

Occupational Exposures, Monitoring and Control Initiatives in Swedish Mines

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**GRAMKO - Committee for Occupational Safety and
Health in Mining Operations**

MDEC 2001

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Metal Mines in Sweden

Members of the
Swedish Mining Association

- ▲ LKAB
- Boliden Mineral AB
- ★ Zinkgruvan Mining AB



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Ore Production Sweden 2000

Company	Production	Workforce	Turnover MSEK
LKAB (Fe)	20.6 Mt	2,574	4,742
Boliden Mineral AB (Cu, Pb, Zn, Au, Ag)	22.7 Mt	1,350	2,202
Zinkgruvan Mining AB (Zn, Pb, Ag)	733 Kt	339	515

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SWEDEN - A significant producer in EU

Metal	Share of EU's mine production 2000	Position
Iron	95 %	1:st
Silver	66 %	1:st
Lead	46 %	1:st
Copper	41 %	1:st
Zinc	26 %	3:rd (to Ireland and Spain)
Gold	20 %	3:rd (to Finland and France)

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Source:SGF


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Diesel Vehicles in Swedish Mines

Totally **1,182** diesel vehicles
including contractors vehicles

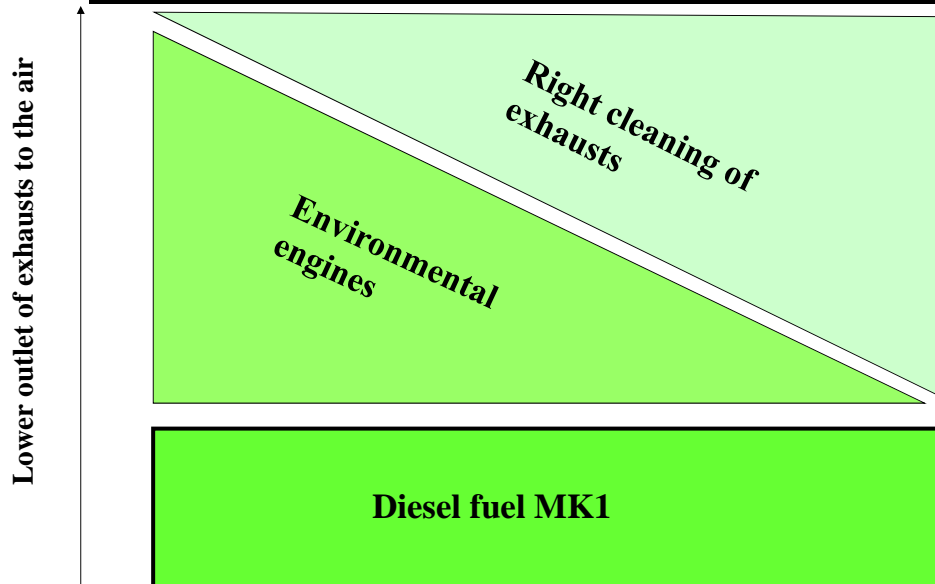
Light duty vehicles - **674 (57%)**

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Our conditions to minimise diesel exhausts



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Requirements on Diesel Fuel MK 1

(Swedish Standard SS 15 54 35 – 1993)

Sulphur (mass content)	max. 10 ppm
Aromatics (volume content)	max. 5 %
PAH (volume content)	max. 0.02 %
Flash point	min. 56 °C

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Ordinance on Rock Construction

(The Swedish National Board of Occupational Safety and Health)

Stipulate e.g. regular control of diesel exhaust gases – Soot/carbon and CO.

After max. 200 hours in operation.

Most mines – after 150 hours.

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Diesel Exhausts Action Programme 2001 - 2002

Objective:

The aim is to decrease the exposure of diesel exhausts within the mining industry by using best available technology.

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Diesel Exhausts Action Programme 2001 - 2002

- Particle filter on diesel vehicles under ground is recommended
- Reports on operational experiences from filter traps which is used today
- Occupational measurements in air
- Work-shop in June 2002
- Evaluation

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Currently we are monitoring.

- Health effects
- Fuels
- Engines and vehicles
- Cleaning technology
- Maintenance
- Ventilation

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Example

Guidelines

(1)

Particle filter on diesel vehicles in mines


New vehicles: Particle filter for highly productive equipment (e.g. LHD). The type of filter should not increase the level of NO₂.

Existing vehicles: Particle filter - if necessary, due to the situation. If you can't get satisfied air quality with other kind of measures (e.g. ventilation).

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Example	Guidelines	(2)
<i>Particle filter on diesel vehicles in mines</i>		
<u>Cabins:</u> Filter with active carbon or other components which reduces the level of gases in the air to the cabin should be installed, when possible. (Air-conditioning)		
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<i>Workshop in Luleå 29 maj 2001</i>		
<i>Exhaust gas filter systems for Diesel vehicles in the Mining Industry</i>		
<u>Aim:</u> Updating knowledge of exhaust gas cleaning devices available on the market. How to use the best available technology.		
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Type of particle filter in use

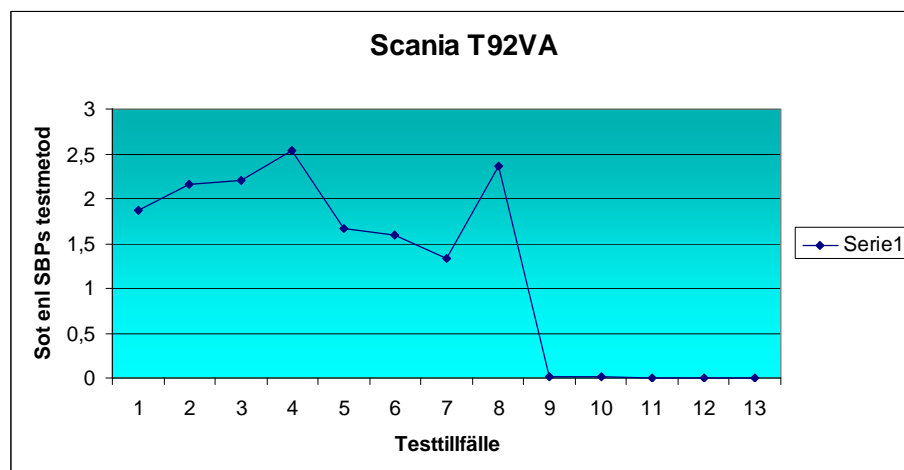
- **Unikat model K180** 9
- **Unikat kombifilter K18 (catalyst)** 1
- **Unikat CAT trap** 6
- **Unikat V18** 4
- **Unikat U135S** 1
- **Mine-X DQ 10A** 3
- **ECS ADD trap** 8
- **CRT (catalyst)** 8
- **EPC 007C (catalyst)** 1

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Effekt av avgasrening

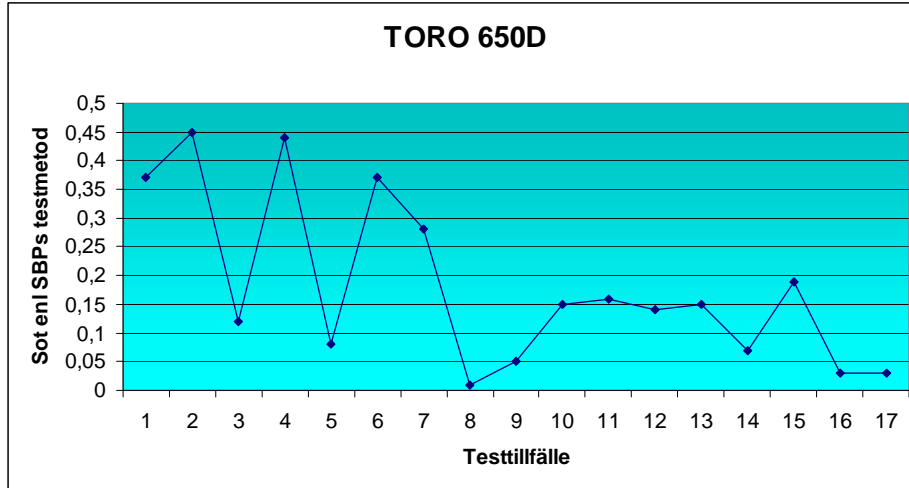


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Effekt av avgasrening



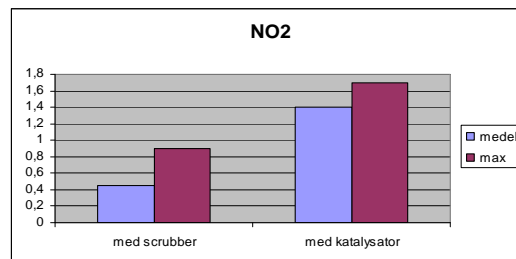
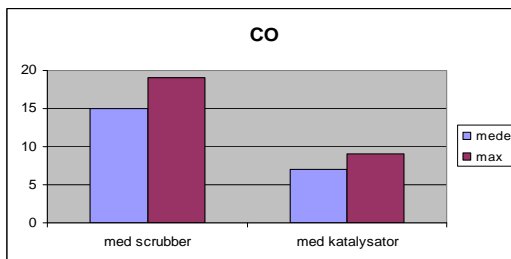
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Zinkgruvan Mining AB

Comparing measurements scrubber - catalyst

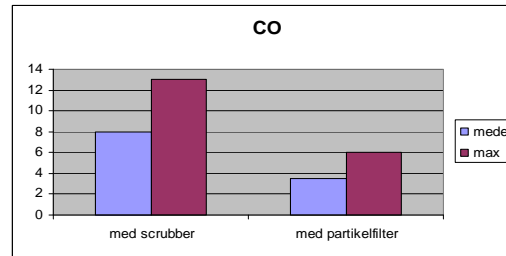
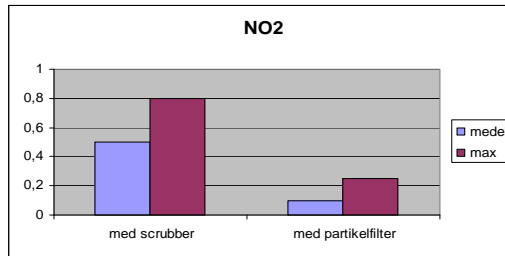


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Comparing measurements
scrubber - particle filter

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Some experiences from particle filters

- The miners feel a better air quality
- Too high levels of NO₂ when using oxidation catalysts
- Regeneration of filters - good handling and maintenance routines/instructions are needed
- Right and sufficient dimension on filter equipment
- Put demands on suppliers of mining equipment

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Occupational Exposure Limit Values

Exhaust gas	<u>Level Limit Value (8 hrs)</u>
Carbon dust	3 mg/m³
CO	20 ppm
CO₂	5000 ppm
NO₂	1 ppm
NO	25 ppm
SO₂	2 ppm

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Levels of exposure – average

Regularly measurements in the respiratory air

NO₂ 0.5 ppm (At loading – close to
1 ppm)

Dust 0.8 mg/m³
respirable

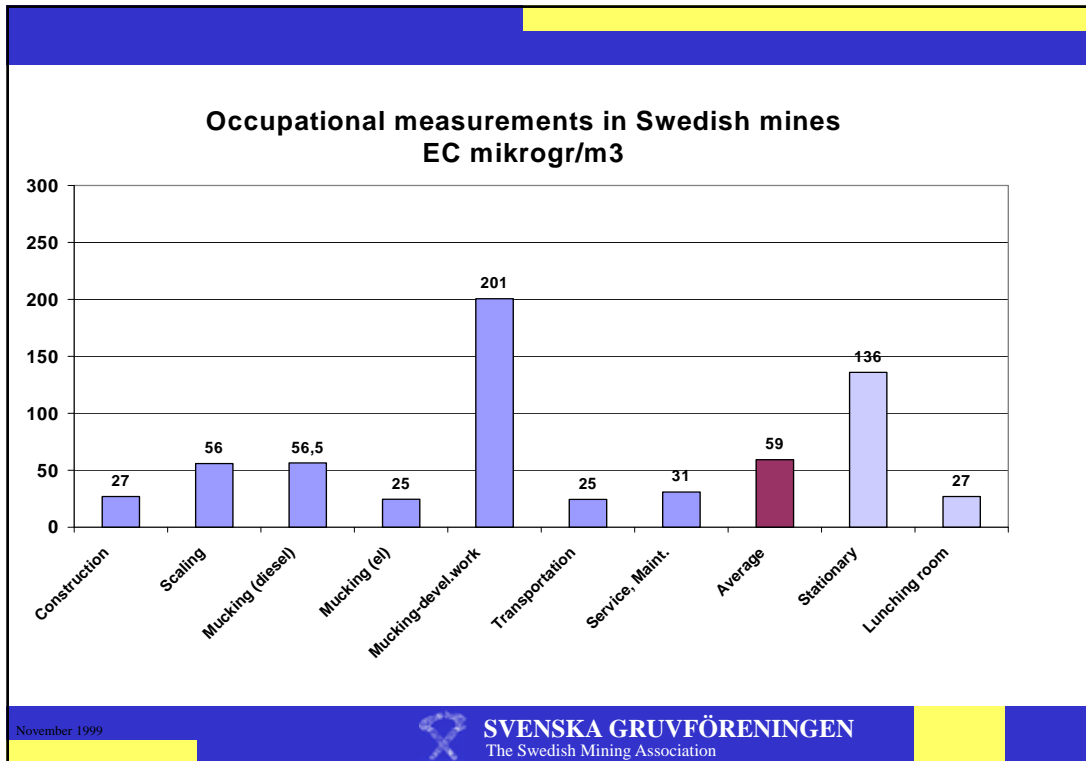
**Equipment for monitoring CO-levels in the
ambient air installed on many mobile
machines.**

At 25 ppm – go/drive out of the area!

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***Occupational measurements
on nitrogen dioxide, NO₂***


Example: Scoop tram (TORO), mucking

Inside cabin: 0.4 - 0.6 ppm

Outside cabin: 0.6 - 2.8 ppm

(Metrosonic, Willems badge)

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National and International Contacts

- **Sweden - Occupational Medicine, Work Life Institute, Motortest Center, Suppliers, Manufacturers.....**
- **Scandinavia - Norway, Finland**
- **Europe - Euromines, Eurometaux, SHCMOEI, VERT**
- **Canada, Ontario - OMA, MASHA, CANMET DEEP**
- **Australia - MineSafe International 2000**

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Efforts and Strategies so far

- **Diesel Fuel MK1 (low sulphur)**
- **Low emission engines**
- **Filter on machines with continuous operation**
- **Maintenance – regular control of exhausts on engines**
- **Ventilation – directing to working areas**
- **Measurements in respiratory air – air quality control**
- **Support to epidemiological studies on health effects**

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