

THE ELEMENTS OF SUCCESS

MDEC: Diesel Emissions Program
Case Study: Musselwhite Mine



Farah Kassam



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Musselwhite Mine

Musselwhite Mine is a 4,000 ton per day gold producer in Northwestern Ontario. As a fly-in, fly-out underground mining operation located 500km north of Thunder Bay,

Musselwhite Mine came on stream in 1997 with an initial 10 year mine life. Presently the operation has an additional 10 years of projected mine life, with expected future growth as exploration continues.





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Intent of presentation

- Illustrate through examples what the industry is doing to ensure workers are not being over exposed to diesel particulate matter
- Case Study: Rock Breaker at 400ML
 - 3 approaches
 1. Change workers habits
 2. Correlation between load time, load frequency
 3. Increase ventilation

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DPM Program Overview

Musselwhite mine started using the NIOSH 5040 in June 2008 during this time the following was completed

1. Assessment of each occupation underground as the RCD level for Ontario is very high therefore we were never even close to the TWAEV
2. Basic chart indicating average exposure levels
3. Short term studies of work areas deemed high risk
4. Implementation of the program to the work force
5. Training for supervisors introduced in the new common core modules

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Diesel Exhaust

- Diesel exhaust is a complex mixture and variable mixture of gases, organic vapours and fine particles
- The amount and composition varies depending on fuel and engine type, maintenance schedule, tuning, workload, and any exhaust gas treatment

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Measuring Exposure

Here at Musselwhite due to the extended shift of 10.5 hours our TWA EV is 0.216 mg/m³

($0.4 \times (40 / (10.5 \times 7)) = 0.216 \text{ mg/m}^3$)

- **Organic carbon (OC):** not a good choice because other sources of OC (eg, cigarette smoke, and other combustion aerosols, asphalt fumes) are present in many workplaces

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- **Elemental carbon (EC):** is a better surrogate because it is a more selective measure of particulate diesel exhaust and is a sizable fraction (30-90%) of particulate mass.
- Fine EC particles are derived mostly from the combustion of diesel fuels
- Cigarette and wood smokes contain little if any EC
- Gasoline engines emit far less EC than diesels
- Diesel is safe as it reduces explosion hazards, and is cost effective however in contaminates mine air and can become a health hazard

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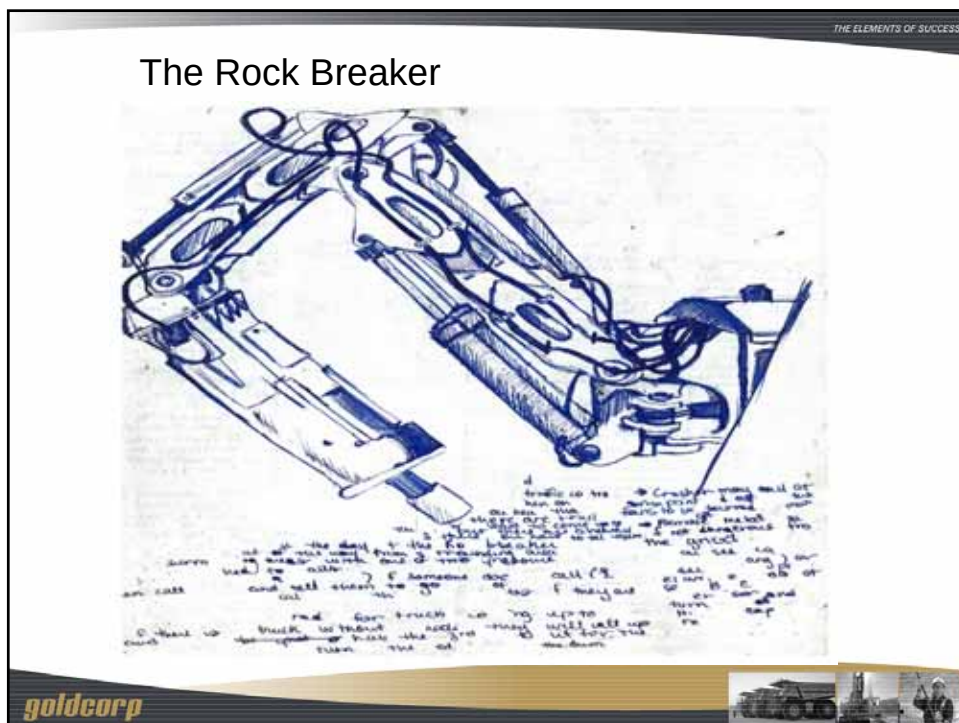
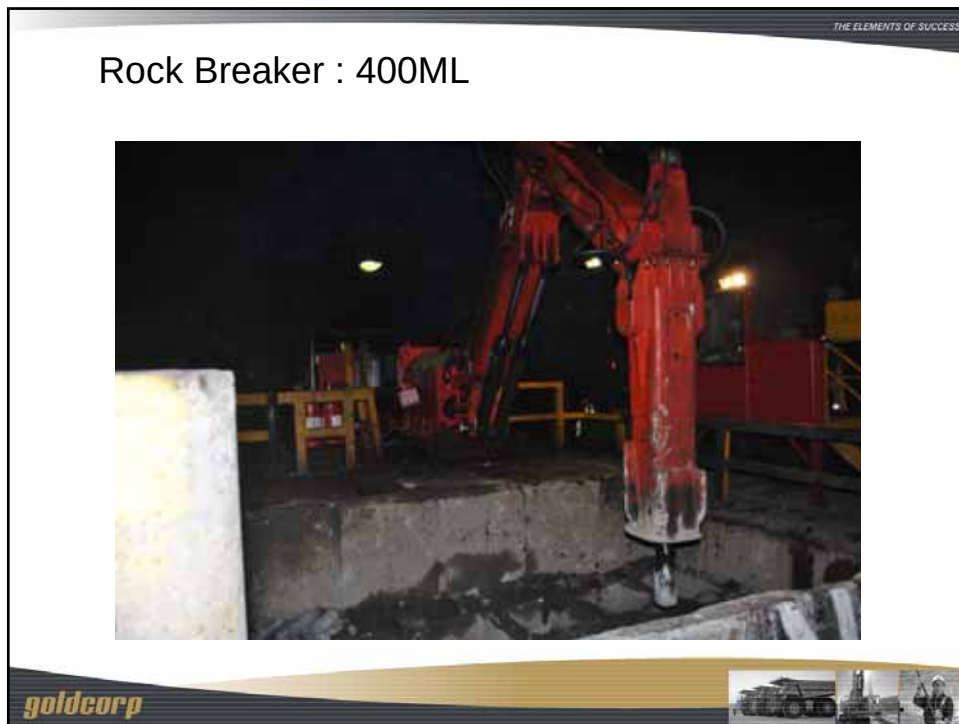
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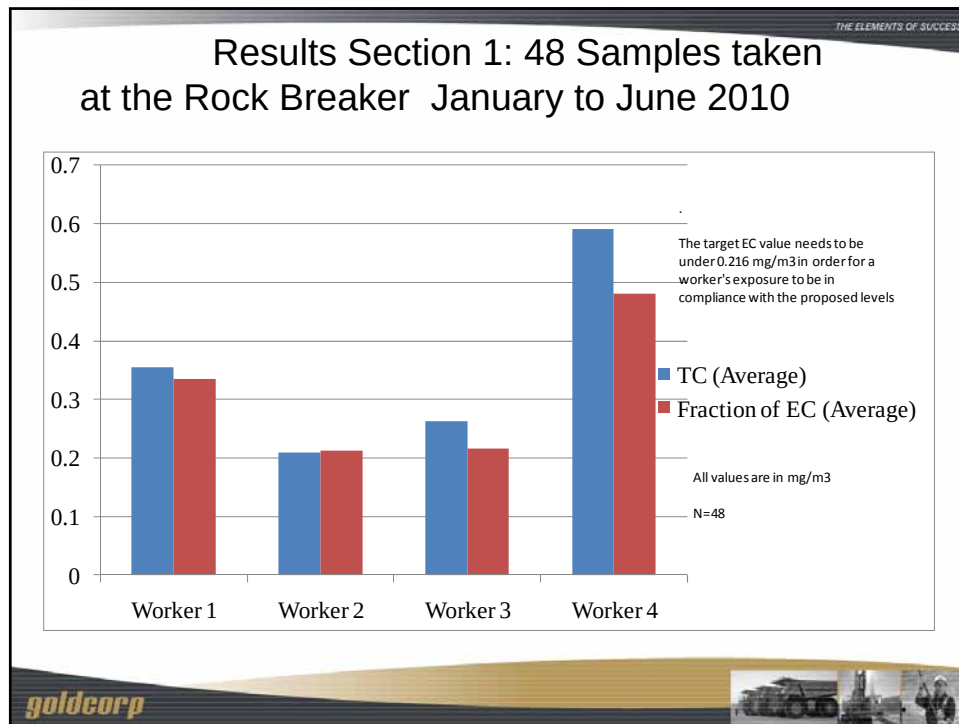
Health Hazards of DPM

- More than 95% of DPM is composed of particles less than 1 micrometer in aerodynamic diameter
- Because of their size these particles are inhaled deep into the lungs where they can induce an inflammatory response
- As a result of their small size DPM has a large specific surface area for adsorption of organic compounds
- They can bring adsorbed organic material into intimate contact with the lung tissue, increasing the potential health effects

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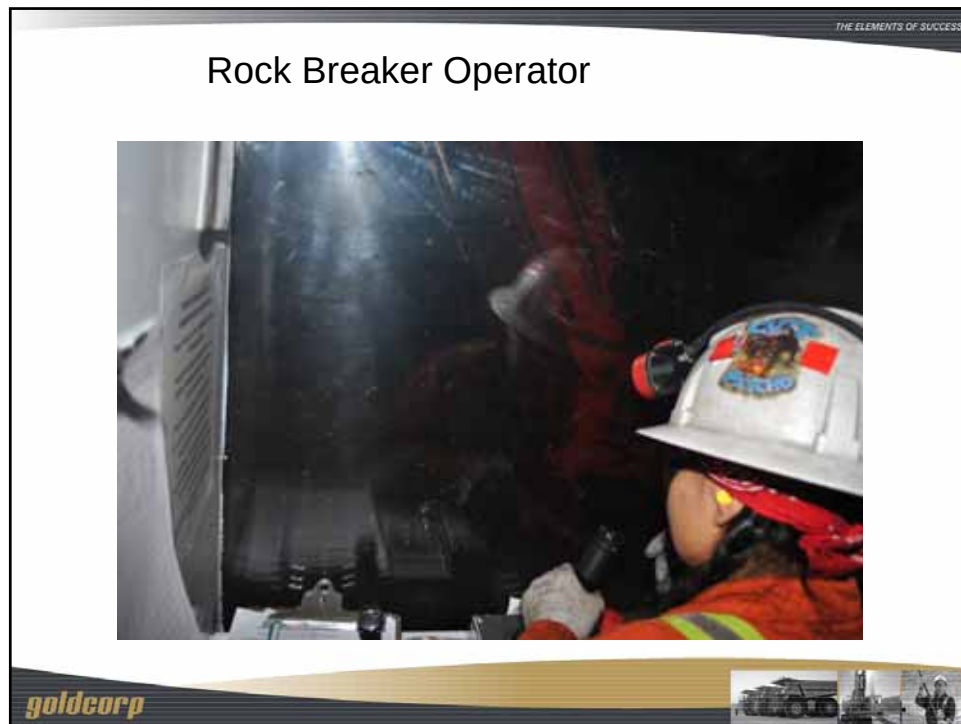
Trucks loads vs levels TC

Each worker was to record how many truck loads were dumped into the rock breaker. The average number of trucks per day was 70.

Workers control the rock breaker from a cab located directly in front of the breaker.

Loads of muck did not have strong correlation with the TC and EC.

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2nd Round of sampling

Instructions given to operators

1. Stay in cab for as long as possible
2. Record time in which you are outside the cab
3. Indicate if you are walking to the ramp
4. Record number of trucks at the breaker

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Grizzly platform



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Cab adjacent to grizzly



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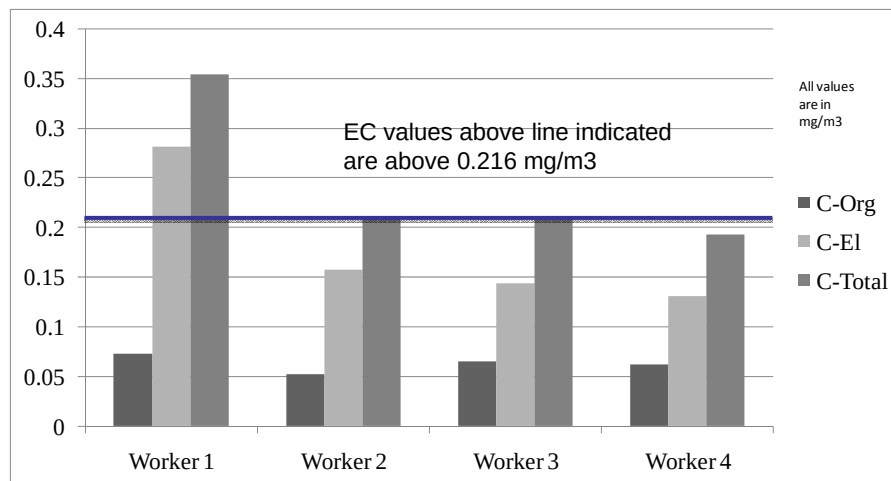
Truck at the breaker



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Results for Section Two N=28



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Changes

TC stayed the same for workers 1 and 2 however TC decreased by 20% for worker 3 and by 67% for worker 4

EC was reduced by 75% , workers ensured that they spent more time in the cab and ensured that all truck operators waiting for the breaker did not idle at the entrance of the 400ML

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Section 3: Commissioning of the new fresh air vent raise

In June of 2010 a new fresh air vent raise was installed. At this time further sampling was done at the breaker.

The preliminary results have indicated a further reduction of 10% for elemental carbon.

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What did we learn

- Knowledge is power
- By introducing DPM to the workforce as a health hazard and by explaining what constitutes a health hazard workers are aware and receptive of change
- Sampling is a key component of the industrial hygiene program however the delay in information makes it virtually impossible to sample sporadically throughout the mine.

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- Due to the delay in results it makes it more important that we aim to be well below the TWAEV
- Here at Musselwhite we are undertaking a program where sampling information , programs and educational material is shared throughout all Goldcorp sites.
- DPM exposures depends upon engine exhaust emission, the used of exhaust after treatment and ventilation the solutions must be multi faceted and must incorporate all areas to ensure the solution is affective

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- After all three areas are controlled for the worker still plays a large role in reducing his/her exposure

THANK YOU
Any Questions?

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