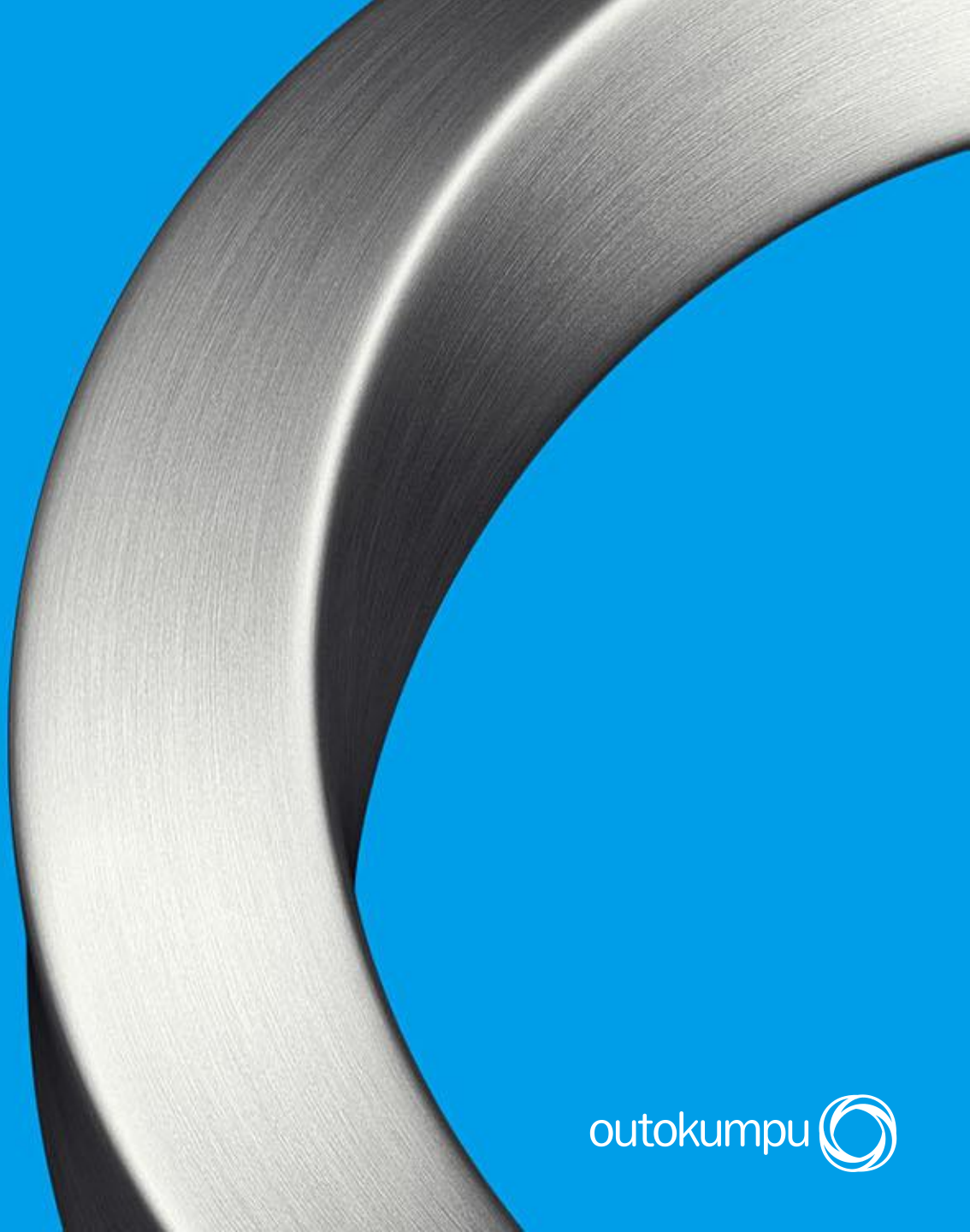
Kemi Mine Underground Safety training

Safety training material

Notice that the presentation contains hyperlinks to slides with further information about the subject!

2020



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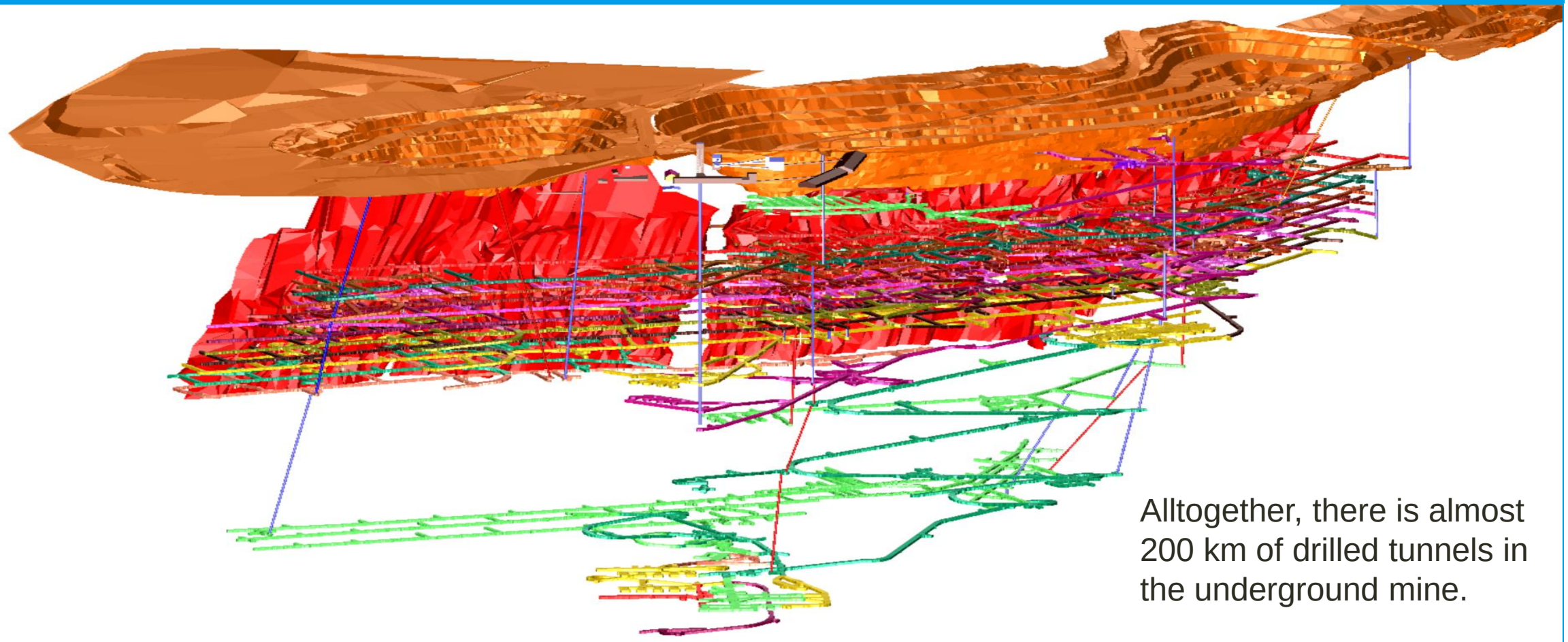
Mine 3D model

General view



Alltogether, there is almost 200 km of drilled tunnels in the underground mine.

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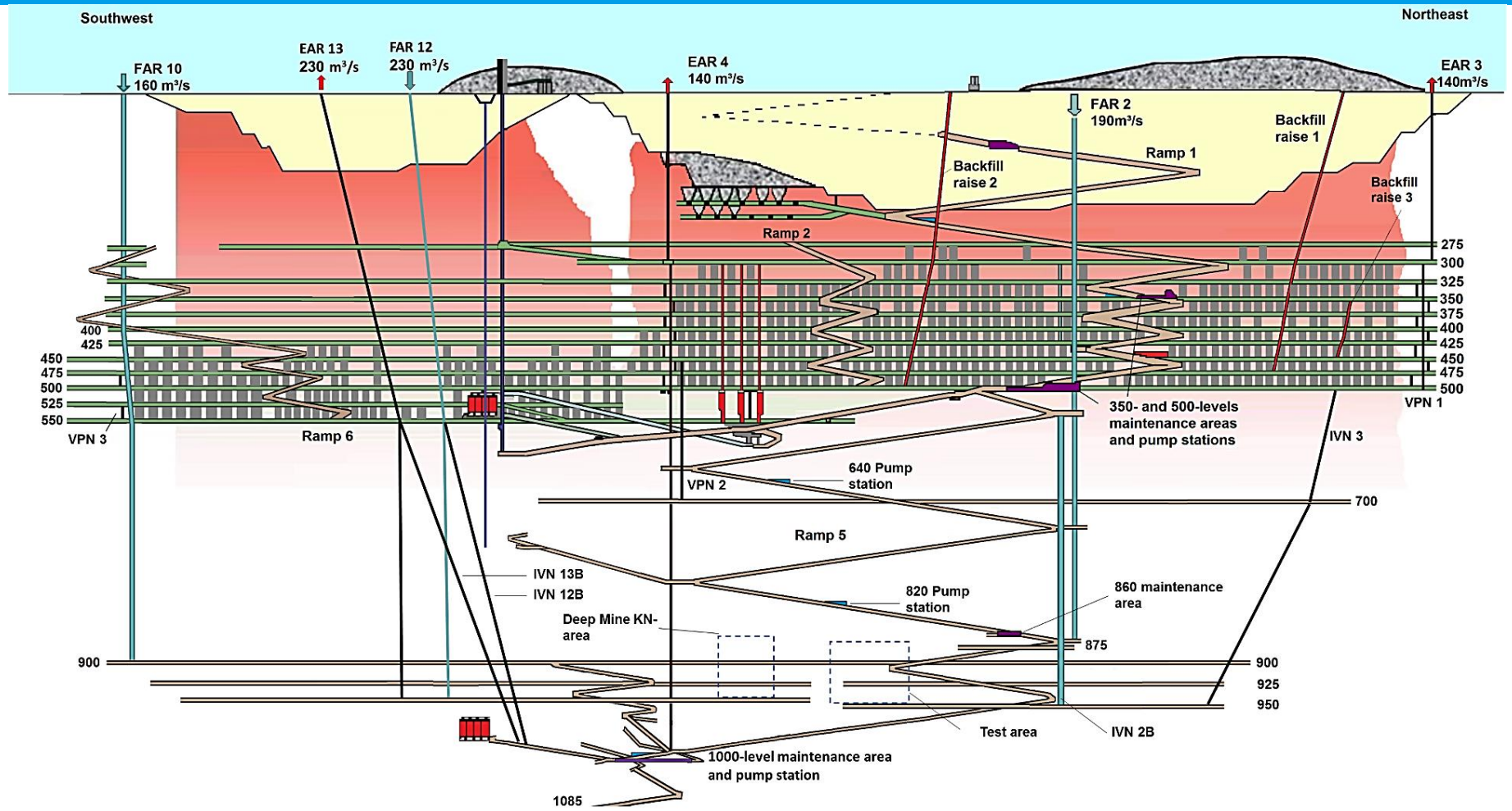
Longitudinal section

Simplified longitudinal section

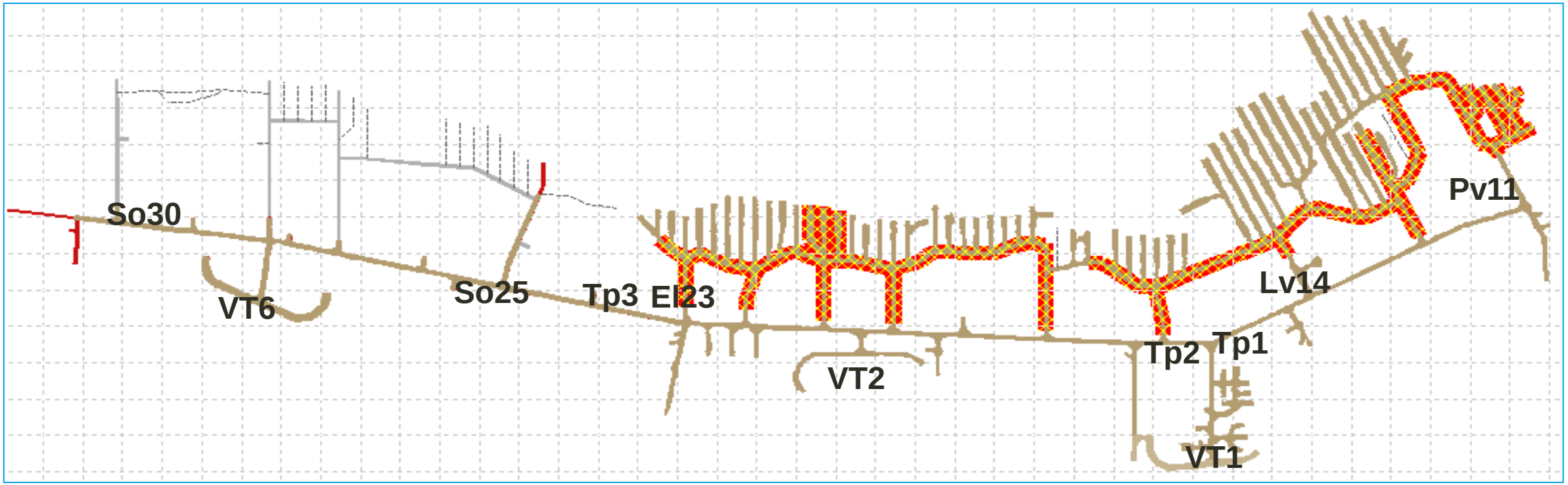


Production levels

Preparatory production levels

Level section (450 level)

Simplified level section



VT = The main road of the mine (called ramp)
Tp = The main level drift
Vertical distance between the levels is approximately 25 m. The layout is highly similar between different levels.

Areas with asbestos risk

General knowledge and instructions

- All production levels including preparatory production levels (levels 225-950) and ramps VT2 and VT6.
- Person must use respiratory protection (< 2 h → half-face respiratory protection with P3 class particle filter, > 2 h → filtering device with fan unit (minimum TH2 approved)).
- On ore processing line (crushing department, HK1-HK4 and loading room)Deepmine processing line(crushing department, loading room and HK5-HK7) respiratory protection with P3 class particle filter and disposable overalls.

- When leaving a work site that contains asbestos, clean yourself before entering office, canteen or social premises
- 500 level maintenance hall has a vacuuming space and a clean room. Decontamination container is located above ground.
- Disposable overalls must be taken off and put to a plastic bag before leaving the work site. Put used overalls to an asbestos waste container.

Warning: risk of asbestos, use a respiratory protection

Important phone numbers in underground mine

General knowledge

Kemi Mine emergency number	016 45 **3737**
Emergency number	**0-112**
Kemi mine info	016 45 3511
Concentrating plant control room	016 45 3535, 3540
Mine control center(TOKE)	016 45 3503

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LPG in Kemi Mine area

Liquefied petroleum gas storage

Use of LGP

- LPG is used to warm up the underground ventilation air during winter time. Two fans with a power of 95 m^3/s/channel blow fresh air to the underground mine through fresh air channels FAR2 and FAR10.

LPG in Kemi Mine area

Liquefied petroleum gas storage and safety measures

- LPG is stored in two 99 m^3 containers
- Container areas are isolated and located outside traffic
- The LPG-system is equipped with continuous working liquefied petroleum gas indicators that alarm in case of leakage
- The alarm signal is audible overground and on 500 level shelter (refuge) area
- In case of an emergency, you will get an emergency text message that gives instructions on how to act

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Mining equipment

Personal protective equipment (PPE)

- Protective helmet with reflector and helmet attachable ear muffs (always wear a chinstrap when working at height)
- Safety glasses or IRIS helmet with integrated safety glasses
- Reflective protective clothing, flame-proofed
- Respiratory protection with P3-filter
- Safety shoes with nail puncture protection (above ankle-sleeved)

Mining equipment

- Miner's belt
- Emergency escape device with minimum of 60 minutes operating time which meets the requirements of the standard EN 13794
- Miner's lamp or flashlight
- Carbon monoxide indicator
- DMR-phone

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Underground mine access control

Right to enter the mine requires

- Occupational safety card
- Valid hot work card
- Persons who have completed the underground mine safety training. Validity time of the training is 1 year.
- Professional guests need a guide throughout their visit to the mine.
  - The guide can be mine's own supervisor or a person who have completed the underground mine safety training.
- The visit of non-professional guests in the mine requires written permission from the mine VP, department head or chief geologist (age limit 15 years)

Underground mine access control

Use of the access control system

- When entering and leaving the mine, each person signs in with their access card/Flexim key to access control reader.
- Access control readers are located at the entrance of the mine and in the hoisting tower.
- Truck drivers sign in at the beginning of their shift and sign out at the end of their shift.
- The guide is responsible for the safety of visitors and persons working in the mine for a short period of time. The guide is also responsible for having the persons listed on his/hers access card/Flexim key before going to the mine.

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Underground mine access control system view

Access control window

outokumpu Maanalaisessa kaivoksessa työskentelevät henkilöt **MA-kaivos (113)** 350SP (0) 500SP (0) 1000SP (0)

Henkilölista MA kaivos 03.10.2023 11:19:41 (muodostettu 03.10.2023 11:20:22)

Violetti teksti pelastusryhmäläinen, (9 hlö:a) **lihavoitu teksti** työnjohtaja/toimihenkilö sininen teksti panostaja

☑Näytä DMR paikannus ☐Näytä pääurakoitsija Yrityssuodatus: Paikka suodatus:

NIMI	AIKA	YRITYS	GSM	DMR	PAIKKATIETO (DMR)	AIKA-ALUEELLA [min] (DMR)
[redacted]	03.10.2023 10:52:23	KEMIN KAIVOS	0407122335	1094	Hp-500 urakkavalvonta	0
[redacted]	03.10.2023 11:16:27	KEMIN KAIVOS	0442921960	1090	Hp-500 kiinteä kunnossapito	0
[redacted]	03.10.2023 10:58:43	KEMIN KAIVOS	0451690222	1085	Hp-500 sähkökorjaamo	0
[redacted]	03.10.2023 11:00:14	KEMIN KAIVOS	0405481341	1403	Hp-500 parkkipaikka	0
[redacted]	03.10.2023 10:07:10	KEMIN KAIVOS	0407679863	1235	Hp-500 laitehuolto	0
[redacted]	03.10.2023 08:20:18	KEMIN KAIVOS	0451314997	5050	Hp-500 sahko-TJ	0
[redacted]	03.10.2023 07:37:31	KEMIN KAIVOS	0406836022	1220	Hp-500 urakkavalvonta	0
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[redacted]	03.10.2023 07:41:30	KEMIN KAIVOS	0407121409	1107	Hp-500 TOKE	0

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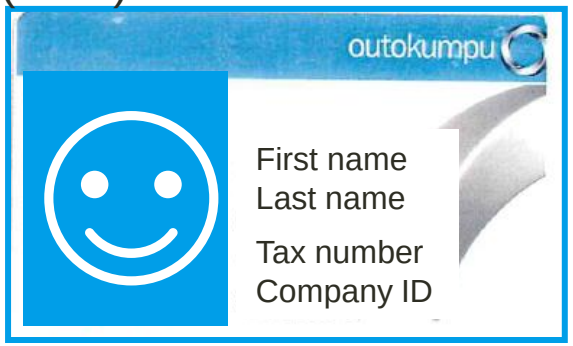
Underground mine access control

Mine entrance

Stop the car next to the access control reader. The driver collects access cards from every person in the car and stamps them in the access control reader. Green light turns on when the card has been read successfully. When every card has been read successfully, open the gate by pushing the button on the right side of the access control reader. If you have problems with your access card, contact Kemi mine info (3511).



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Traffic in the underground mine

General knowledge of traffic

- In the underground mine, vehicles can be used and transported by a person who has completed the safety training and gotten a permit.
  - The employer is obliged to train drivers of vehicles working in the underground mine. Driving training for drivers that drive occasionally in the underground mine is organized by Outokumpu.
  - Driving training can be organized if needed, for example if the person has never driven in an underground mine.
  - Petrol- and LPG-driven vehicles are prohibited.
- The maximum driving speed is **30km/h.**
- Bypassing another vehicle/mining machine at bends and intersections is prohibited.
- Seat belts must be used in all vehicles.

Traffic in the underground mine

Dodging rules in the order of importance

1. Always dodge rescue vehicles
2. Always dodge a convoy car and the following vehicle
3. The vehicle going downhill dodges the vehicle going upwards
4. The vehicle coming from connection drift dodges the vehicle driving in ramp
5. The vehicle coming from connection drift dodges the vehicle driving in main level drift

A convoy car uses yellow flashing beacon on flash mode when convoying another vehicle in the mine. The convoy car drives one curve ahead of the following vehicle, so that the oncoming traffic has more time to react to the situation. The driver of a convoy car gives directions and instructions through a radiophone.

Traffic in the underground mine

Consider in underground traffic

- Drive with high-beams on
- When driving on the ramp, always shut the high-beams before a curve, so that you can detect the oncoming traffic
- Choose a gear that decelerates
- If you have to use the brakes, pump them gently to avoid heating
- If the brakes fail while driving on the ramp, **stop the vehicle by driving it to a wall in a controlled manner**
- Do not reverse to the ramp
- If you have to park on the ramp, put the yellow flashing beacon on, gear on, parking brake on and tilt front tires towards a wall (in case of a breakdown you also need to put down a warning triangle and inform the mine control center (TOKE)).
- At intersections turn signal must be used. When facing another vehicle use turn signal to inform the dodging direction.
- Ramp can be slippery
- Lights on the roof indicate for intersection or a dodging recess
- Mirrors help you see the oncoming traffic
- Look out for trenches while driving on main level drifts

Traffic in the underground mine

For driving permit, small vehicles must include the following safety equipment

- **Yellow flashing beacon** on top of the vehicle
- At least one **12kg** (2x6kg) **fire extinguisher** placed in a location where it is easily accessible
- **Emergency escape devices** according to the number of persons specified in the vehicle registration document
- **First-aid kit**
- **Warning triangle**
- **VHF-phone** programmed to the Kemi mine frequency, channel 3
- **Fresh air filter**
- **Ground grip tyres**
- **Number identification** located visibly to the front, both sides and back of the vehicle. Number identification must be distinct and company specific
- **Signboard supplies**: string, cable ties, signboards (you need to know the signs needed in your work). Printed signboards are located in the 500 level shelter entrance hall

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Blasting in the underground mine

Blasting times and detonation permit

- Permanent blasting times:
  - Mon-Sun 7.00-7.10
19.00-19.10
- During the blasting time it’s forbidden to enter and move in the mine.
- Everyone has to either leave and **log out of the mine** access control system **or** go and **log in to the 350, 500 or 1000 level shelter** in the access control system.
- The detonation permit is issued based on the underground access control.
- After the blasting, when leaving the 350, 500 or 1000 level shelter, remember to **log out** in the access control reader.
- Everyone should also note that detonations can also be carried out at other times, so prohibit signs and detonation guards´ instructions must always be followed. Secondary blastings are warned in advance via text message and the blasting workers check and guard the area.

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Signboards in the mine

General knowledge

- There are plenty of different kinds of signboards in the underground mine.
  - Blue signboards guide, for example about personal protective equipment
  - Yellow signboards warn and restrict operations in the area
  - White signboards prohibit
- Depending of the working phase, different signboards must be placed in to the tunnel
- Everyone needs to know all the signboards associated with their work
- If you notice flaws or shortage with the signboards, you are obligated to fix them

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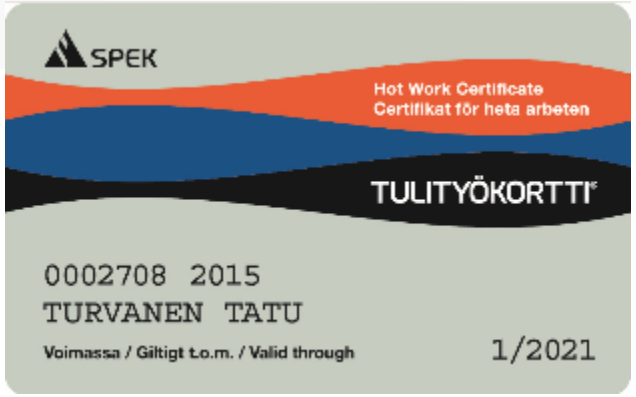
Hot work

- Operating hot work in inflammable or explosive areas, occasional hot work sites and special work sites always requires written hot work permit and valid hot work card
- Valid hot work card is required from all the hot work operators and supervisors
- Written hot work permission is not needed in the permanent hot work sites: above ground maintenance hall, 115 level maintenance hall's welding operation site, 350 level maintenance hall's welding operation site, 500 level maintenance hall
- Always do the hot work on a permanent hot work site when possible. Even then you need to know the safety guidelines of that working method, target and environment.
- Permanent hot work site needs to meet the safety requirements of an occasional hot work site, if the working target or conditions increase the fire hazard on the hot work site (Mining machines, inflammable material etc.).



Electrical safety

Consider in underground mine

- Environmental conditions are often damp
- Cables and electric lines are more vulnerable in mining conditions
- Access to electric rooms requires permission and special training
- It is not allowed to store anything extra in electric rooms
- Notice all energized devices in your work
- Cables of the mining machines can be handled only as de-energized. Cable must be marked with a warning cone
- Inner problems of a power unit can only be fixed by an electrician. Leave electrical installing to professionals

Before plugging the machines to the power unit, examine the plug and the case so that they are not damaged or wet. Energize **after** the plugging.

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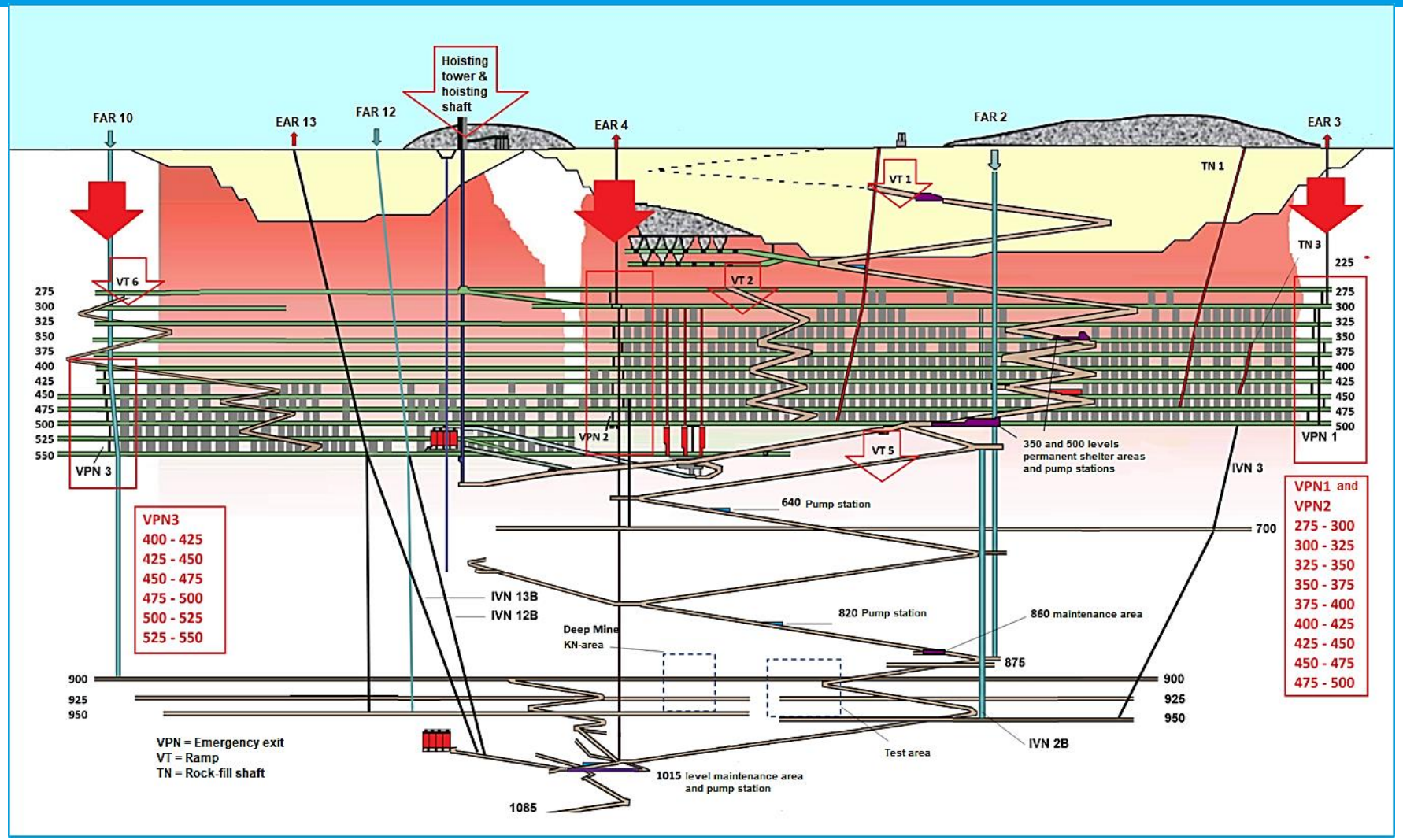
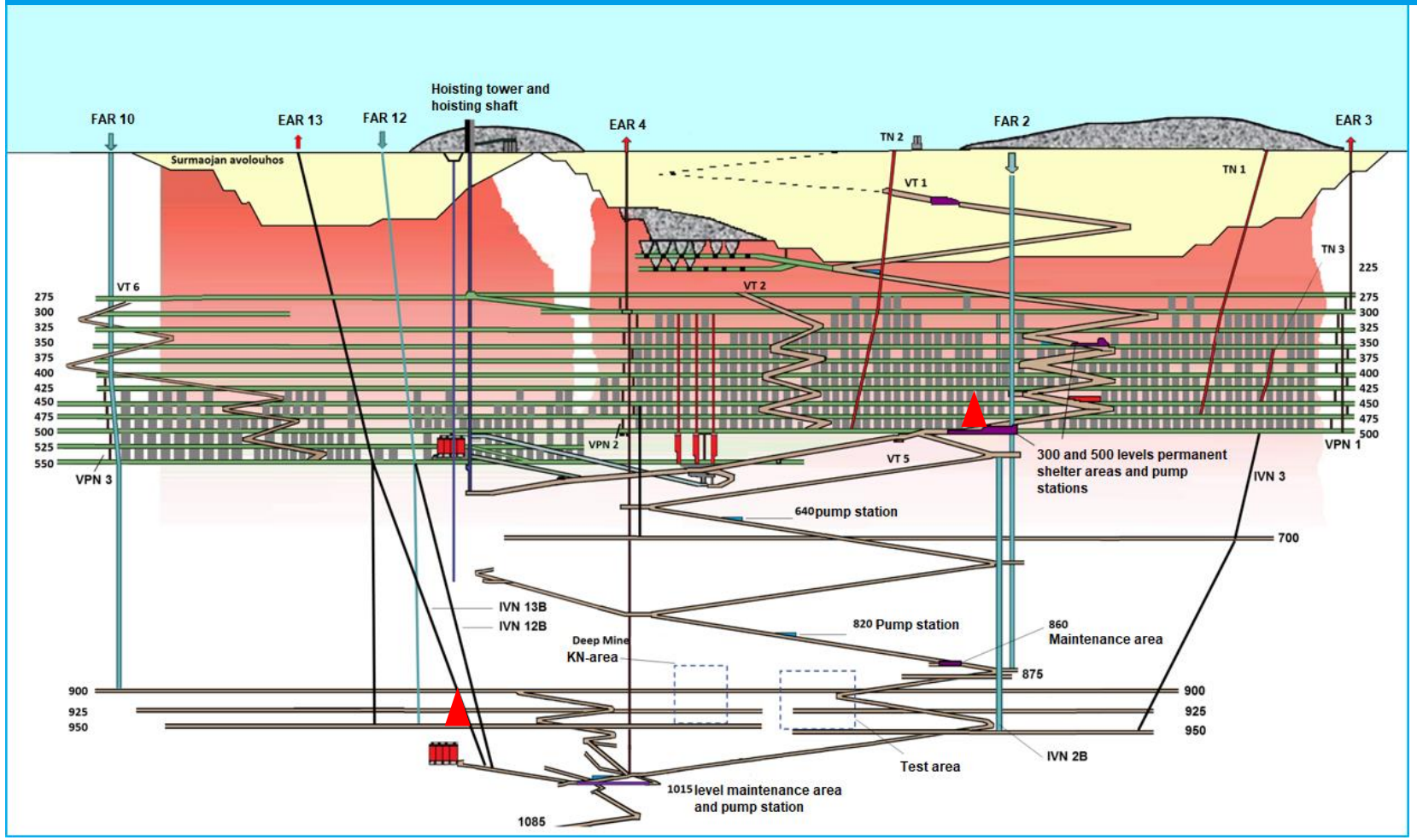
Underground mine emergency exits



Underground mine rescue chambers/shelters



Permanent shelters
HP-500
HP-1000
6 Transferable rescue chambers are located in necessary places on different levels (ie. Near current production drifts)

▲ = Permanent shelter

Action on site of an accident

- Investigate the situation
- Rescue people who are in danger
- Make an emergency call
- Prevent further injury or damage
- Provide first aid and/or medical care
  - Perform CPR if necessary
  - Suppress big bleedings
  - Turn unconscious people on their side
  - Handle the patient with care
  - Speak calmingly

Occupational safety work

- Observing hazards
- Investigation of near-miss incidents and workplace injuries
- Safety Behaviour Observation (SBO)
- Safety briefings
- Think before acting! (Take 2)
- Safety trainings

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Accidents

If the brakes fail while driving on the ramp, stop the vehicle by driving it to a wall in a controlled manner

Accidents

When driving with a load, the load must be evenly set and the driving speed must fit to the situation

Accidents

3.1.2018, at 18.00. A fire

What happened?
Gradall excavator catched fire during a change of shift in tp3yhp1-350 and burned completelly.

What was the root cause?
There is no certain knowledge of the cause. It is assumed it started from Gradall's own electrical device. Automatical extinguishing apparatus turned on but couldn't extinguish the fire.

Immediate actions:
Fire was extinguished and fire-watch was performed. Evacuation to shelters was successfull.

Corrective and preventive actions:

- Adding "Switch off the main current when leaving the machine" to work instructions
- Demanding automatical extinguisher apparatus for all mining machines
- Checking preventive maintenance objects and adding to maintenance list if needed
- Real-time updates of the locations of mining machines during breaks (contractor presents)
- Separate meeting for feedback about fire and rescue services in the situation

Waste management

Contractors

- **Contractors are in charge of tidiness, order and sanitation on their own work sites and storage areas**
  - ”Contractor’s waste management plan” has been dealt to every contractor
- **If there is an environmental accident in the Kemi Mine area**, it requires immediate actions
  - To minimize the environmental effects (for example oil leak or dusting)
  - Accidents must be reported to supervisors
  - Even the small oil leaks must be reported

Waste management

Contractors

- The contract defines the responsibility that contractors have about waste management

- Kemi Mine follows the Waste Management Act of Keminmaa Municipality
  - **Contractor with own storage area:**
    - Contractor is responsible for collecting, storing, recycling, transporting and disposing all of their own waste material away from the Mine area
    - Refuse incineration, burying waste or other disposal inside the Mine area is **prohibited**
    - Hazardous waste must be stored and handled in a way that it can not end up to soil, ground water or water systems
    - Hazardous waste containers must be stored inside (locked or monitored)
  - **All contractors and contracting parties**
    - When contractor employees work on Mine’s work sites, they must use and follow the Kemi Mine waste management

Attachment: Respiratory protection, model examples

Half-face respiratory protector 6500 QL

Motorized mask CleanSpace ultra

Motorized mask M3 Versaflo

- < 2 h half-face respiratory protector (P3 class particle filter)
- > 2 h filtering device with fan unit (minimum TH2 approved).
- Disposable FFP3-class paper mask is for guest use only

Areas with risk of fibrous asbestos

Mining equipment

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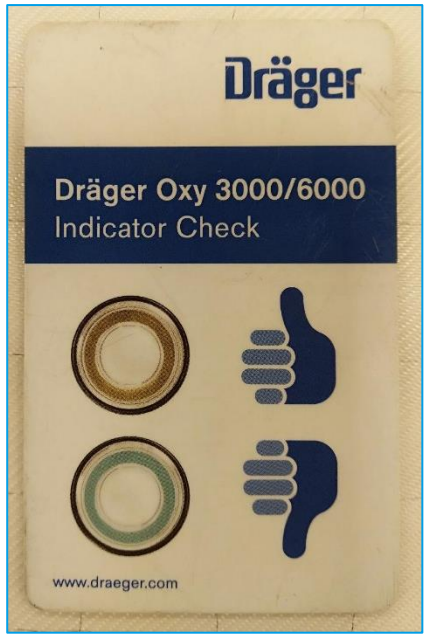
Attachment: Emergency escape device

Emergency escape device with minimum of 60 minutes operating time and meets the requirements of the standard EN 13794



Notice!
Always check where the protective equipment are in that exact vehicle that you use in the mine. Read the manual if necessary. You might need the Emergency escape device in Fire situations for evacuation.

Attachment: Carbon monoxide indicator

Carbon monoxide and use of the indicator

- Carbon monoxide (CO) is a toxic, colourless, odourless and flavourless gas that you can not detect without an indicator
- Alarm begins when the lower limit value is achieved
  - Limit value in a long-term exposure (8h) 20 ppm
  - Limit value in a long-term exposure (12h) 10 ppm
- The alarm sound gets more frequent when the upper limit value is achieved
  - Upper limit value when you have 15min to leave the premises 75 ppm
- In case your indicator has Time Weighted Average (TWA), you have to turn off the indicator after your shift and back on again at the beginning of your next shift. If TWA-alarm begins, you must leave the work site at once, and not get any more exposure to carbon monoxide during that shift.

Attachment: Reporting to Mine control center

Mine control center (TOKE)

Report to Mine control center about safety hazards/observations without delay.

- **Safety observation**
  - Fire and rescue situations
  - Workplace injuries, severe near-miss incidents and property damages
  - Other infrastructul issues: Electricity, data, ventilation ect.

- **In other cases** always report to your own supervisor or Outokumpu's Foreman

Attachment: Calling emergency numbers

Things to tell:

- Your name and location
- Municipality and address as accurately as possible
- What has happened, is the fire department needed
- Number of injured persons
- How guidance is organized

Things to remember:

- Put on the speaker if possible
- Speak calmly with a clear voice
- Answer the questions asked by the Emergency Response Centre operator
- Do not hang up until you are allowed to

Kemi Mine emergency number	3737
General emergency number	0-112

Attachment: 500 level shelter

Permanent shelter area (Hp-500, SP-500)

- Main permanent shelter area
- The shelter has a canteen and office premises
- Pressurized with the air from the fresh air channel (FAR2)
- First-aid supplies (for example in front of Mine control center (TOKE))
- An ambulance and a fire engine in the rescue team garage

Attachment: Transferable rescue chamber

Respetra Rescue Chamber

- 4 bigger (14 people) and 1 smaller (8 people)
- Contains air filter devices
- Table and chairs
- Has a backup battery for 24 hours in case of a power failure
- WC
- Something to drink
- First-aid supplies
- Phone
- Detailed instructions inside the rescue chamber

Attacment: Emergency exits

- Approximately 25m long ladders
- At the end of main level drifts close to air channels
  - TP1, VPN1 275 - 500
  - TP2, VPN2 275 - 500
  - TP3, VPN3 400 - 550
- Attach your self to ladders by a ”safety carriage” that you can find in the red mail box
- Emergency exits are used in fire situations, when you need to go further down towards a smoke-free area