Reduced environmental impact and promote safety during blasting – RENIS

Project leader
Nikos Petropoulos, LTU

Partners
Forcit, Kimit LKAB, New Boliden

Project duration
03-2022 – 06-2023 (on-going due to delays)

SWEDISH MINING INNOVATION

Med stöd från
VINNOVA Sveriges innovationsmyndighet
Energimyndigheten
FORMAS
Strategiska innovationsprogram

Goals of the project

The aim of this study is to test various recipes of civil emulsion explosives to investigate the production of carbon monoxide (CO), carbon dioxide (CO_2), nitrogen monoxide (NO) and nitrogen dioxide (NO_2) during the detonation of their detonation. To further increase the knowledge of the influence of different additives for example Ammonium nitrate prills in various percentages. In addition, the effect of the water hammer effect on the detonators as formed by the detonation of the emulsion explosives.

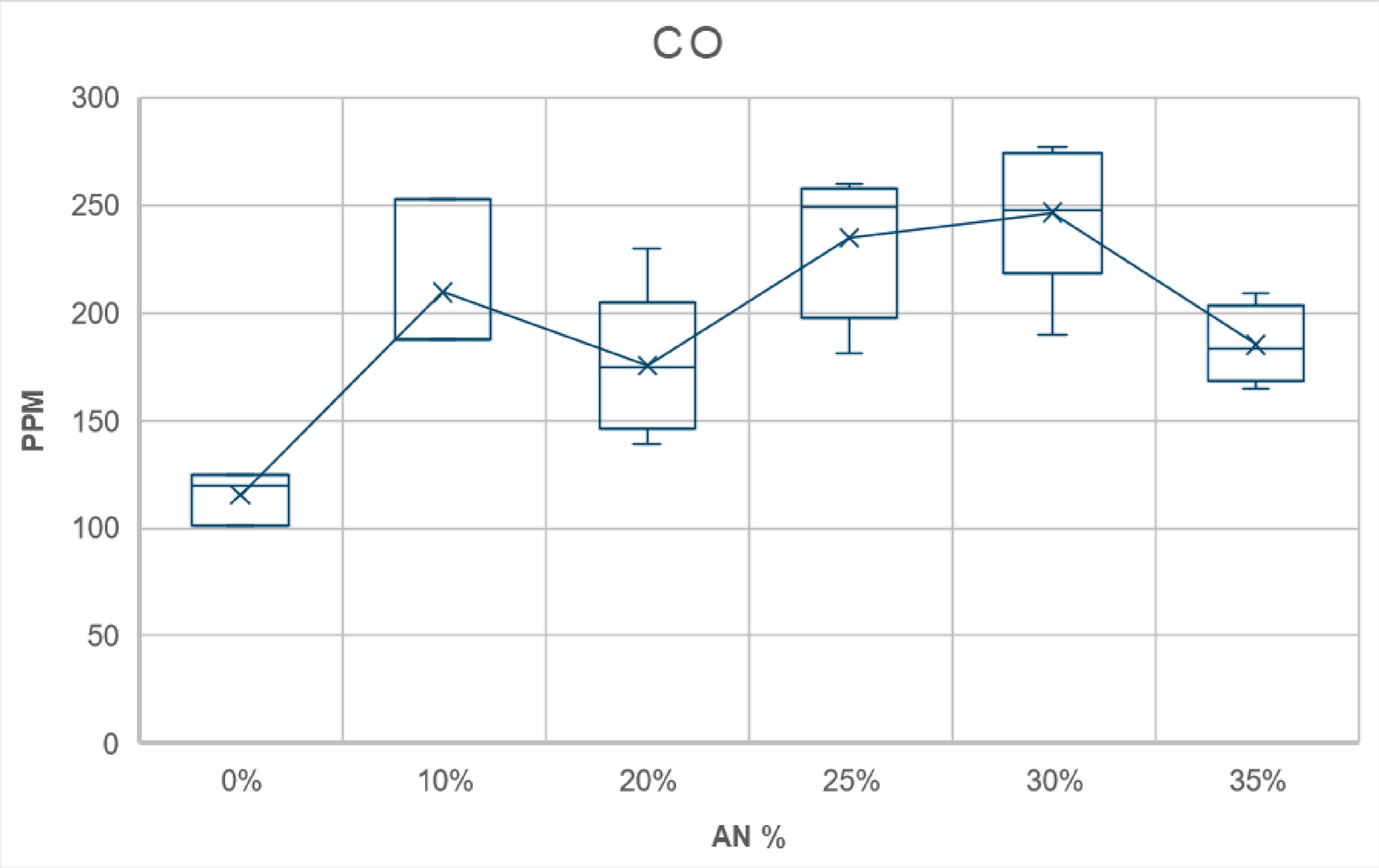
Med stöd från
VINNOVA Sveriges innovationsmyndighet
Energimyndigheten
FORMAS
Strategiska innovations-program

Results so far

Test	Type of Explosive	Confiner	File	Date	T. Air
T1	E682	Magnetic mortar Ø50 mm	-68	5-Dec	0
T2	E682	Magnetic mortar Ø50 mm	-69	5-Dec	0
T3	E682	Magnetic mortar Ø50 mm	-70	6-Dec	-1
T1	E682+ 10% AN	Magnetic mortar Ø50 mm	-71	6-Dec	1
T2	E682+ 10% AN	Magnetic mortar Ø50 mm	-72	6-Dec	-1
T3	E682+ 10% AN	Magnetic mortar Ø50 mm	-73	7-Dec	-4
T1	E682+ 20% AN	Magnetic mortar Ø50 mm	-41	30-May	16
T2	E682+ 20% AN	Magnetic mortar Ø50 mm	-42	31-May	15 (rainy)
T3	E682+ 20% AN	Magnetic mortar Ø50 mm	-45	31-May	17 (rainy)
T4	E682+ 20% AN	Magnetic mortar Ø50 mm	-58	06-Jul	23
T5	E682+ 20% AN	Magnetic mortar Ø50 mm	-64	08-Jul	28
T1	E682+ 25% AN	Magnetic mortar Ø50 mm	-59	07-Jul	16
T2	E682+ 25% AN	Magnetic mortar Ø50 mm	-60	07-Jul	18
T3	E682+ 25% AN	Magnetic mortar Ø50 mm	-61	07-Jul	16 (rainy)
T4	E682+ 25% AN	Magnetic mortar Ø50 mm	-63	07-Jul	16 (rainy)
T1	E682+ 30% AN	Magnetic mortar Ø50 mm	-54	05-Jul	22
T2	E682+ 30% AN	Magnetic mortar Ø50 mm	-55	05-Jul	23
T3	E682+ 30% AN	Magnetic mortar Ø50 mm	-56	06-Jul	32
T4	E682+ 30% AN	Magnetic mortar Ø50 mm	-57	06-Jul	24
T5	E682+ 30% AN	Magnetic mortar Ø50 mm	-65	08-Jul	25
T1	E682+ 35% AN	Magnetic mortar Ø50 mm	-74	7-Dec	-1
T2	E682+ 35% AN	Magnetic mortar Ø50 mm	-75	8-Dec	-7
T3	E682+ 35% AN	Magnetic mortar Ø50 mm	-77	8-Dec	-5
T4	E682+ 35% AN	Magnetic mortar Ø50 mm	-79	8-Dec	-6
T5	E682+ 35% AN	Magnetic mortar Ø60 mm	-81	9-Dec	-3

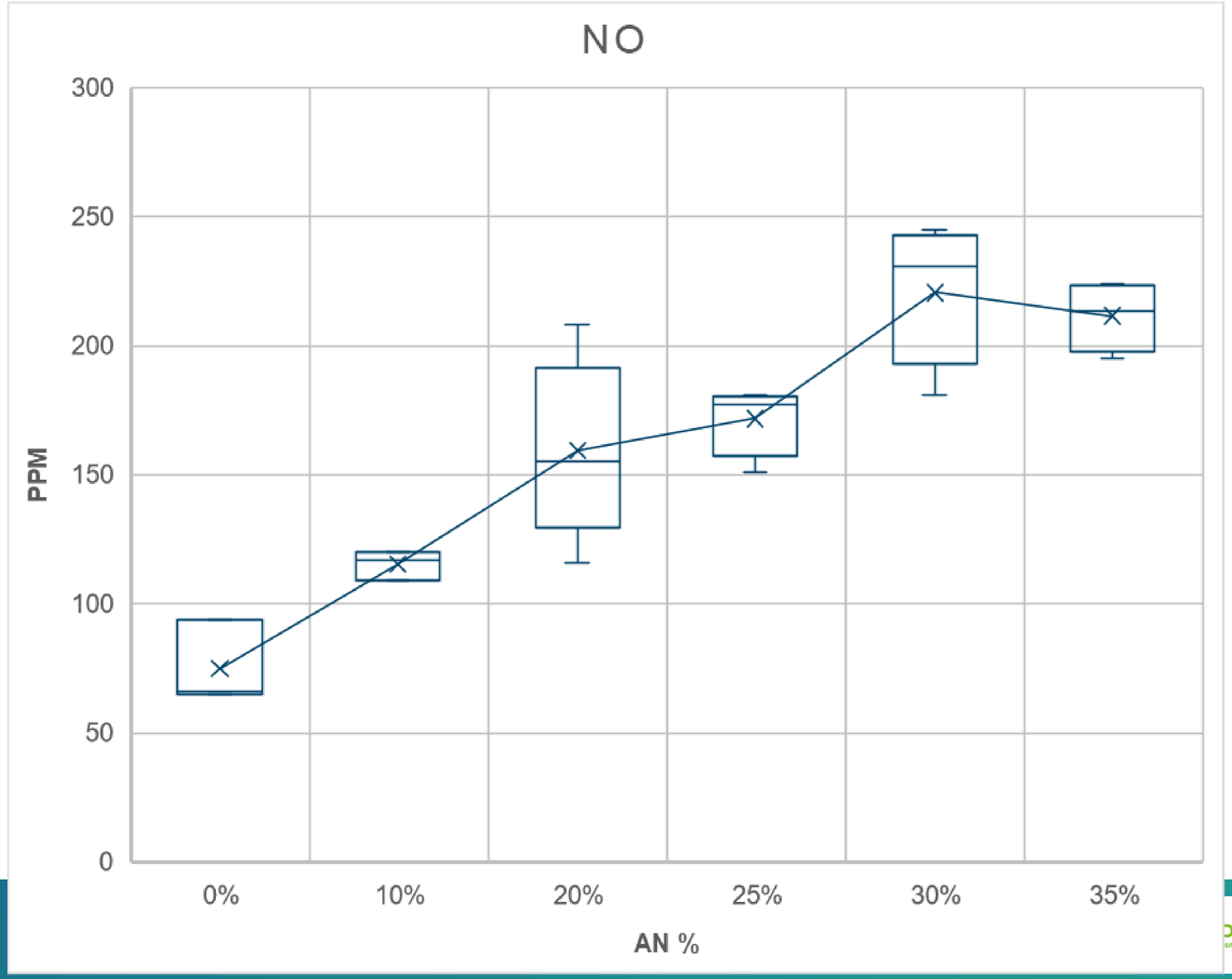
Med stöd från
VINNOVA Sveriges innovationsmyndighet
Energimyndigheten
FORMAS
Strategiska innovations-program

Results-Gas measurements AN prills

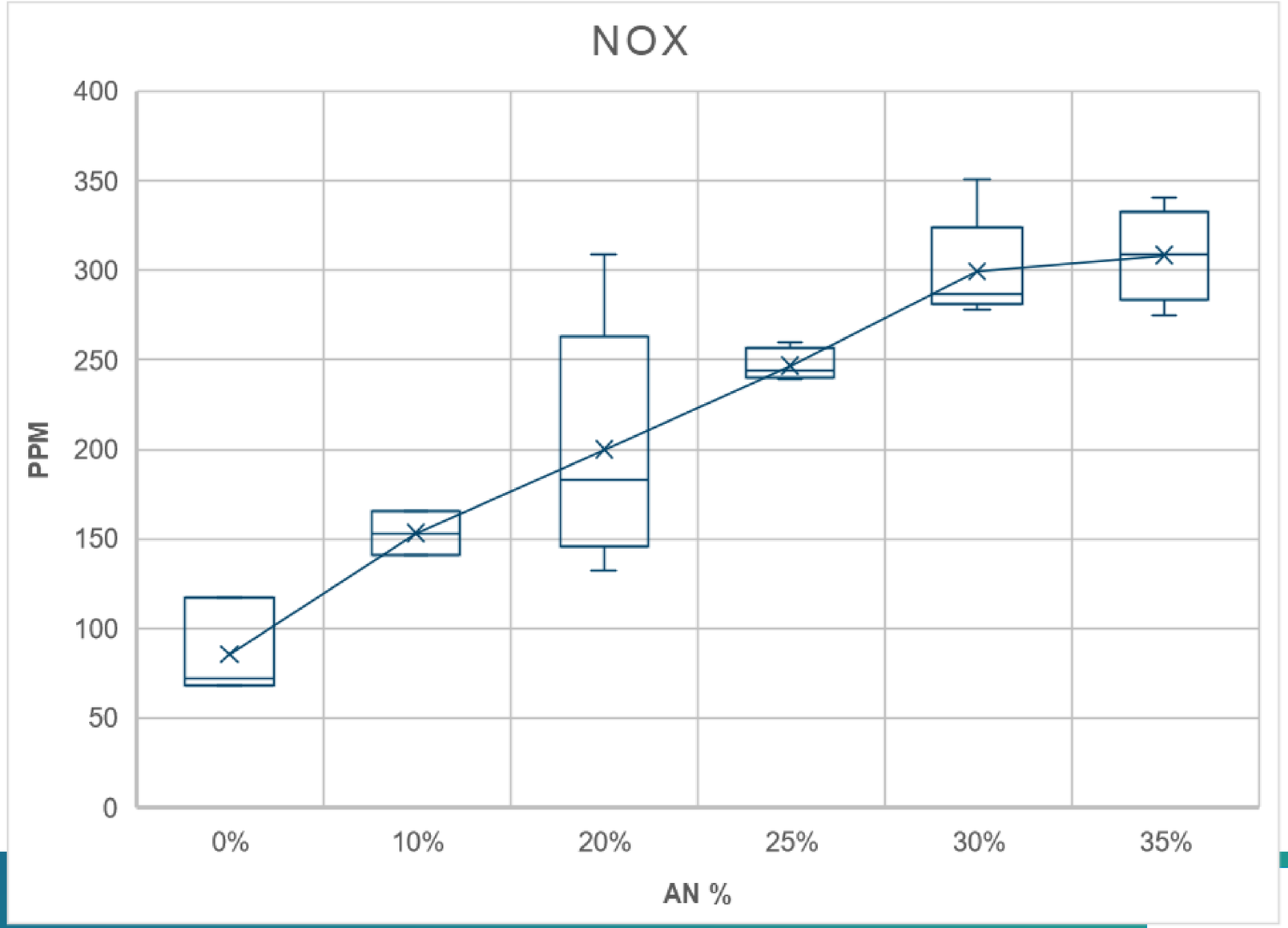


Med stöd från
VINNOVA Sveriges innovationsmyndighet
Energimyndigheten
FORMAS
Strategiska innovations-program

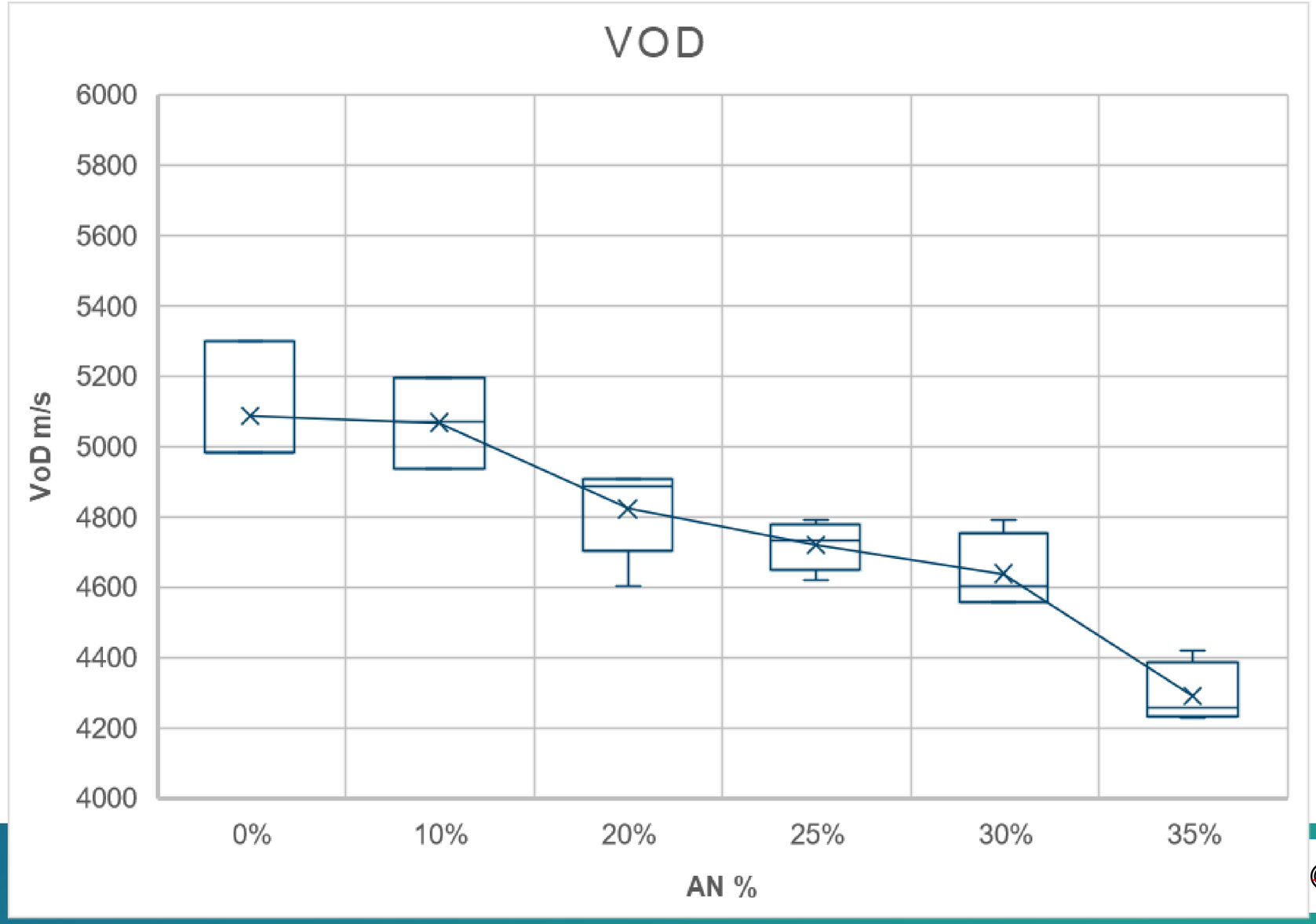
Results-Gas measurements AN prills



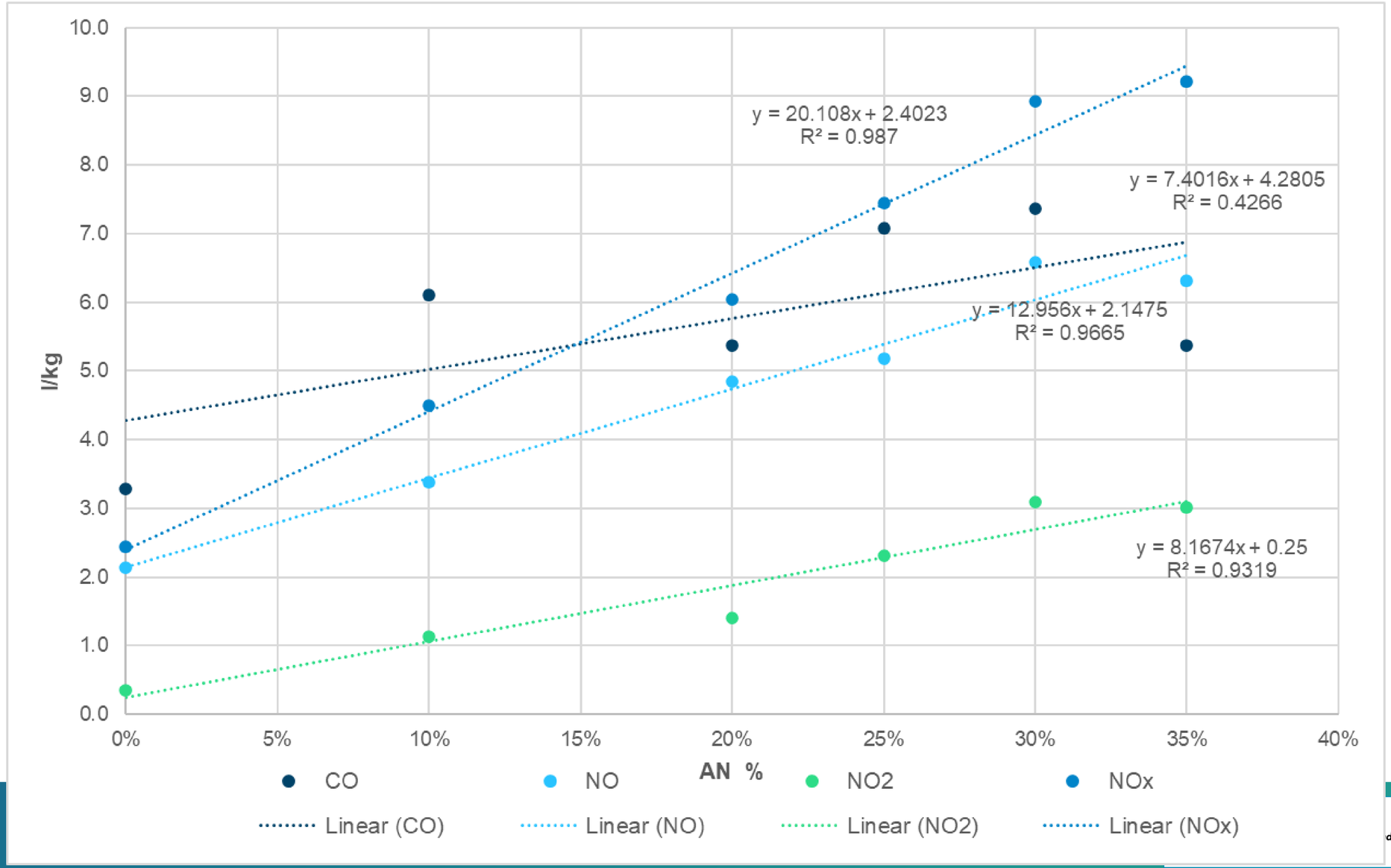
Results-Gas measurements AN prills



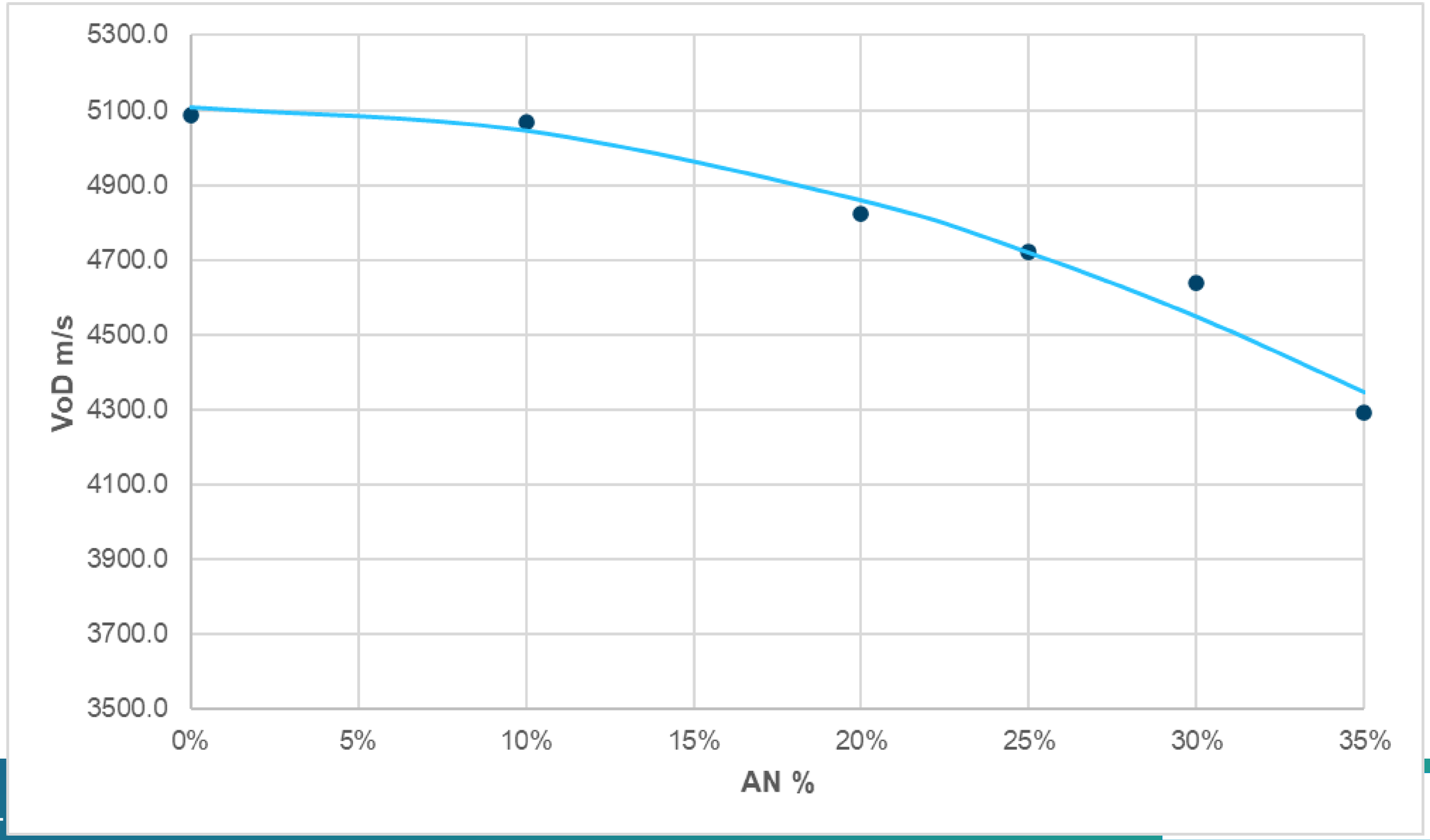
Results-Gas measurements AN prills



Results-Gas measurements AN prills



Results-Gas measurements AN prills



Publications

- Rodriguez San Miguel, C., Petropoulos, N., Stenman, U. & Johansson, D. (2024). The environmental impact of AN prills on emulsion explosives. In: Proceedings of the Fiftieth Annual Conference on Explosives and Blasting Technique: . Paper presented at ISEE 50th Annual Conference on Explosives and Blasting Technique, Savannah, GA, United States, January 25-27, 2024. International Society of Explosives Engineers

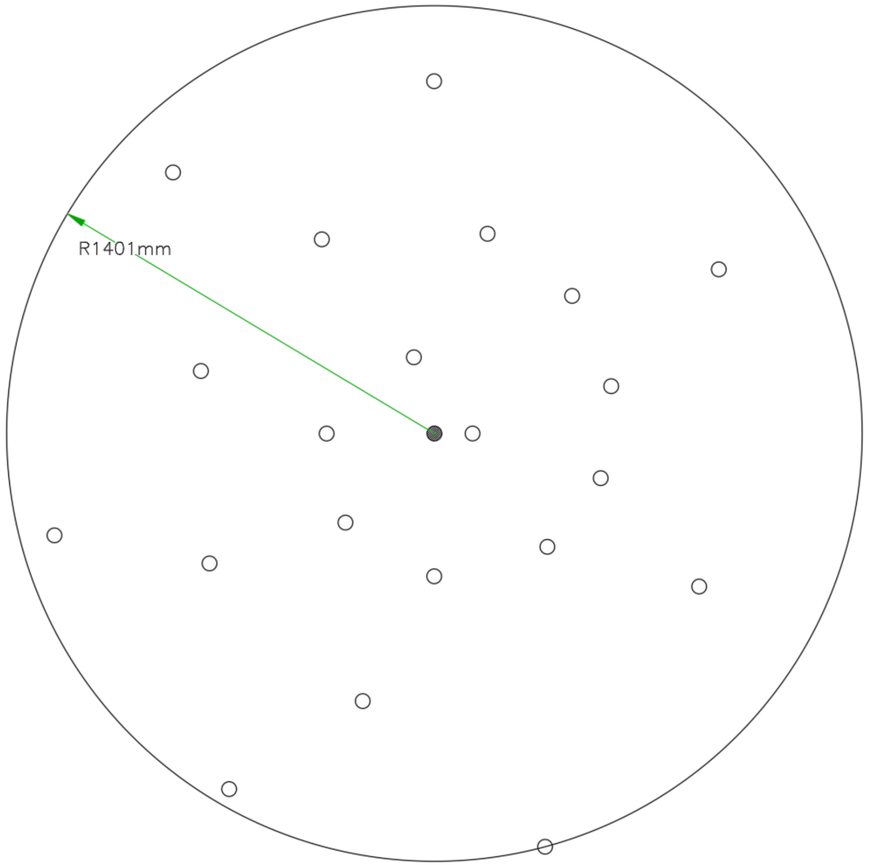
Upcoming activities and next step

WATER HAMMER EFFECT – On-going (severely delayed)

125-1400 mm distance from the blasthole

Measurements:
- **VoD**
- **Borehole stress/pressure measurement (inquiry has been submitted)**

Experimental setup:
- **Middle hole fully charged**
- **The boreholes around will be filled with matrix and all the type of detonators**



$$Distance\ [mm] = 0.0137 * radians - 1.7003$$

Med stöd från
VINNOVA Sveriges innovationsmyndighet
Energimyndigheten
FORMAS
Strategiska innovations-program

Mining innovation for a sustainable future

SWEDISH MINING INNOVATION

Med stöd från
VINNOVA Sveriges innovationsmyndighet
Energimyndigheten
FORMAS
Strategiska innovations-program