Emissions-Based Diesel Engine Maintenance Reducing Worker Exposure to Diesel Emissions

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Overview

- **History behind emissions-based maintenance (EBM)**

- **Mining diesel engines**

  ➢ **Operations and maintenance issues**

- **EBM in global mining**

  ➢ **Implementation and results**

- **Implementing EBM – Challenges and realities**

History of EBM – Global Mining

The Effects of Maintenance and Time-In-Service on Diesel Engine Exhaust Systems

R. Waytulonis, United States Bureau of Mines, 1992

- **Older Deutz and Caterpillar mechanically injected engines**

- **Laboratory and in-mine study**

- **CO, HC and DPM significant increase beyond 4,000 hrs operating**

- **Failure modes – intake system and fuel injection system**

- **Lab simulated faults – no mine in-use testing**

History of EBM – Global Mining

The Relationship Between Diesel Engine Maintenance and Exhaust Emissions

S. McGinn, Diesel Emissions Evaluation Program (DEEP), 2000

- **Six month in-mine field study**

- **In-use field emissions testing system**

- **Baseline > Improved maintenance**

  - **Emissions reductions 65% gases and 55% DPM**

- **Six-System diesel engine maintenance system**

History of EBM – Global Mining

The Role of Emissions Based Maintenance to Reduce Diesel Exhaust Emissions, Worker Exposure and Fuel Consumption

Jennifer Hines, University of Wollongong Thesis Collection, 2019

- **Coal industry in-mine studies**

- **Field testing instruments for gases and DPM**

- **Reductions in worker exposure to EC and reduced fuel consumption**

  - **Up to 33% reduction in EC – up to 20% reduction in fuel consumption**

- **"Emissions testing and associated maintenance should be implemented at any mine which operates diesel vehicles underground"**

Mining Diesel Engines

"You don't control what you don't measure"

In-Use Emissions Testing Instrumentation

Gas Emissions   **Particulate Emissions**

O_2, CO, CO_2, NO, NO_2, NOx Elemental Carbon - EC

Mining Diesel Engines

Six-System Diesel Engine Maintenance

- **Engine specific PMs**
- **Quantified results**
- **Emissions**
- **Power-pressures-temps**
- **Measure-Measure-Measure**
- **Baseline and control**

1. **INTAKE**

2. **EXHAUST**

3. **FUEL INJECTION**

4. **COOLING**

5. **LUBRICATION**

6. **ECM & CONTROLS**

EBM in Global Mining

Real World Example #1

Sample Report

Date / Time: 26/05/2014 1:39:41 PM   Vehicle: DEMO VEHICLE
User Name: SMCGINN   Fuel: Diesel
Test Location: Inlet DOC   RPM: 1664
Sample Duration: 1
Comment:

		Sample Value	Target Value
SMOKE		7	8
O2	%	9.7	12
CO	PPM	84.3	150
NO	PPM	1225.7	900
NO2	PPM	58.2	50
CO2	%	8.3	7
T.GAS	c	777.3	700
MEQI		71.8	50
NOx	PPM	1283.9	950

Sample Report

Date / Time: 26/05/2014 1:49:45 PM   Vehicle: DEMO VEHICLE
User Name: SMCGINN   Fuel: Diesel
Test Location: Outlet DOC   RPM: 1664
Sample Duration: 1
Comment: CI-L03 second test after doc

		Sample Value	Target Value
O2	%	10.1	12
CO	PPM	4	150
NO	PPM	1020.7	900
NO2	PPM	154	50
CO2	%	8	7
T.GAS	c	583.8	700
MEQI		92.3	50
NOx	PPM	1174.7	950

EBM in Global Mining

Real World Example #2

Implementing EBM

Challenges and Realities

- **Change is painful – go for the** [silver bullet] **instead …. It's only** [image]

- **Real world example #1 long term explanation**

- **DEEP project long term explanation**

- **Real world example #2 long term explanation**

Questions?

Thank you!