Exposure to Diesel Particulate Matter (DPM) and Regulations in Canadian Mining Provinces

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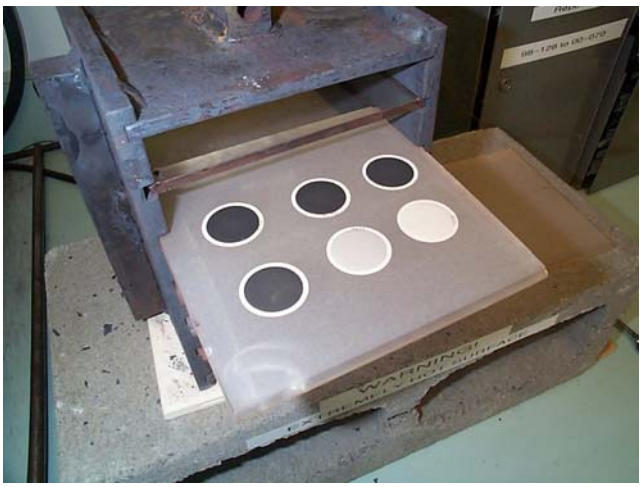
Objectives

- Compare RCD and Elemental/Organic carbon method (NIOSH 5040)
- Examine present RCD exposure levels in Canadian metal/non-metal mines
- Examine present EC/TC exposure levels in Canadian metal/non-metal mines
- Look at Total Carbon/Elemental Carbon (TC/EC) ratios for Canadian mines

RCD Method

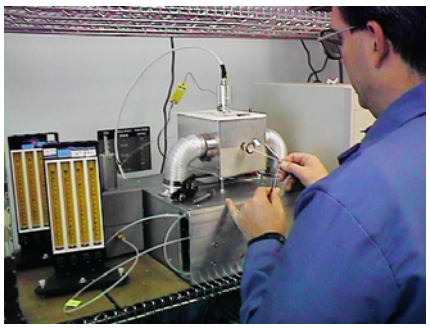
- Respirable combustible dust (RCD)
- Detection limit of 0.04 mg/m^3
- Principle of analysis: determination of mass loss on ashing @ 400°C for 2 hours
- Inadequate for compliance monitoring at low limits of exposure (0.60 mg/m^3)

DPM Analysis – RCD Method



DPM Analysis – RCD Method

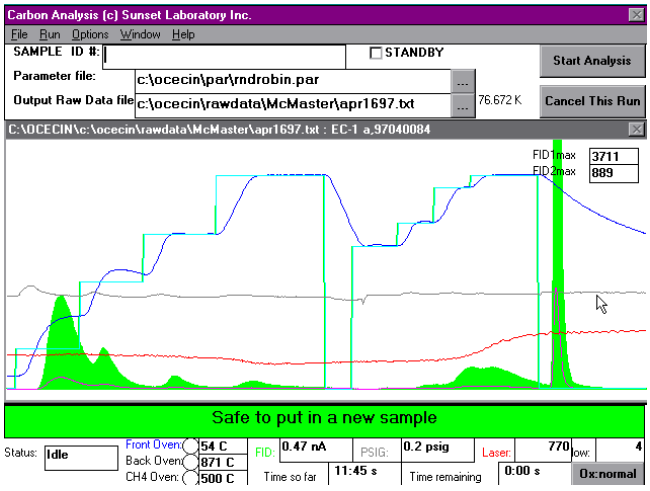
NIOSH 5040 Method



- Detection limit: 0.001 mg (elemental carbon) and 0.005 mg (organic carbon)
- Principle of analysis: two-phase heating of sample with measurement of combustion gases

DPM Analysis – NIOSH 5040

DPM Analysis – NIOSH 5040



Diesel particulate matter requirement in Canadian mines

Province/Territory	Diesel Particulate Matter measured as RCD	Maximum value (mg/m^3)
British Columbia, Ontario, New Brunswick, Nova Scotia and Northwest Territories & Nunavut	Yes	1.5
Alberta	----	----
Saskatchewan	----	----
Manitoba	As established by ACGIH	TLV
Quebec	Yes	0.6
Newfoundland and Labrador	As established by ACGIH	TLV
Yukon	----	----

Note: In Saskatchewan the NIOSH 5040 Method is now mandated to measure exposure of miners to DPM

Sources

- **DPM sampling methods: Statistical comparisons – Win Watts**
- **Evaluation of existing DPM sampling and analytical methods at a high-sulfide ore mine – Michel Grenier**
- **Diesel Particulate Matter Sampling Exercises in Saskatchewan Potash Mines**
- **Compilation of the legislation on explosives storage and ventilation requirement for Canadian provinces and Territories – Sylvie Poirier**
- **Selected RCD and Elemental/Total Carbon analysis reports for Canadian Mines**

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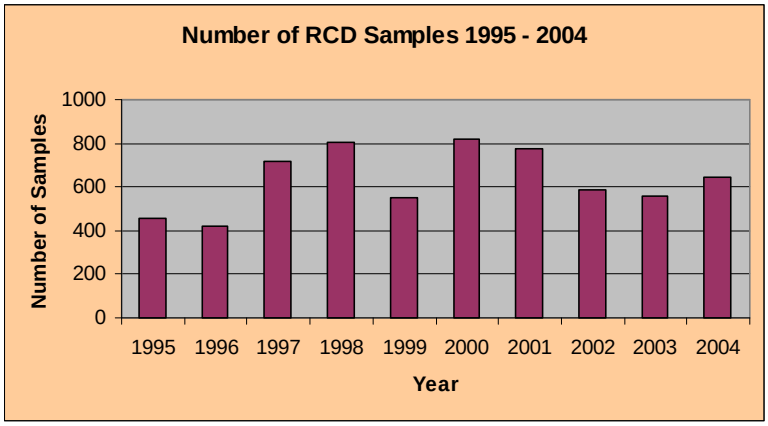
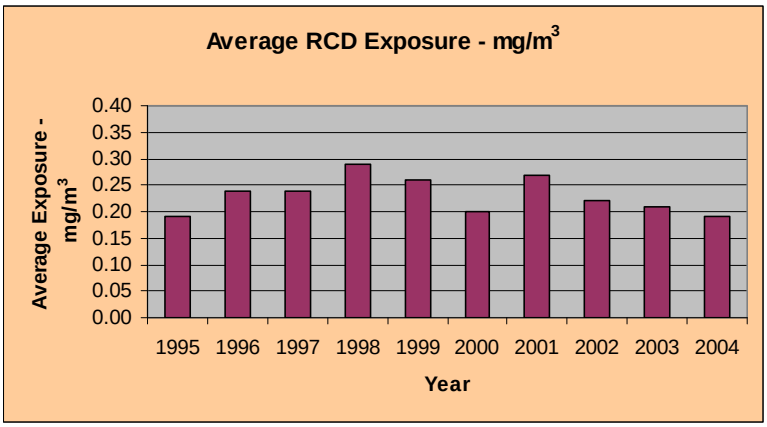
Questions

- How does the RCD data compare to the TC/EC data
- What is the ratio of TC to EC in field samples
- What are the current exposure values in the mining industry
- Can Canadian mines meet lower DPM compliance levels

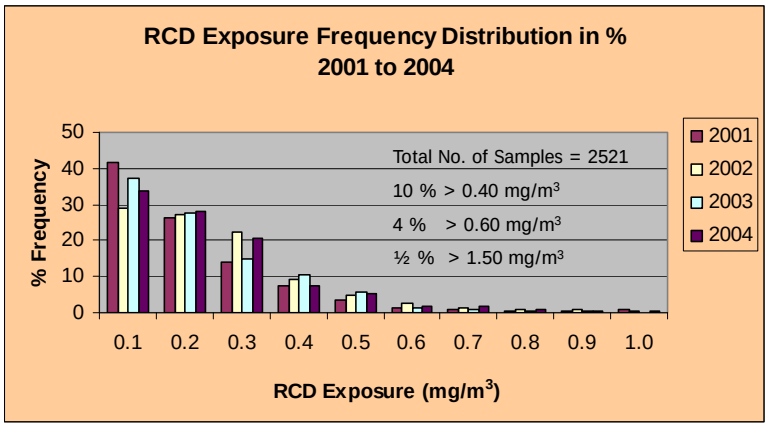
No. of RCD samples (CANMET) -Canadian mining industry



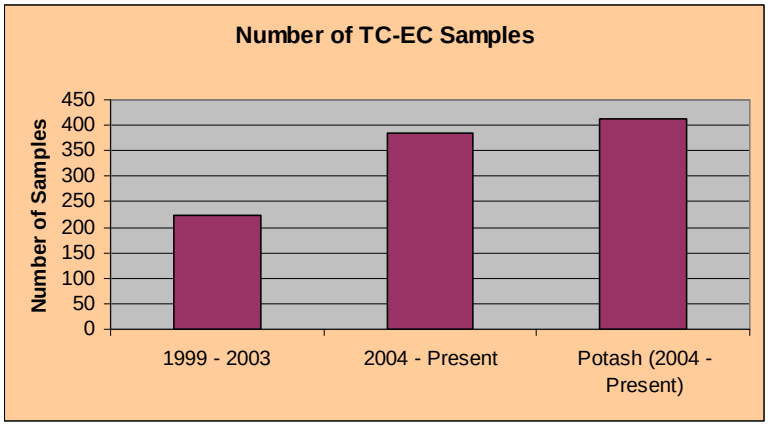
Average exposure values for the Canadian mining industry (RCD)



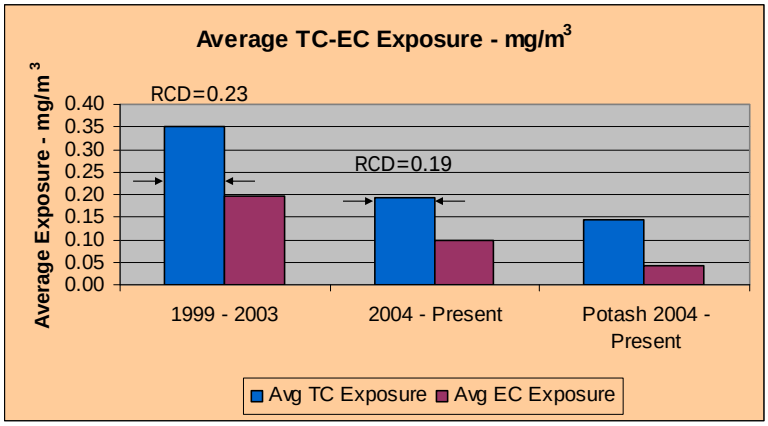
Current exposure values for the Canadian mining industry (RCD)



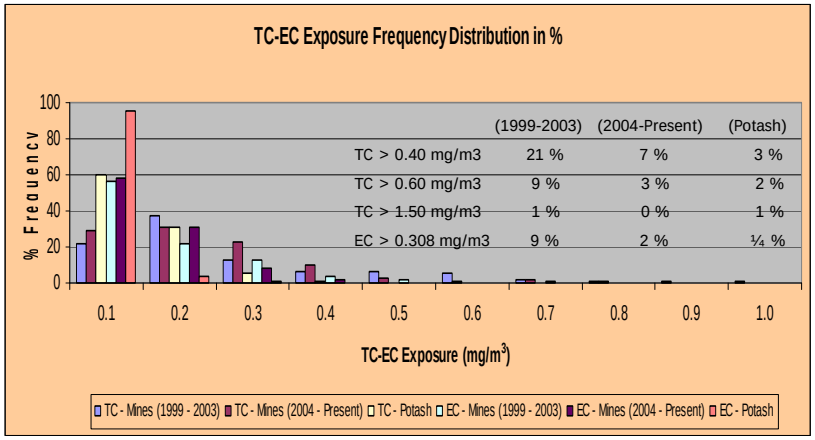
No. of TC/EC samples (CANMET) - Canadian mining industry



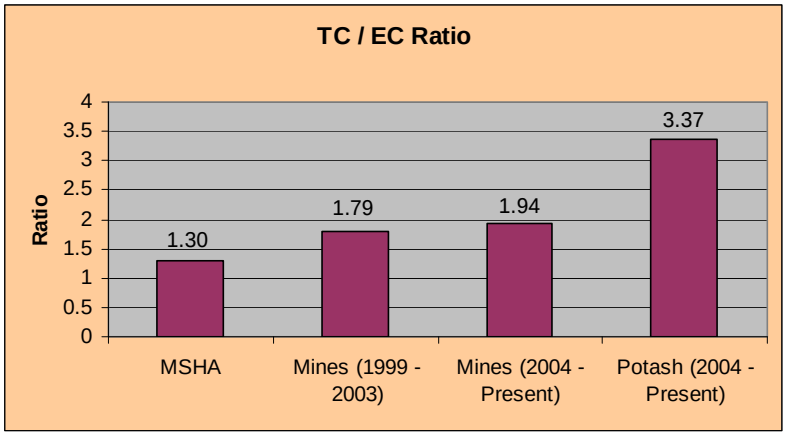
Average exposure values for the Canadian mining industry (TC/EC)



Current exposure values for the Canadian mining industry (TC/EC)



Ratio of Total Carbon (TC) to Elemental Carbon (EC)



Conclusions

- **RCD is equivalent to Total Carbon (TC)**
- **Provinces & Territories are moving towards lower DPM exposure**
- **As DPM compliance levels are lowered the NIOSH 5040 Method will be the method of choice**
- **The ratio of Total Carbon to Elemental Carbon for Canadian Mines is higher than the 1.3 ratio calculated from work done in U.S.**
- **In the near future the 1.5 mg/m^3 DPM compliance level currently used in most Canadian mining jurisdictions should be reviewed**