



Biodiesel, DPM & Underground Mine Worker Health



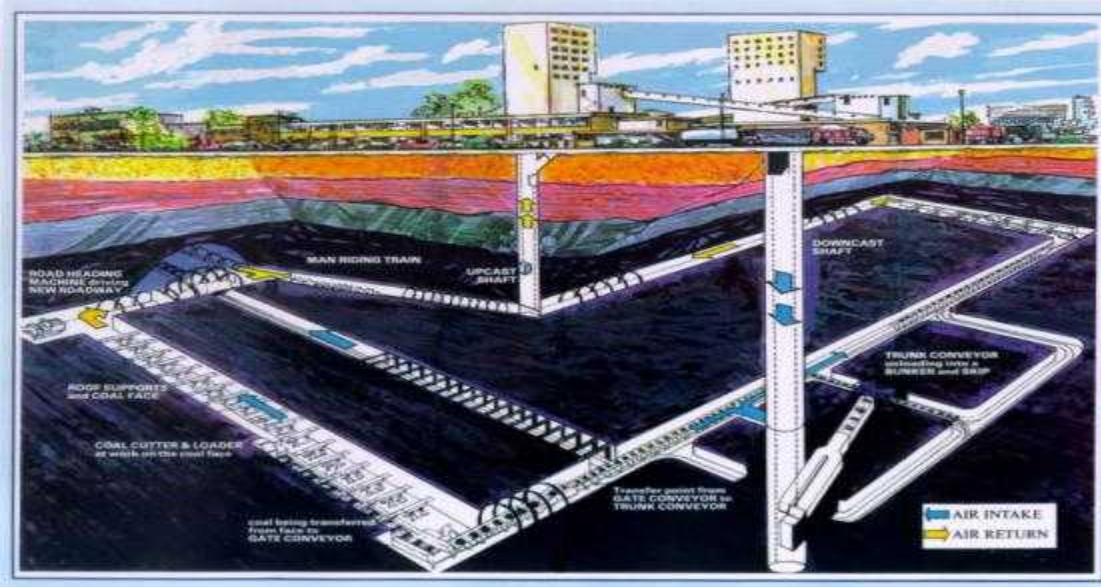
{ In this case, it's o.k. to say you inhaled }

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MSHA Ruling for Diesel Particulate Matter (DPM) in UG Mines



Federal Register

Thursday,
May 18, 2006

Part II

Department of Labor

Mine Safety and Health Administration

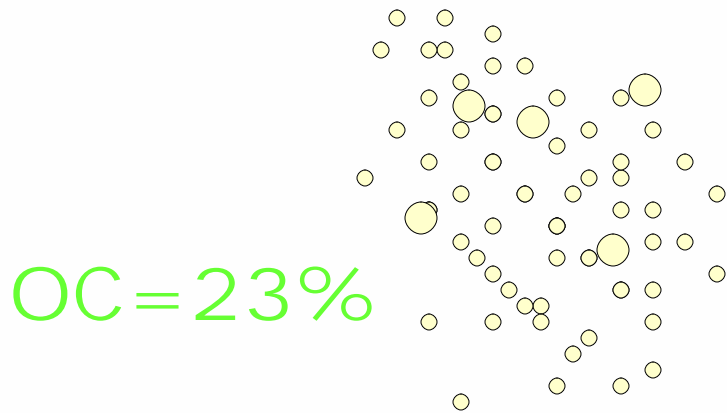
30 CFR Part 57
Diesel Particulate Matter Exposure of
Underground Metal and Nonmetal Miners;
Final Rule

Phases in final DPM Personal Exposure Limits over two years

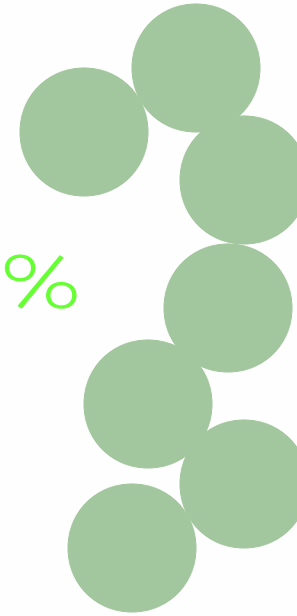
- $308_{EC} \mu\text{g}/\text{m}^3$ - effective May 20, 2006 ($400_{TC} \mu\text{g}/\text{m}^3$)
- $350_{TC} \mu\text{g}/\text{m}^3$ - effective January 20, 2007
- $160_{TC} \mu\text{g}/\text{m}^3$ - effective May 20, 2008



DPM Carbon Components



Vapor Phase
Hydrocarbons (OC)



Elemental Carbon
Cores (EC)

$$77\% \times 1.3 = 100\%$$
$$EC \times 1.3 = TC$$
$$308_{EC} \times 1.3 = 400_{TC}$$

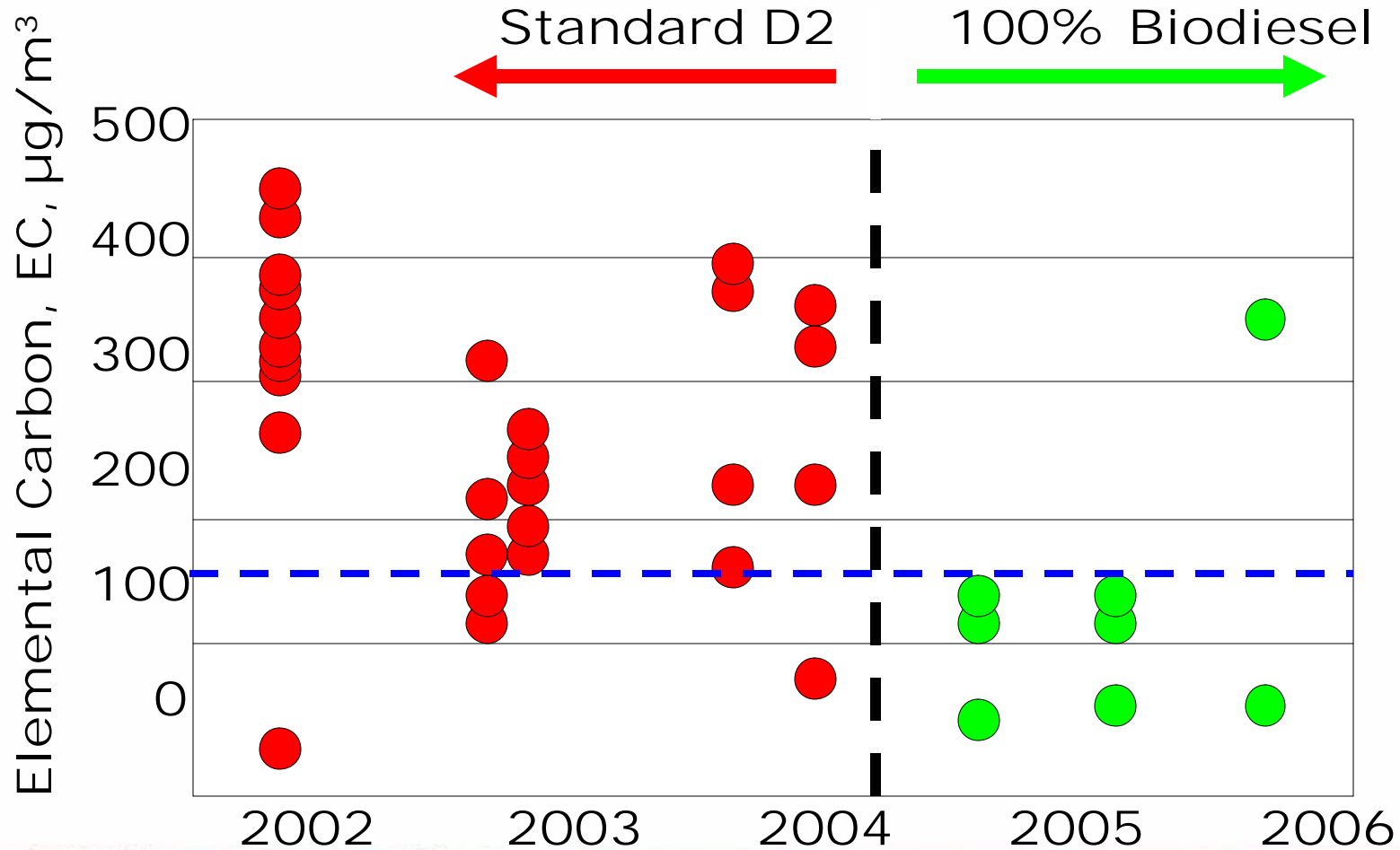
2008 Final Limit 160_{TC} µg/m³



MSHA compliance samples, EC



MSHA compliance samples, EC





Biodiesel and DPM Emissions

MSHA Tech Support compliance assistance at Carmeuse Lime and Stone – area samples

EC
reductions
(compared to D2)

- Maysville Mine
 - B20 (recycled vegetable oil) 35%
 - B50 (recycled vegetable oil) 71%
 - B50 (virgin soy oil) 49%

- Black River Mine
 - B35 (recycled vegetable oil) 33%
 - B35 (virgin soy oil) 16%





Biodiesel & PM Traps

- Biodiesel blends may provide SIGNIFICANT benefits with 2007 PM trap equipped engines
- Although similar in size/distribution, B20 particles are different than petrodiesel particles
- Break Even Temperature of PM Traps reduced by 30 to 50 degrees F with B20
 - May increase fuel economy w/ PM traps
 - May lengthen PM trap life
- Engine out PM reduced
 - Helps EGR, reduces engine oil soot levels





Going over B20 requires caution

- Cold flow
- Materials compatibility
- Cleaning effect
- Fuel Stability a bigger concern
- Lower BTU content becomes noticeable
- Engine oil may become diluted with fuel
- Not supported by OEM's



