TEHNILISE JÄRELEVALVE AMET
ESTONIAN TECHNICAL SURVEILLANCE AUTHORITY

Mining legislation and mining Safety in Estonia

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Introduction

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This presentation focuses mainly on oil shale underground mining due to its high level of risk and large proportion in Estonian mining industry.

Contents:

- Mining in general
- Mining legislation
- Oil shale mining
- Safety regulation
- Mining incidents
- Conclusions

Mining in Estonia

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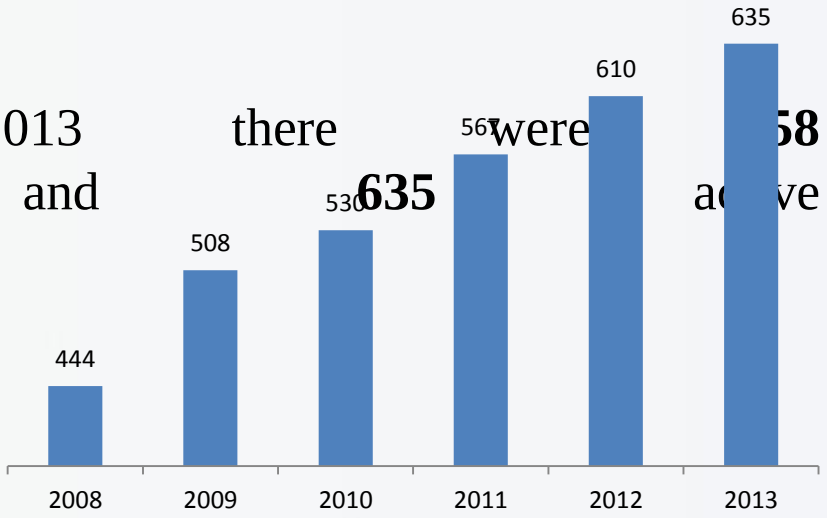
Minerals

- Currently mined:
  oil shale, peat, limestone, dolostone, sand, gravel, clay
- Potential in the future:
  graptolite shale, granite, iron ore, phosphorite

Mines

By the end of 2013 there were **58** mining companies and **635** active mining permits:

- **3** underground mines (oil shale)
- **632** open cast mines



Mining permits

Legislation (1)

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- Mining in Estonia is mainly regulated by two legal acts – the Mining Act and the Earth Crust Act.

- **Mining Act** (came into force 1 December 2003)

Regulates the technical side of mining, ensuring the safety of people, property and the environment, and providing the economical use of deposits. Inspection on the compliance with these regulations is done by the Estonian Technical Surveillance Authority.

- **Earth's Crust Act** (came into force 1 April 2005)

Provides the procedure and the principles of the exploration, protection and use of the earth's crust, with the purpose of ensuring economically efficient and environment-friendly use of the earth's crust.

Legislation (2)

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The Mining Act

- Safety requirements
- Requirements for the mandatory documentation (project documentation, development plans, occupational safety instructions, documents concerning risk assessment, mine surveying documentation)
- Rescue work in underground constructions
- Rights to operate as an entrepreneur
- Requirements for specialists in charge
- Assessment and attestation of conformity of people in charge (competency exam, certificate of competency issued by NPO Estonian Mining Society)
- Suspension and termination of mining

Legislation (3)

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The Earth Crust Act

- Geological Research and Geological Exploration (general requirements, procedure, issue of permits, submission of results, preservation and publication of geological data)
- Extraction of mineral resources (except for the part regulated by the Mining Act)
  - issue of the permit for extraction, changing the permit or declaring it invalid
  - extraction tax or payment for the right to mining
  - report on extraction of mineral resources
  - restoration of the land disturbed by the extraction of mineral resources
- Relations between the owners of the immovable property and the holders of permits for geological investigation, exploration permits and extraction permits
- Use of the Earth's crust not related to the extraction of mineral resources
- Protection of the Earth's crust.

Oil shale (1)

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- The main risks in Estonian mining industry concern underground mining (oil shale).
- Estonian oil shale – Kukersite – deposits are one of the world's highest-grade deposits with organic content averaging over 40%. Its conversion ratio into usable energy is between 65 and 67%.
- Estonia's Kukersite represents about 1,1% of global European oil shale resources.
- Total Kukersite re are estimated to b tonns of which economically proven defined as minea calorific values of located in environmental restrictions.

Oil shale (2)

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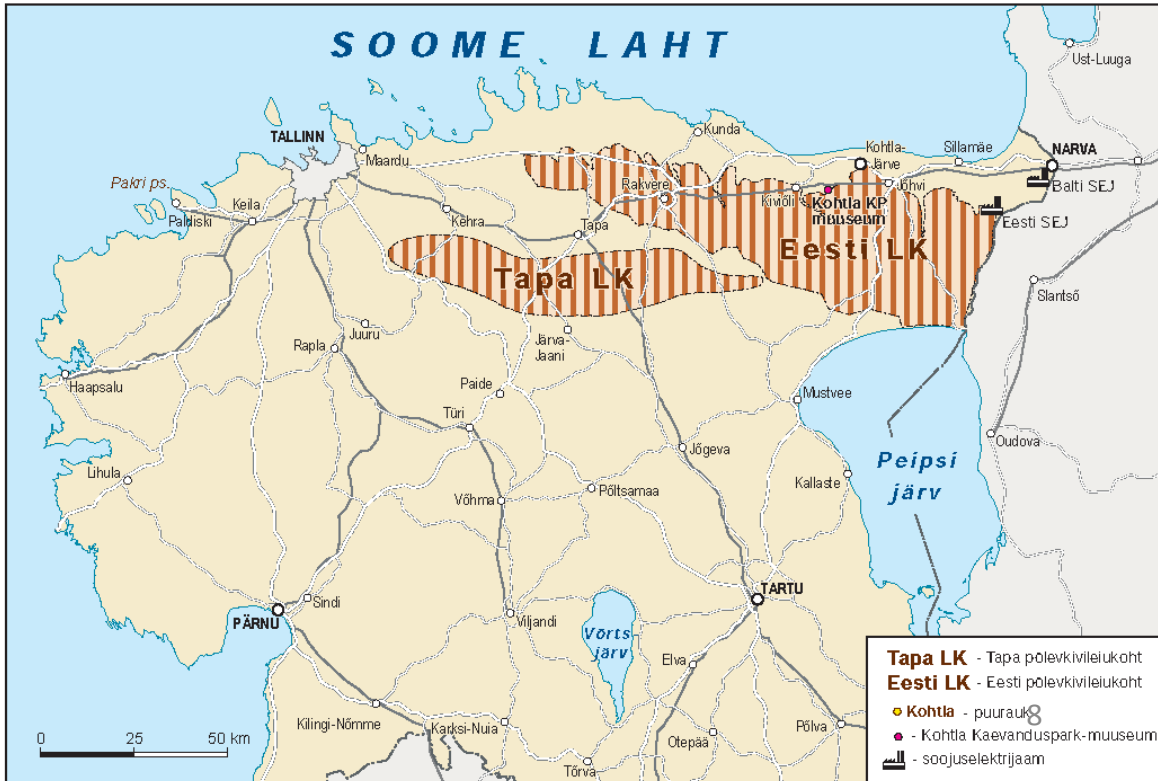
- Oil shale is extracted in East Estonia, where it lies at the depth of 10-70 m underground. Depending on the depth of the seam, it is extracted in open cast mines or underground mines.
- The Estonian deposit covers 2000 km2 which is used industrially.
- Currently active oi cast mine and two (Estonia and Ojamaa).



Oil shale (3)

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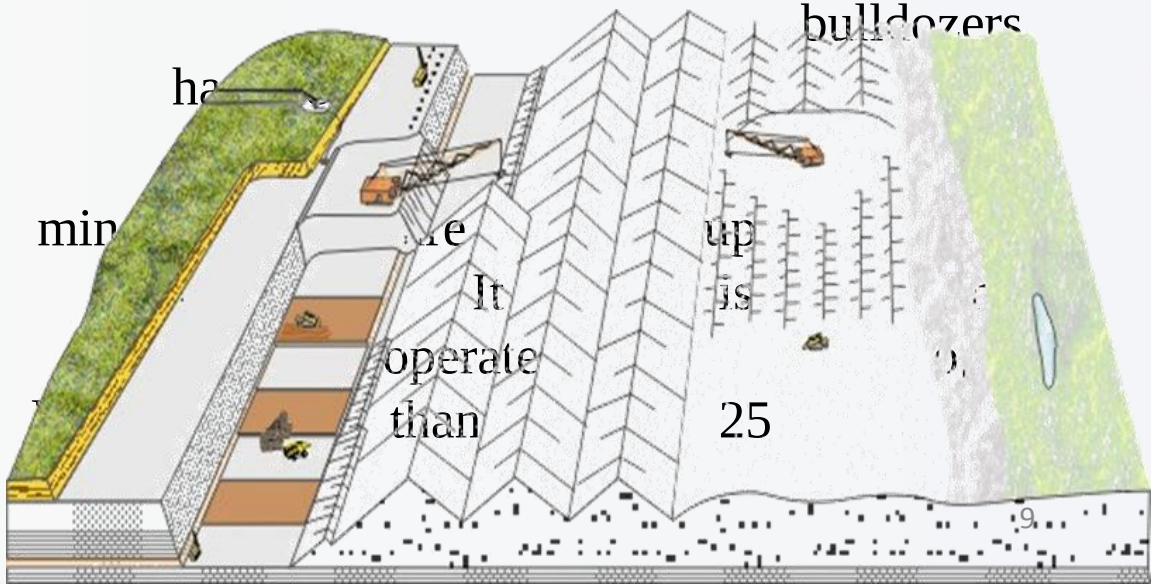
Open cast mining

•The biggest open cast mine – Narva – uses technology of stripping the rock with relatively large-bucket (10–35 m3) excavators – draglines. The overburden is first broken up by blasting.

•At open cast mines with thin overburdens, stripping is done with smaller excavators using front end loaders and hydraulic excavators.

•Oil shale is extracted with ripper bulldozers. hydraulic ha surface miners.

•Open cast min re up 25 m in It is beneficial to operate cast mines than 25 30 m.



Oil shale (4)

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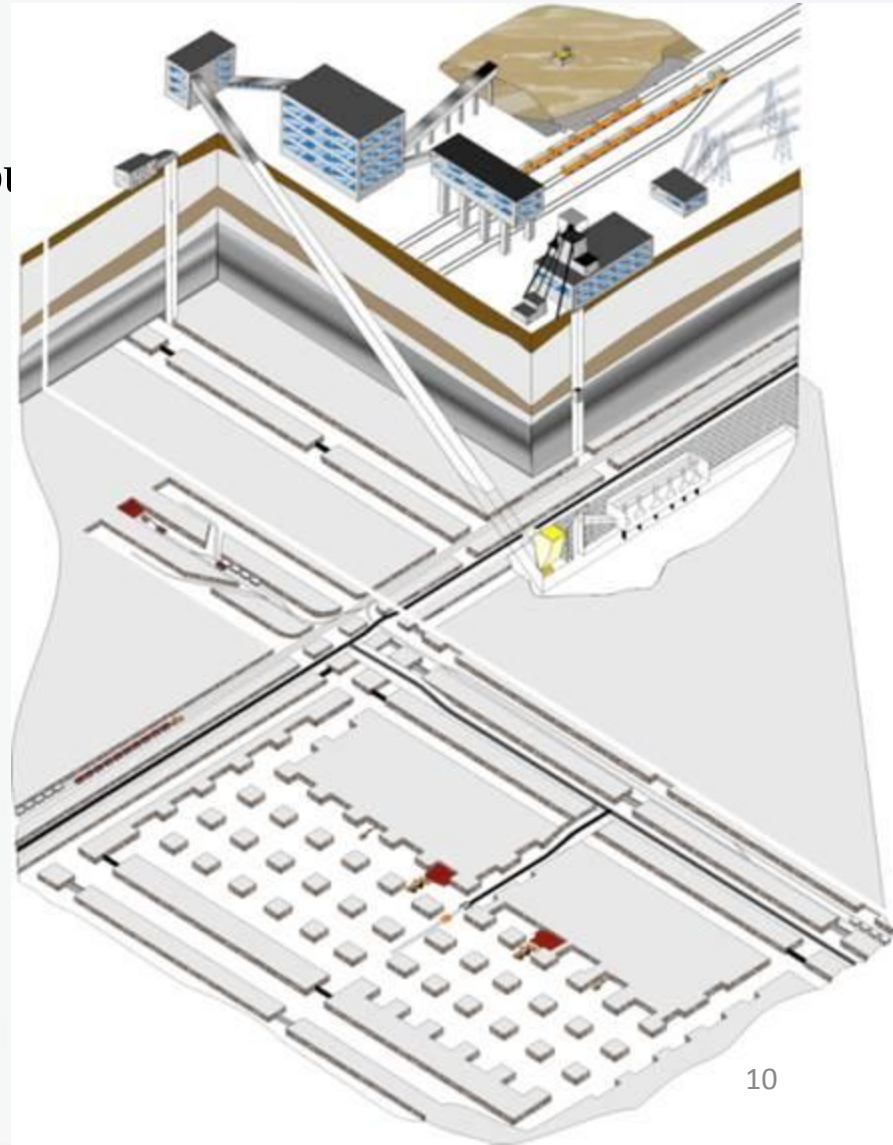
Underground mining

•The two undergrou
Estonia and Ojamaa
room and
This means around
due to pillars.

•Oil shale is
blasting and
using loaders
conveyors.

•Roof is supported
anchors bolted
upper layer of limestone.



Safety regulation

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Safety requirements for underground mining (1)

- **General requirements**
  Mining near natural waters and drowned shafts (closer than 200 m) must be documented with a separate mining project. Pillars must be used to prevent fire spread, inflow of water and collapses. Pillars cannot be mined. Working alone is prohibited. Regular checking of mining faces and other shafts is regulated. Plans of underground workings must be kept up to date and be available to all employees.
- **People on site**
  People working underground must be accounted for. The record-keeping procedures must ensure the identification of all personnel present in the mine at all times.

Safety regulation

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Safety requirements for underground mining (2)

- **Drainage**

Drainage, where applicable, must be implemented in every running mine. Additional precautions should also be developed and implemented to ensure the work safety during high water periods.

- **Ventilation**

Adequate ventilation must be ensured when using underground workings. Air sampling and analyzing must be organized. Ventilation speed is regulated. Separate shafts must be used for incoming and outgoing air. It must be possible to stop and shut down the ventilation system in case of fire. Vent pipes must be made of non-combustible material.

- **The use of internal combustion engines**
  The use of gasoline and gas-fired engines is not allowed. This requirement does not apply in the event of rescue and fire fighting. The use of diesel engines is regulated.

Safety regulation

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Safety requirements for underground mining (3)

- **Construction of shafts, exits and roof supporting**
  Mines must have two separately located exits which are easy-accessed and with permanent construction. Mining faces must have two separate exits to other shafts. Shafts must be marked in order to help workers find way to exits. Roof supporting must be organized in a way that workers can work under supported roof.
- **Maintenance and elimination of shafts**
  Active shafts must be kept clean and functional. Inadequate and unsupported shafts and shafts under construction must be marked with prohibition signs. Loose rocks must be removed.

- **Transportation**

Transportation of employees must be organized in case of long distances or declines. Vertical shafts must be equipped with ladders (angle up to 80º) and intermediate platforms.

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Fire safety regulation in oil shale mines (1)

- **Fire safety measures**
  Measures for fire prevention and fire-fighting must be implemented according to the specifics of each mine. Fire safety measures are: fire-fighting water supply; primary fire extinguishing equipment; fire barriers; usage of fire-safe materials and fire-fighting equipment.
- **Fire-fighting water supply**
  Water supply must be according to calculation and the supply system must be fully operational at all times with an independent power source and must be checked regularly. Conveyor drive units must be equipped with automatic fire-fighting equipment, except in case of permanent surveillance. Shafts with conveyors must be equipped with water supply pipelines.

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Fire safety regulation in oil shale mines (2)

- **Fire barriers**
  Fire barriers are used for localizing and limiting the spread of fire. Fire barrier doors must be built with non-combustible material. In the reach of 5 m from both sides of the barriers, roof supports must be made of non-combustible material.
- **Requirements for roof supporting**
  Non-combustible material must be used for roof supporting – concrete, metal, natural and synthetic stone. Wooden supports may be used in areas with geological defects (due to high moisture and clay content).
- **Other fire safety requirements**
  Floors in rooms for storage and handling flammable material must be made of non-combustible material. Materials used in conveyors' construction must be non-combustible. Fire-fighting equipment must be easy-accessed and visibly marked.

Safety regulation

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Mining rescue service (1)

Mining rescue service consists of a mining rescue commando, a technical support base and special equipment. Commando consists of rescue teams. A team consists of a team manager and at least five smoke divers. Technical support base consists of a garage, a smoke chamber and repair facilities for machinery and equipment.

- **Tasks of the rescue service**
  Promptly implementing necessary measures to eliminate any risks in case of hazards dangerous to people, property or the environment. This includes fire-fighting and organizing evacuation for 4 hours non-stop; measuring toxins and analyzing hazards; water transportation of at least 13,9 l/s to a distance of 1000 m; giving first aid; construction and deconstruction; ensuring communication; ensuring the condition and maintenance of equipment necessary for rescue activities; handling underground systems.

Safety regulation

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Mining rescue service (2)

- **Rescue service work management**
  Recue service work management must ensure standby of at least one rescue team at all times. Underground workers can be used as support teams who must fulfill the same requirements.
- **Cooperation between mining rescue service and rescue authority**
  Mining rescue service presents an overview of measures to insure preparedness to the rescue authority once a year. Mining rescue manager must always contact the rescue authority and keep them in touch with rescue activities.

  Opinion on the preparedness of mining rescue service is given to the Estonian Technical Surveillance Authority by the Estonian Rescue Service.

Incidents (1)

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Incidents (2)

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- Occupational injuries in the mining industry mostly take place in underground mines. Incidents are mainly caused by employees and technical failures, however, underground mining opposes many other great risks for people and for the environment. The three main risks are:

1. **Collapses**. Collapses in closed mines and operating mines. Bigger collapses appear only in closed mines which cause considerate deformations in landscapes. There have been minor collapses in operating mines mainly caused by mining operations.

2. **Fire**. Fires are ignited by moving parts in machinery and equipment (belt conveyors). Due to oil shale being combustible, fire can spread very quickly and may lead to extensive consequences. For instance, during an underground fire in 2008, a concrete barricade was built to prevent fire spread.

Incidents (3)

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3. **Water**. Oil shale seams lie below the groundwater level which means that necessary drainage and water management measures need to be taken into account. High water periods propose an extra danger of flooding the mine. New and operational mines need to deal with closed and flooded shafts that propose a threat to operational shafts.

   Incidents concerning these risks and experience have taught us over the years that they need to be strictly regulated by mining legislation which of today, have been included in the Mining Act.

   Estonian Technical Surveillance Authority is inspecting underground mines several times a year – around once a month during off-season, and verifies the compliance to safety and other requirements.

Conclusions (1)

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Occupational injuries

•Most occupational injuries are related to employees' mistakes and technical failures. Injuries mainly happen to elder employees who seem to get used to routine and pay less attention to safety.

•Changes in the working environment and technology are important risks for potential mining incidents.

•Occupational safety training and surveillance needs to be taken more seriously and re-training must be carried out more frequently.

•A more thorough risk assessment on mining accidents needs to be periodically carried out in the future in cooperation between mining companies and mining inspection authorities.

Conclusions (2)

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Accident prevention

•Project documentation is stored for at least 7 years after the completion of projected work. Underground mine plans are stored permanently in The National Archives. This helps to prevent future collapses when working above closed mines.

•Roof supporting must be strictly in accordance with project documentation.

•Automatic fire-extinguishing systems (heat sensors) have been installed in every mine. This prevents fire spread where there is no permanent surveillance.

•Dangerous hotspots for fire breakouts are monitored with surveillance cameras.

•The most flammable equipment – conveyors – are monitored and controlled by a remote control system accessible from the ground.

Conclusions (3)

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- Roof supports above conveyors' drive units are bolted with non-combustible material (metal) in order to ensure roof stability in case of fire.
- Water management is regulated according to high water period inflow capacity.
- Thick concrete barriers have been built between closed and operating mine shafts. This works as a preventing measure for water inflow as well as a fire hydrant in case of fire – water pipes are installed into the barriers.
- Record-keeping of people working underground is ensured by using chips. Every employee must use their chip in order to go underground. This enables a constant overview of the number of people working underground.

One of our department's most important goals is to increase safety in the mining industry of Estonia.

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Thank you for your attention!

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