



Goldcorp - Porcupine Gold Mines Retrofit DPF Implementation at Hoyle Pond Mine

MDEC Conference 2018 – Patrick Lessard, Steve Levesque, Lindsay Harvey

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Hoyle Pond Mine

- In the heart of historic Porcupine gold mining district
- Timmins, Ontario
- 1,200 TPD underground operation
- In operation since 1987
- 2018 Goldcorp corporate objective – 20% DPM reduction

Overview

- Emissions testing and engine maintenance
- Retrofit DPF technologies
- DPF support systems
- Performance Results
- DPM sampling results

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Emissions Testing and Maintenance

- Ecom analyzer with DEEMS interface
- Planned and scheduled intervals
- Engine condition monitoring and maintenance intervention

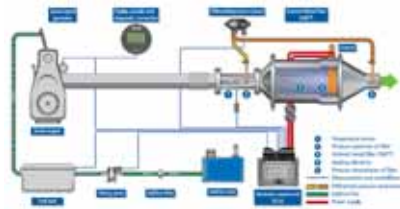


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DPF Technologies

- CAT Partial Flow Filter - passive
- TF Hudgins Stratus – active sintered metal DPF
- Clariant Envicat – passive catalyzed Cordierite DPF



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DPF Support Systems

- CDTi (ECS) Exhaust Monitor Logger
 - Rugged and simple
 - Monitors – alarms – logs exhaust temp and backpressure
- DPF Cleaning and Spare Parts
 - DM Filter Services, Newmarket, ON
 - Former ECS CDTi group with UG mining experience



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Fleet DPFs - Current

MACHINE	TYPE	MODEL	DPF
428	Truck	AD30	Clariant Envicat
429	Truck	AD30	Clariant Envicat
432	Truck	AD30	Clariant Envicat
568	Scoop	R1600	Clariant Envicat
574	Scoop	R1600	Clariant Envicat
575	Scoop	R1600	Clariant Envicat
576	Scoop	R1600	Clariant Envicat
565	Scoop	EJC210	Clariant Envicat
542	Scoop	R1300	TF Hudgins Stratus
545	Scoop	R1300	TF Hudgins Stratus
733	Pickup	Toyota	Clariant Envicat

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Fleet DPFs – Additions By Year End

UNITS	TYPE	MODEL	DPF
2	Truck	AD30	Clariant Envicat
2	Scoop	R1600	Clariant Envicat
1	Scoop	LH410	Mammoth
1	Scoop	LH514	Mammoth
1	Scoop	LH307	Clariant Envicat
1	Scoop	RDH 300	Clariant Envicat
1	Support	Minecat	Clariant Envicat
1	Support	Boomtruck	Clariant Envicat

Note: All haul trucks and 90% of scoops (HP) equipped with DPFs end of 2018

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CAT Partial Flow DPF



- No added maintenance
- No backpressure concerns
- Simple retrofit effort
- No reliability issues



- Low DPM filtration efficiency
- More DOC than DPF

TF Hudgins Stratus DPF



- Good DPM filtration efficiency
- Simple cleaning – in house
- Low backpressure



- System complexity – active regen
- Reliability issues
- High maintenance effort

Clariant Envicat



- High DPM filtration efficiency
- Superior gas performance
 - CO and NO₂
- Low backpressure
- Passive regen performance

- DPF cleaning logistics
- Added maintenance
- Retrofit kitting

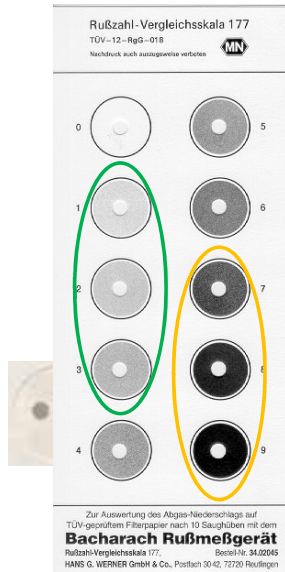
Performance Results – Emissions

Objectives

- DPM reduction – Smoke # < 4
- CO reduction > 75%
- NO₂ = 50 ppm

		Sample Value	Target Value
SMOKE		3	8
O2	%	10.2	12
CO	PPM	0	200
NO	PPM	395.7	600
NO2	PPM	47.6	50
CO2	%	7.9	7
T.GAS	F	607.5	750
MEQI		31.7	50
NOx	PPM	443.2	

Performance Results – DPM Emissions

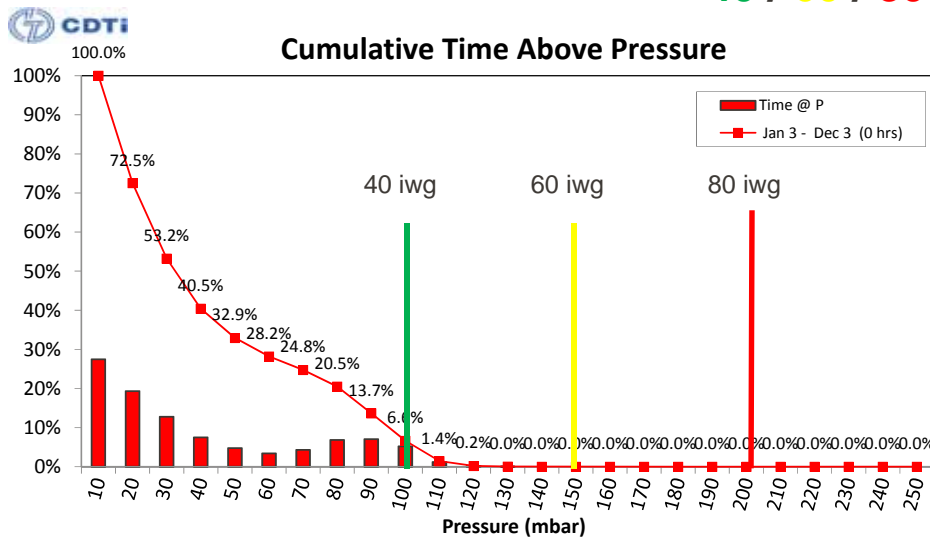


DPF Outlet Smoke Number Results

- █ Ceramic Cordierite / Sintered Metal
- █ Partial Flow Through

Performance Results - Backpressure

40 / 60 / 80 iwg Rule

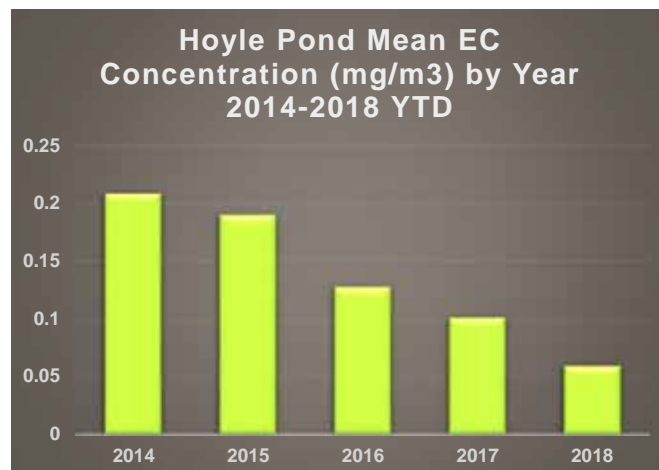


Performance Results – Passive Regen

Objective - < 80 iwg backpressure 500 hr cleaning

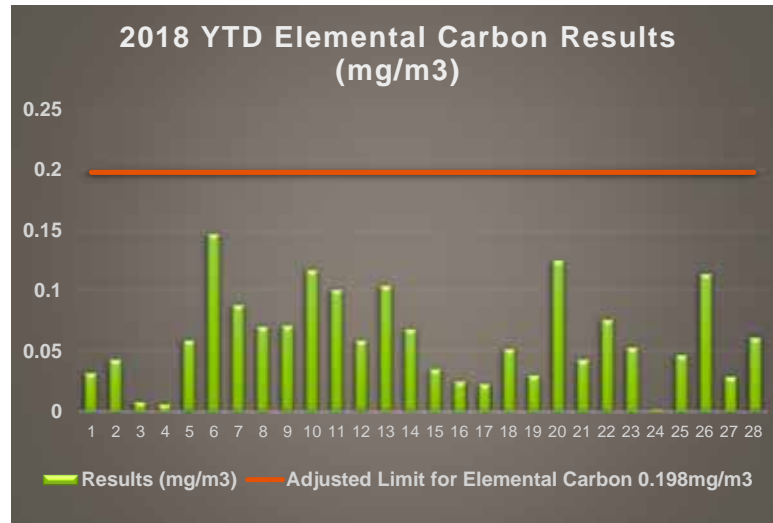
- AD30 trucks duty cycle – > 320-340C exhaust temp @ 30%
- Scoops duty cycle - > 380-400C exhaust temp @ 30%
- DPF cleaning interval – between 500 to 800 hours
- Backpressure consistent 40-50 iwg maximum (Logger / Magnehelic)
- Plan extending to 1000 hour interval

DPM (EC) Mean Concentration



Note: Reductions include ventilation improvements

DPM (EC) Mean Concentration YTD



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Summary

- Emissions testing / maintenance + DPFs have greatly reduced DPM
- Passive wallflow monolith DPFs have proven most reliable and effective
- Operators specifically request the DPF equipped scoops and trucks
- Overall maintenance impact is manageable and still improving
- Expand DPFs to more of the fleet
- Improved install kits – extended cleaning cycles – component management

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Safe Enough for our Families



Thank You!