MDEC 2007 ROUNDTABLE FORUM REVIEW PANEL

DPM Regulation and Engine Certification

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Richmond Hill, Ontario

CANMET-MMSL 08-125(OP)

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DPM Analytical Methods

- Respirable Combustible Dust (RCD)
  - Québec, Ontario, N.B., B.C., …
- NIOSH 5040 method:
  - Also known as the elemental carbon method
  - Mentioned by name in the MSHA ruling for the U.S.
  - Adopted by Saskatchewan and maybe soon in Ontario

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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 lower limits of exposure

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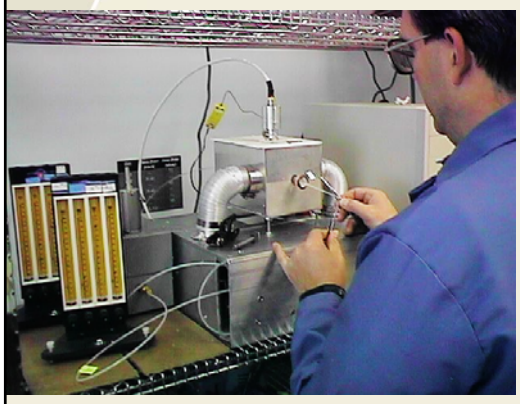
Elemental Carbon Method



- 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

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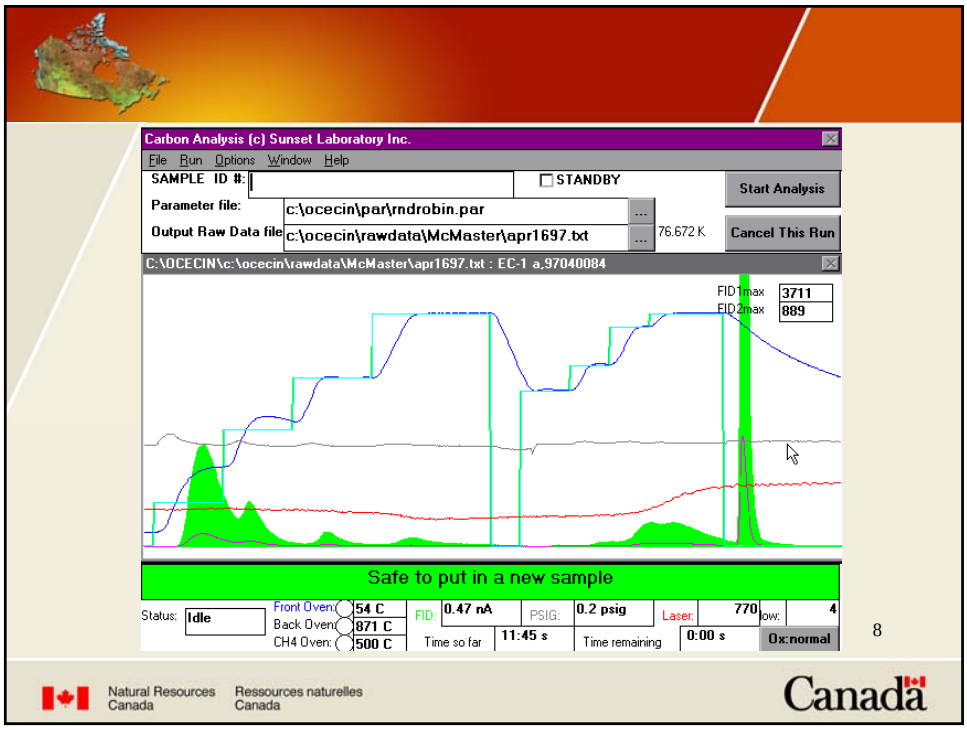
Carbon Analysis (c) Sunset Laboratory Inc.
File Run Options Window Help
SAMPLE ID #:
STANDBY
Start Analysis
Parameter file:
c:\ocecin\par\rndrobin.par
Output Raw Data file
c:\ocecin\rawdata\McMaster\apr1697.txt
76.672 K
Cancel This Run
C:\OCECIN\c:\ocecin\rawdata\McMaster\apr1697.txt : EC-1 a,97040084
FID1max 3711
FID2max 889
Safe to put in a new sample
Status: Idle
Front Oven: 54 C
Back Oven: 871 C
CH4 Oven: 500 C
FID: 0.47 nA
PSIG: 0.2 psig
Laser: 770
low: 4
Time so far 11:45 s
Time remaining 0:00 s
Ox:normal
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Elemental Carbon vs. RCD

- EC method is at least 10 times more sensitive than the RCD method
- But when other variables associated with sampling are taken into account (flow rate, time, etc.) concentrations values measured using EC or TC are three times more precise that RCD values

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DPM Exposure Limits - CANADA

- Canada - 1.5 mg/m^3 (RCD)
- Québec - 0.6 mg/m^3 (RCD - Spring 2003)
- Ontario – proposed 0.4 mg/m^3
- Saskatchewan – No limit of exposure but mines have to use the Elemental Carbon method

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DPM Exposure Limits – U.S.

- MSHA – American metal mines (NIOSH 5040)
  - Jan. 2007 - 0.350 mg/m^3 Total Carbon (TC)
  - May 2008 – 0.160 mg/m^3 Total Carbon (TC)
- January 2007 court ruled that:
  - Evidence of impact of DPM on health is credible
  - Elemental Carbon method passes the test
  - Mine operators can meet the challenge
- May 2008, MSHA implements 0.160 mg/m^3 with allowance for a site specific TC/EC ratio to be calculated

U.S. Department of Labor MSHA Mine Safety and Health Administration

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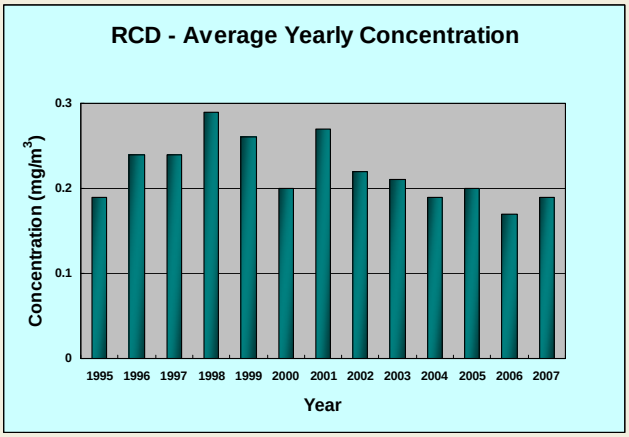
Average Yearly Exposure Canadian Metal Mines - RCD



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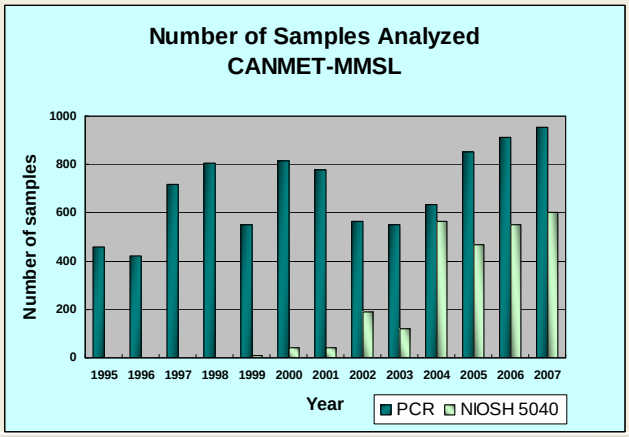
DPM Samples Analyzed at CANMET-MMSL Metal Mines



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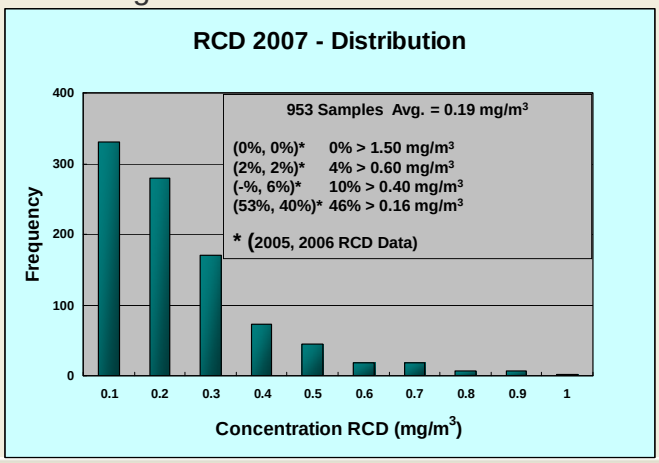
Exposure Data Breakdown – 2007 Underground Metal Mines - RCD



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Comments from Roundtable Delegates

- What % of Canadian RCD data for M/NM would have exceeded the 0.4 mg/m^3 limit? A: 6%
- In U.S. administrative measures (respirators) are allowed in order to meet compliance
- DPM should be reduced to lowest practicable levels, but not at the expense of mine closure
- Canada should adopt levels of exposure as stringent as the U.S. but care has to be exercised (TC/EC ratio is a serious and complex issue)

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Comments from Roundtable Delegates

- Many avenues can be identified to reduce DPM, one company invested $75M in new Tier 2 and 3 engines in the past 2 years
- To which someone retorted that ventilation should not be forgotten, a clean engine can easily foul up a badly ventilated heading
- DPFs are good, but you have to be able to demonstrate that you can do the basics correctly first (clean, well-maintained engines, good fuel, proper ventilation)

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Engine Approval or Certification

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MSHA and CSA

- Steady-state evaluation of an engine's emission profile
- Worse case concentration values are used to calculate a ventilation rate
- Both were developed to focus on health concerns associated with exposure to diesel emissions (as opposed to EPA regulation)

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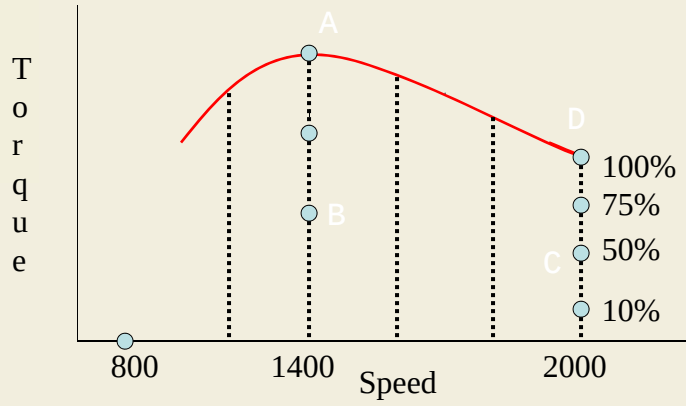
ISO-8178-CI
8-Mode Test Cycle



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Comments from Roundtable Delegates

- Engine certification is a good indication of engine emissions performance and fuel economy when **new**
- As such the process offers a good idea of baseline performance
- Maintenance and proper ventilation practice are the only ways to ensure that proper advantage is taken of clean engine technology

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Comments from Roundtable Delegates

- Engines are getting complex and some expressed concern that mine personnel may not be adequately trained
- Manufacturers suggested that this would not be a problem
- One fleet maintenance manager said that some of the more complex maintenance tasks are already being performed by trained engine manufacturers reps

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Comments from Roundtable Delegates

- Engine manufacturers said that new engines can go 2000 to 3000 hours before maintenance is required
- It was suggested that a unique certification standard be used and that any accredited and reputable laboratory be allowed to perform the tests

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Thank you
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