Diesel Emission Management Plan
“Our Journey and recommendation”

Jeanot Tourneur

Safety first. Safety foremost.
Company history – an established track record of success

In over 25 years, Barmiino has grown from a domestic contract miner servicing junior and mid-tier clients, to an Underground hard-rock mining specialist servicing some of the world’s largest mining companies globally.

1989
- Awarded first total underground mine services contract and commenced Diamond Drill division.

1995
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2003
- Acquired concrete and crushing business.

2007
- Awarded single largest contract in Barmiino’s history at AngloGold Ashanti’s Australia’s Sunrise Dam gold mine.

2011
- June: Sunrise Dam gold mine recognized as Best Safety Performer in AngloGold Ashanti-Gold, registering 940 consecutive days LTI-free.
- December: Named as preferred tenderer for mine development and production at Sirius Resources’ Nova nickel project. Also, named as preferred tenderer for the batch plant at the project.
- May: Achieved a world record of 700 km development metres, with one jumbo, in one month at Dugald River Mine.

2013
- Gold Fields, Angelina Mine
- Gold Fields, Barra
- Gold Fields, Welcome
- AngloGold Ashanti, Loxton Park
- Northern Star, Auracie
- Northern Star, Ballarat
- Aurora Minerals, Merivale
- MMG, Aloy
- MMG, Jorgensen Avenue
- MMG, Aloy

Operations spanning Australia and Africa

90% of revenue derived from Australia, excluding AUMS

Diesel Emission Management Plan

Revenue by Commodity
- Gold: 40%
- Zinc: 10%
- Copper: 30%
- Nickel: 10%
- Other: 10%

Legend
- Project Type
  - Mining
  - Uranium
  - Titanium
  - Nickel

Diesel Emission Management Plan
Primary focus of Barminco’s strategy

- Minimise workplace employee exposures
- Meet statutory requirements

Guidelines and recommendations

- Management of Diesel Engine Pollutants in underground environments (MDG 29) – New South Wales Department of Primary Industries
- Management of Diesel emissions in Western Australian mining operations – Department of Mines and Petroleum
- Guidance note for management of diesel engine exhaust in metalliferous mines (QGN21) - Queensland
- Environment Protection Authority (EPA) of Tasmania
Emission analysis

- Raw exhaust testing using a DustTrak
- Same truck fleet
- Same testing methodology
- @1000 hrs.
- No trend

Project: Dugald River

- Raw exhaust testing using a MAHA MPM
- DPF fitted
- Same testing methodology
- ± 300% variance
- No maintenance intervention
- Inconsistency similar to the DustTrak unit
Accuracy and repeatability

• A solid measurement system requires two sides to be complete:
  repeatability and reliability as well as accuracy and precision
• The Australian MDG29 suggest you establish a baseline then act for a result that is 30% over the base.

Consultant recommendation

• Dugald River management plan uses the 15% and 30% action points as recommended in MDG29.
• NIOSH 5040 test standard
• Sunrise laboratory - USA
What does this mean?

- The emission of a diesel machine does vary significantly over time (hence MDG29 control levels are wrong)

OR

- There is something wrong with our testing methodology.

Our emission management plan

- Continual Improvement Approach
- 95% Upper Confidence Limit (UCL) to determine outlying engines - over the first 6 months (estimated)
- MDG 29 guideline
- Integrate DPM as a preventive maintenance tool
Diesel particulate filter history

- 2010 – approx. 3 for R&D
- 2013 – 9
- 2014 – 39
- 2015 – 18

Total spent to date $2.2 million

Emissions based maintenance - SIX SYSTEMS

1. INTAKE

2. EXHAUST

3. FUEL INJECTION
Emissions based maintenance- SIX SYSTEMS

1. COOLING

2. LUBRICATION

3. Electronic Control Management & CONTROLS

Diesel emissions instruments

ECOM EN2-F

Diesel ChekMate®
Diesel emissions instruments

Diesel ChekMate®
- Sampling and conditioning device
- Mixing and cooling system

DEEM6S

Implementation

- Baseline values
- Target Values (TV)
- Compare test measurements against target values
- Individual emission analysis
- Look for interactions
Servicing of DPFs

• Filtration efficiency
• Backpressure
• Leaks
• Cleaning regime

Documentation

• Standard
• Procedure
• Safe Work Instruction (SWI)
  – Machine modification
  – Back pressure monitoring system
  – Testing equipment methodology
  – Stall test
Regulations - DPM

- Ontario – 0.4 mg/m³ (NIOSH 5040 TC)
- U.S. MSHA – 0.16 mg/m³ (NIOSH 5040 TC)
- Western Australia – 0.10 mg/m³ (NIOSH 5040 EC)
- What is the prediction for the future?

THANK YOU

QUESTIONS