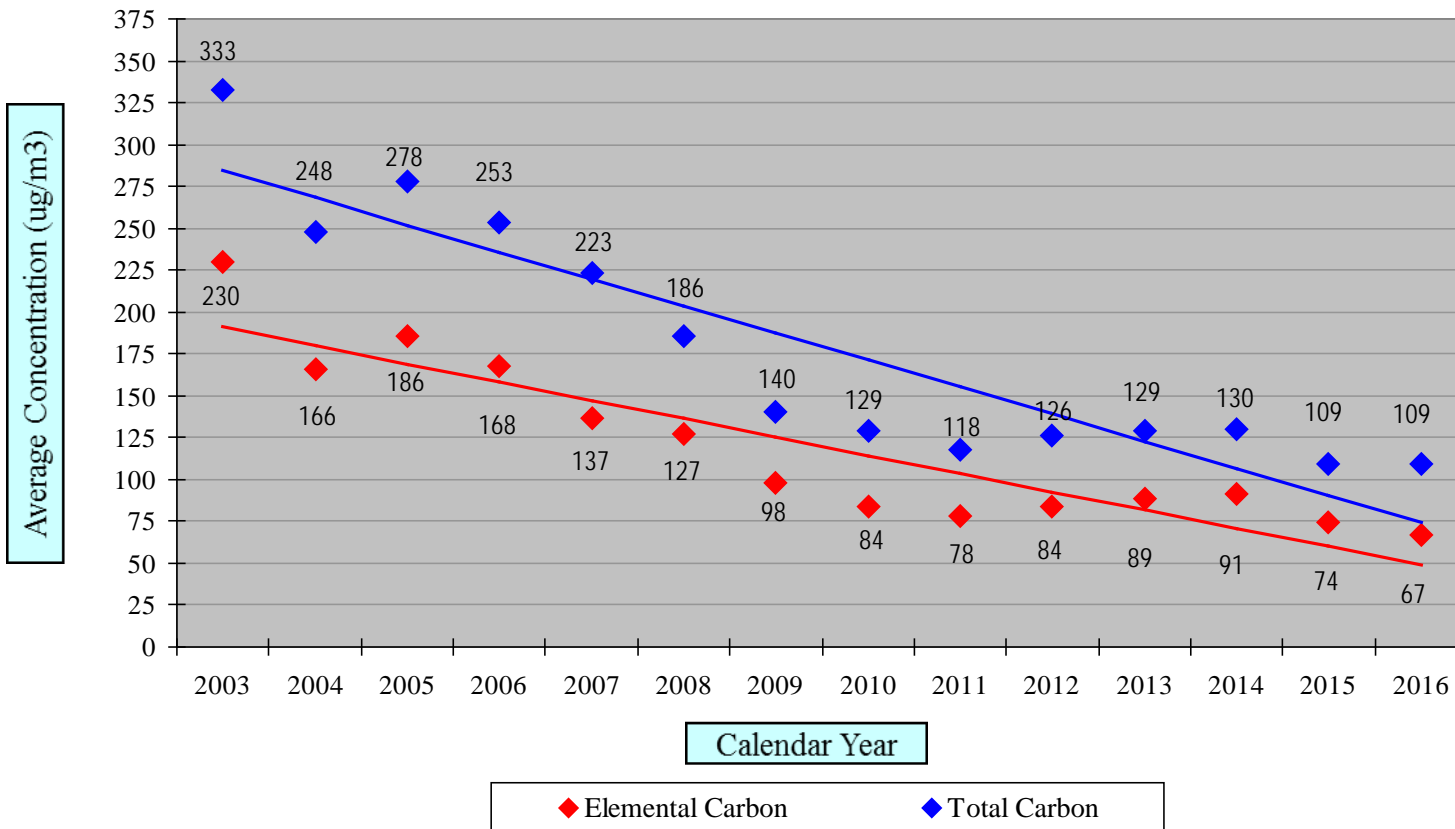
MSHA

Metal and Nonmetal Diesel Particulate Matter Exposure Update September 19, 2017

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Underground Metal/Nonmetal Mines Average DPM Concentration by Calendar Year





MSHA DPM Samples CY 2012-2016

	Number of Samples	Samples Exceeding the PEL	Percent
CY 12	566	107	18.90%
CY 13	452	86	19.03%
CY 14	545	99	18.17%
CY 15	512	73	14.26%
CY 16	524	75	14.31%



Number of DPM Samples Exceeding the Existing PEL Between CY 12-16 by Miner Occupation

Miner Occupation	Number of Samples Exceeding the PEL	% Among Samples Exceeding the PEL
Blaster, Powder Gang	134	31
Front-end Loader Operator	48	11
Scaling (mechanical)	39	9
Truck Driver	32	7
Mucking Mach. Operator	28	6
Drill Operator, Rotary	21	5
Drill Operator, Jumbo Perc.	20	5
Roof Bolter, Rock	18	4
Drill Operator, Rotary Air	17	4
Miner, Drift	14	3



Number of DPM Samples Exceeding the Existing PEL Between CY 12-16 by Commodity

Commodity	Number of Samples	% Among Samples Exceeding the PEL
Crushed, Broken Limestone NEC	205	47
Gold Ore	80	18
Lead-Zinc Ore	48	11
Zinc	45	10



How Reductions were Accomplished





Current Control Technologies in Metal and Nonmetal Mines

▶ Exhaust Aftertreatment Systems:

– Scrubbers:

- Water or dry scrubbers

– DPF Filters:

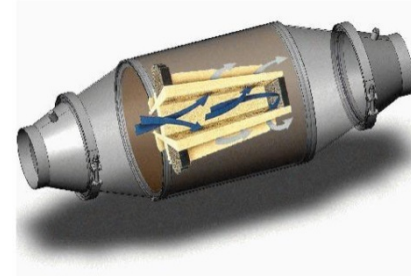
- DPM:

- Paper
- Sintered Metal
- Ceramic

-Catalyzed or uncatalyzed diesel particulate filters

- Exhaust Gases:

- Oxidation catalytic converters i.e. diesel oxidation catalysts





Current Control Technologies in Metal and Nonmetal Mines (2)

- ▶ Selective Catalytic Reduction: Diesel exhaust fluid/Urea Injection
- ▶ Low Emission Engines
- ▶ Environmental Cabs on Mobile Equipment
- ▶ Ventilation
 - Passive/Active





Current Control Technologies in Metal and Nonmetal Mines (3)

▶ **Fuel, Fuel Additives, Alternative Fuel:**

- Ultra low sulfur diesel (ULSD: < 15 ppm sulfur fuels)
- Fuel additives:
 - Cetane improvers
 - Oxygenated additives
 - Detergents
 - Dispersants or surfactants
- Biodiesel
 - 5% biodiesel blend to 100%