Systems for the reduction of Combustion Generated Nanoparticles in Heavy Plant Machinery

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Systems for the reduction of Combustion Generated nanoparticles in mines

PROBLEMS

•Diesel Particulate Matter (DMP) is a major concern in mining industry.

• In 2012 IARC (International Agency for Research on Cancer) classified diesel engine exhaust as a group 1 human carcinogen (IARC, 2012).

•An specific limit value of 0,05 mg/m^3 measured as elemental carbon that will be in effect in 2026 for the mining industry in Europe.

•Diesel engine exhaust is a primary source of submicron (particles with diameter < 1 mm) mine aerosol (Cantrel et al., 1993).

SOLUTIONS

• **Replace diesel engines for electric-powered systems. (Not always possible)**
•**Install emission control systems in the heavy plant machinery.**

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Objectives

The main goal of this poster is to assess diesel particulate matter reduction after the installation of an emission control system (Proventia NOx Buster and Purifilter), which is based in a combination of Diesel Particulate Filter (DPF) and Selective Catalytic Reduction (SCR) technologies for emissions reduction in heavy diesel plant machinery.

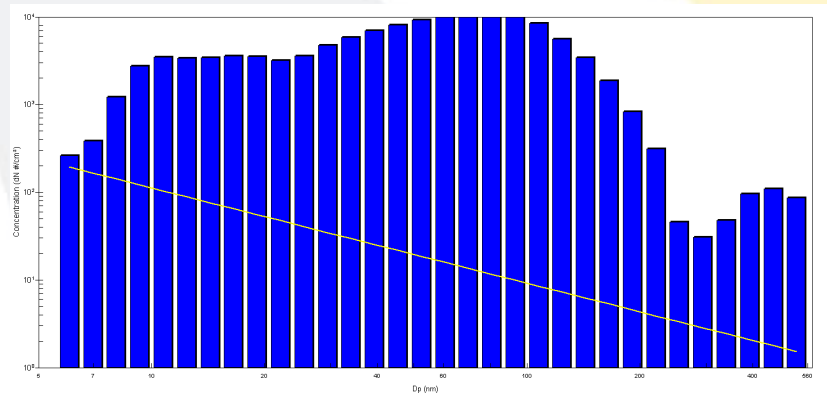Proventia NOx Buster and Purifilter

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Materials & methods

- Engine Exhaust Particle Sizer EEPS-3090 (TSI).

- Rotating Disk Thermodiluter 379020A

From 5.6 to 560 nm resolution available (10 Hz).
32 size chanels

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Sampling procedure:

Out side de mine the lorry fully loaded with mineral

Start to minute 1 - Truck idling.
Minute 1 to 2 - Truck accelerated at 3000 rpm.
Minute 2 to 3.5 - truck idling.
Minute 3.5 to 4 - Truck accelerated at 3000 rpm.
Over minute 4 - Truck idling.

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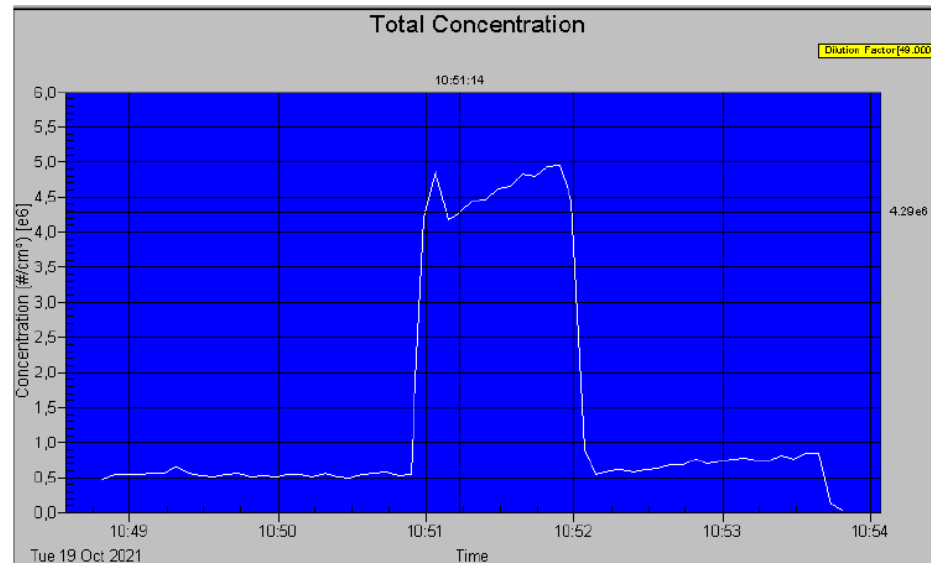
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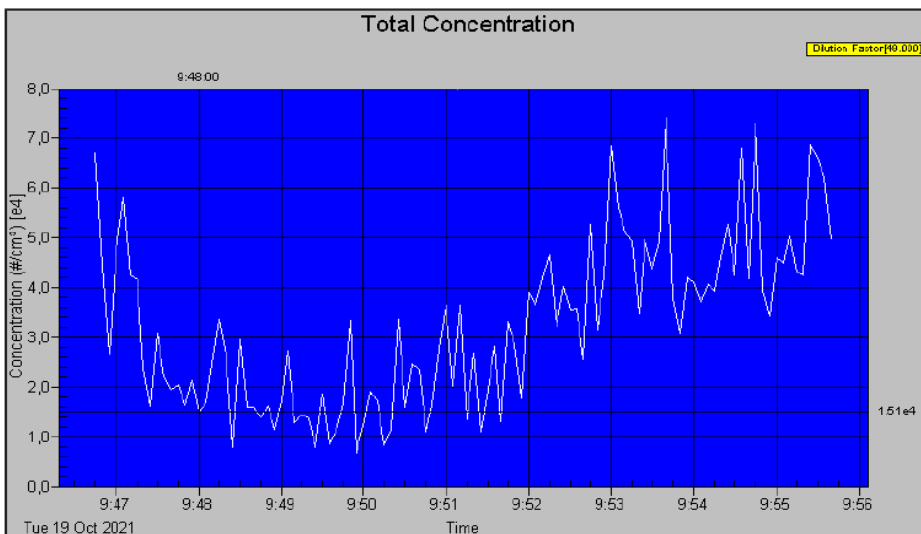

Volvo BM A20 without system

Idling: 500.000 nanoparticles /cm^3
Acelerate: 4.500.000 nanoparticles /cm^3

Volvo BM A20 With PROVENTIA NOx Buster

Average: 40.000 nanoparticles /cm^3

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Result:

| Plant machinery	Year	System	Dilution Factor	Nanoparticles concentration (nanoparticles/cm³)	Engine Speed
Volvo BM A20-nº6	2001	----	49	500.000	Idling
Volvo BM A20-nº6	2001	----	49	4.500.000	Acelerate
Volvo BM A20-nº7	1990	PROVENTIA NOxBuster	49	40.000	Idling
Volvo BM A20-nº2	1990	PROVENTIA NOxBuster	49	75.000	Idling and acelerate
Volvo BM A20-nº2	1990	PROVENTIA NOxBuster	49	50.000	Idling and acelerate
Volvo BM A20-nº3	1991	Purifilter	49	60.000	Idling
Volvo BM A20-nº3	1991	Purifilter	49	1.000.000	Acelerate
Volvo BM A20-nº5	1988	Purifilter	49	56.000	Idling
Volvo BM A20-nº5	1988	Purifilter	49	100.000	Acelerate

Table 1: Nanoparticles emissions in heavy plant machinery

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Conclusion:

- Results show that the systems based on a combination of Diesel Particulate Filter (DPF) and Selective Catalytic Reduction (SCR) technologies are an alternative way to reduce DPM in the underground mining industry,

- More research needs to be carried out to verify if this emission reduction is enough.
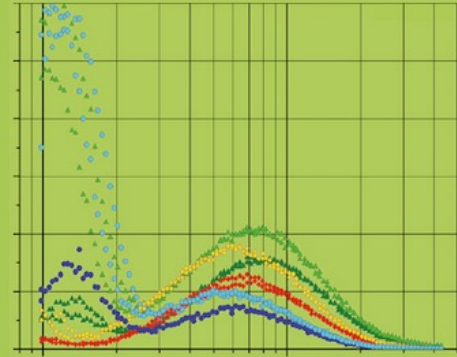
Thanks for your attention

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