Diesel Emissions Maintenance Training Program

THE GOAL:

To demonstrate a practical transfer with a mining operation of the final product and findings from the DEEP Maintenance Project

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Diesel Emissions Maintenance Training Program

THE PLAYERS:

NORCAT
NORTHERN CENTRE FOR ADVANCED TECHNOLOGY INC.

Cambrian College

IMC Global

Diesel Emissions Evaluation Program
DEEP

noranda
Technology Centre

Diesel Emissions Maintenance Training Program

THE PLAN:

To take the final transferred documentation, manuals and best practices created from the Maintenance Project and apply it to a mining operation with minimal planning, setup and intervention

One week maximum!

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THE MINE:

Diesel Emissions Maintenance Training Program

Break Down Of The Classroom Theory:

- **Explain the purpose for following the best maintenance practices.**
- **Identify the steps used in the best maintenance practices .**
- **Identify the tools used to perform the maintenance associated with diesel engine emissions.**

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Break Down Of The Classroom Theory:

- Identify the steps involved with performing an engine tune up based on exhaust analysis.
- Identify when a major overhaul or repair is required.
- Explain the benefits of a proactive approach towards diesel engine maintenance.

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Break Down Of The Classroom Theory:

- Identify the steps involved with performing an engine tune up based on the exhaust analysis.
- Identify when a major overhaul or repair is required.
- Explain the benefits of a proactive approach towards diesel engine maintenance.

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Break Down Of The Classroom Theory:

- Explain the process used for testing exhaust gas on diesel engines.
- Explain the components that make up diesel exhaust gas.
- Identify the different diesel exhaust gas colors and what causes them.

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Break Down Of The Classroom Theory:

- Explain the different types of combustion chamber designs used in diesel engines.
- Explain the layout and design of intake and exhaust systems.
- Outline how operating conditions affect emissions.

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Break Down Of The Classroom Theory:

- Identify the causes for low turbo boost pressure.
- Identify the causes of high exhaust back pressure on diesel engines.
- Identify the causes of high crankcase pressure on diesel engines.

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Break Down Of The Classroom Theory:

- Review the function of the Intake system and outline how to test, maintain and repair it.
- Review the purpose of the exhaust system and how to test, maintain and repair it.
- Identify the tools used to diagnose exhaust system gases.

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Break Down Of The Classroom Theory:

- Outline fuel system diagnostic procedures and explain how to correct any abnormal conditions.
- Outline cooling system diagnostics and repairs.
- Identify the best practices for the handling and storage of diesel fuel.
- Identify the best practices for handling lubrication oil.

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Break Down Of The Classroom Theory:

- Outline the purpose for using the ECOM gas analyzer.
- Explain the function of the ECOM gas analyzer software.
- Identify the pre-test conditions for diesel emission testing.
- Identify the testing protocol used to test diesel emissions.

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Break Down Of The Classroom Theory:

- Outline the importance of correct injection pump timing.
- Identify the pre-test conditions for accurate fuel system testing and adjustments.
- Identify the testing protocol used to test primary fuel circuits.

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Break Down Of The Hands On Training:

- Outline the importance of a clean work environment.
- Perform a demonstration of an intake system restriction and pressure test.
- Perform a demonstration of an exhaust system back pressure test.

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Break Down Of The Hands On Training:

- Perform a demonstration on the use of an infrared hand held temperature probe.
- Perform a demonstration on the use of a digital tachometer.
- Perform a demonstration on the use of a coolant system pressure test kit.
- Outline the procedures for performing a cylinder compression and balance test.

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Break Down Of The Hands On Training:

- Perform a demonstration of a valve adjustment procedure on an engine.
- Outline the procedure for testing the primary fuel pressure and demonstrate if applicable.
- Outline the procedure for checking timing on an engine and perform a demonstration if applicable.
- Outline the procedure for testing injectors if applicable and perform a test.

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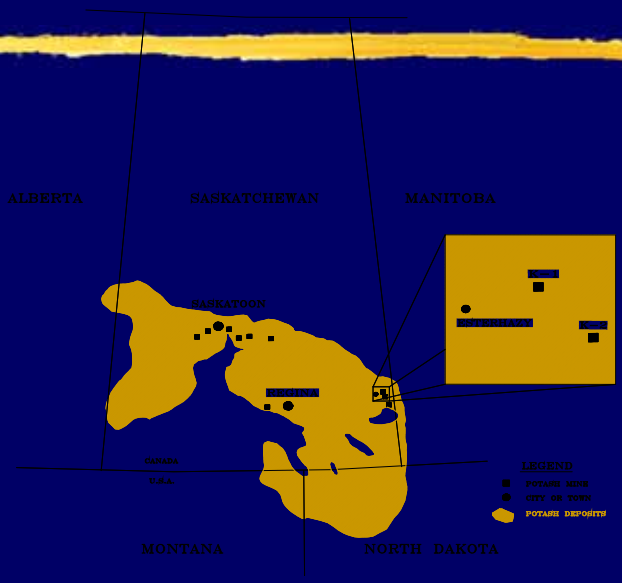
Break Down Of The Hands On Training:

- Perform a demonstration of a cooling system performance evaluation.
- Perform an air to air cooler performance evaluation if applicable.
- Perform an assessment of the fuel storage and handling facilities.

SASKATCHEWAN POTASH

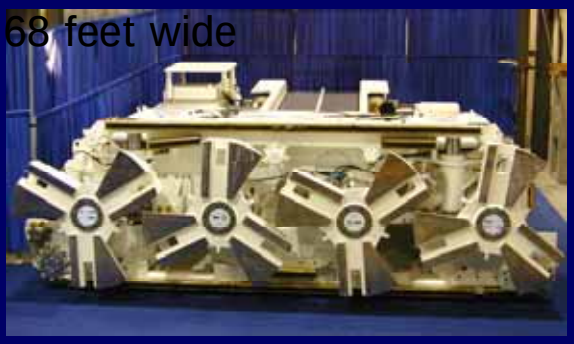


UNDERGROUND MINING

- 750 installed hp
- 7 pass, 65 feet wide
- 3000’ long rooms

UNDERGROUND MINING

- 1800 installed hp
- cut 3 passes, 68 feet wide
- 6000’ rooms



ESTERHAZY DIESEL FLEET

- Operate 190 diesel vehicles
- Average horsepower rating - 100 HP
- Mostly service vehicles rated at 80 to 130 HP
- Small scoops
  - ST 2, 913
- Cranes, scissor lifts
- Tramming units

UNDERGROUND AIR QUALITY

- DPM from early 90's - 0.14 to 0.30 mg/m^3
- Carbon dioxide - 500 to 700 ppm
- Carbon monoxide - 4 to 10 ppm
- Soot in recent sampling:
  - 0.070 to 0.300 mg/m^3 TC
  - 0.004 to 0.190 mg/m^3 EC
- Carbon dioxide - 500 to 600 ppm
- Carbon monoxide - ND to 3 ppm
- Nitrogen dioxide - ND to 0.7 ppm

EMISSION REDUCTION

- New technology - DDEC equipped engines
- Re-power with more efficient engines - 700 D
- Substi r

EMISSION REDUCTION

- Diesel soot traps - limited by diesel operating conditions

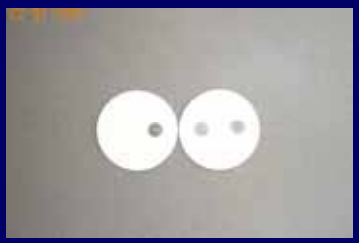
- IMPROVE Maintenance
  - Adopt 6 point engine system

TECH TRANSFER PROGRESS

- Classroom and hands-on training
- ECOM America UGas exhaust gas analyzers
- Magnehelic gauges
- Using analyzer at K1 Mine
- Second analyzer to K2 Mine
- Networked single database

CASE STUDY Series 53 DD

- 53 Series Detroit, 195 hp, 2-stroke with mechanical injection
- Intake resistance - 28” to 8”
- Cat Converter - cleaned
- New injectors
- Set valves
- Reduced NO ~ 40%
  - 960 to 600 ppm
- Reduced NOx ~ 35%
  - 1000 to 650 ppm
- Reduced smoke - 9 to 6
- Significantly more power



CASE STUDY F4L912 Deutz

- F4L912 Deutz, mechanical injection

- Intake/Exhaust - no restriction
- New injectors
- Valves adjusted
- Cat converter - refurbished

- CO reduced 65% - 310 to 110 ppm
- NOx reduced 75% - 1140 to 280 ppm

CASE STUDY F6L912 Deutz

- F6L912 Deutz, mechanical injection

- Leaky air box
- Valves adjusted
- Fuel injection timing adjusted

- CO reduced 50% - 140 to 70 ppm
- NOx reduced 50% - 800 to 415 ppm
- Snap acceleration smoke reduced ~ 50%
- Smoke reduced from >9 to 8

SUMMARY

- Tech transfer was successful
- Equipment easy to use
- Culture changing – mechanics monitor improvements
- Database undergoing changes
- Supportive senior management

IMC

IMC Potash

Esterhazy