

Current Japanese Metal Mines

- Non-ferrous metal mine is difficult to operate in Japan due to the resource price and reserves were degraded
- **There are many closure and abandoned mines at the moment**

⇒ **Acid Mine Drainage (AMD)** is generated under the non-controlled situation

⇒ **Mine facilities** such as tunnel, pit, dam, building and relevant equipments are aged

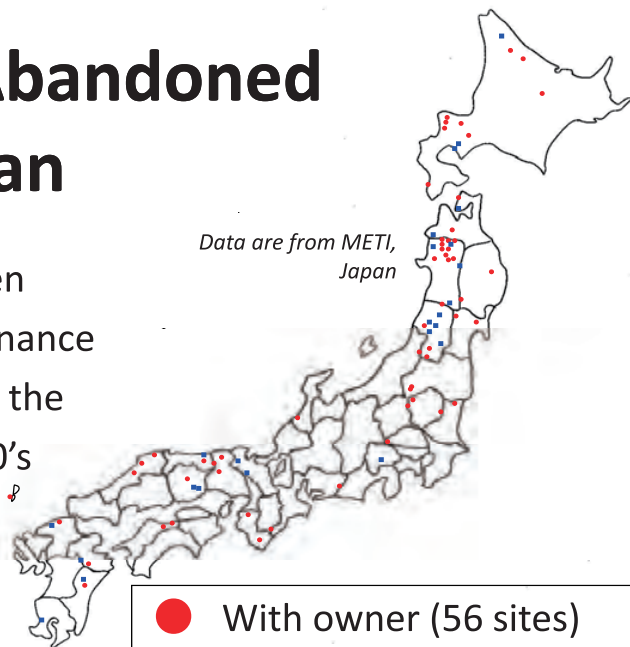
➡ **Appropriate maintenance and management are highly necessary**



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Closed and Abandoned Mines in Japan

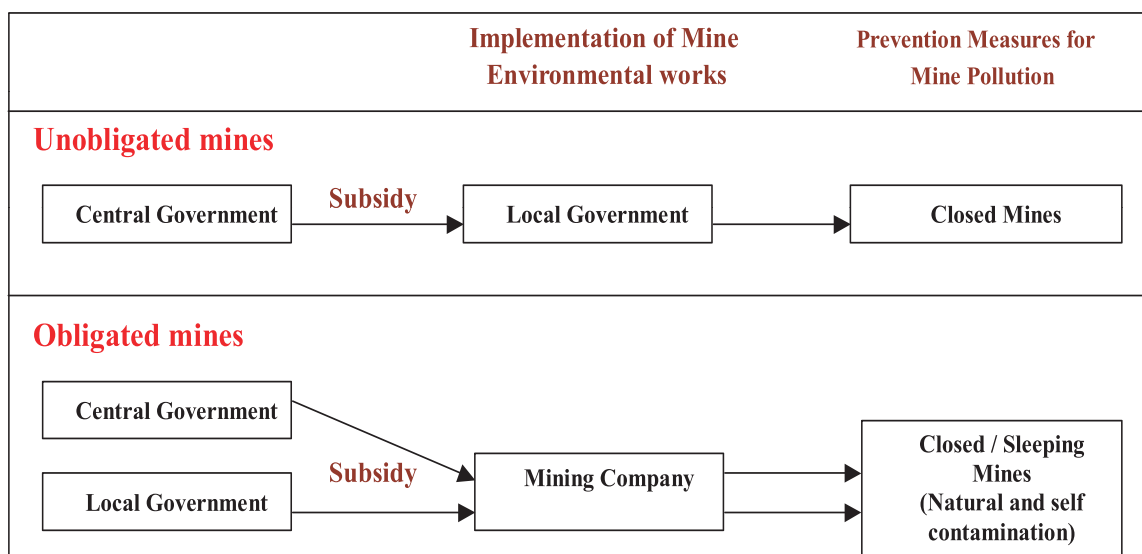
- These mines have been carrying on the maintenance and management after the closure, mostly after 70's
- AMD control is main activity to keep the environment



➡ **These closed and abandoned mines have been under controlling of AMD and site management for the environment**

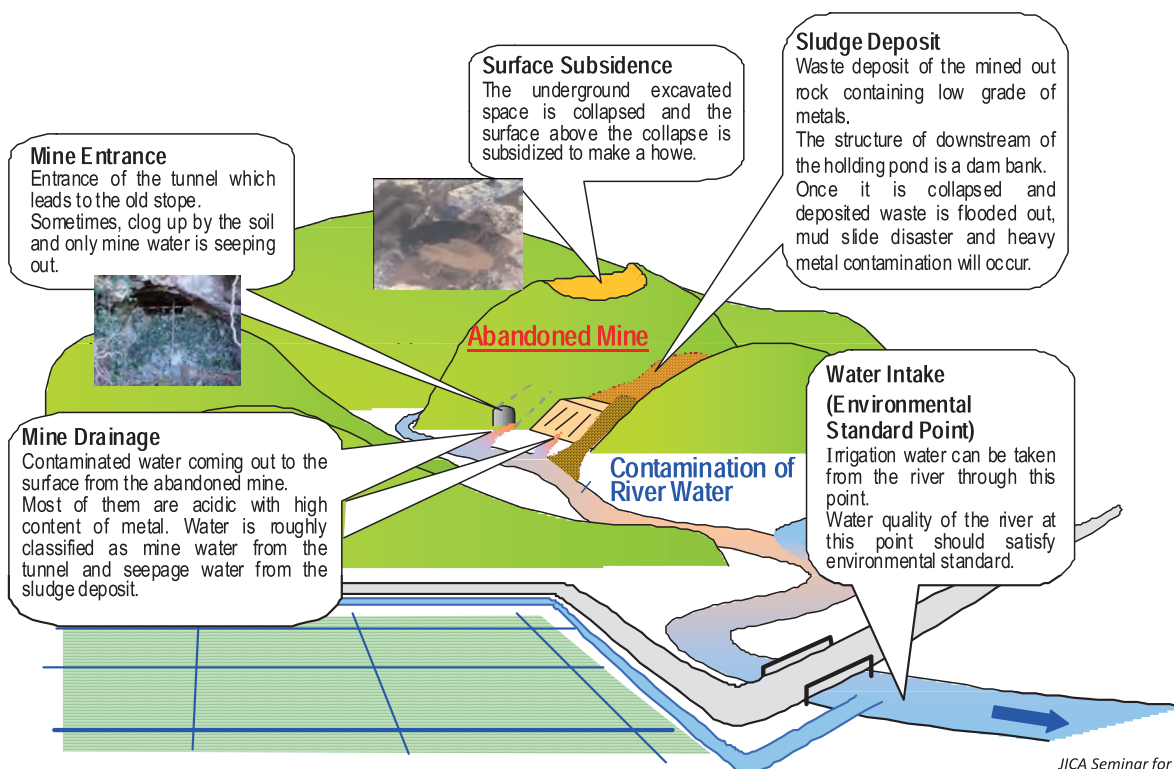
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Management System of Mine Pollution Control for Closed Mines in Japan



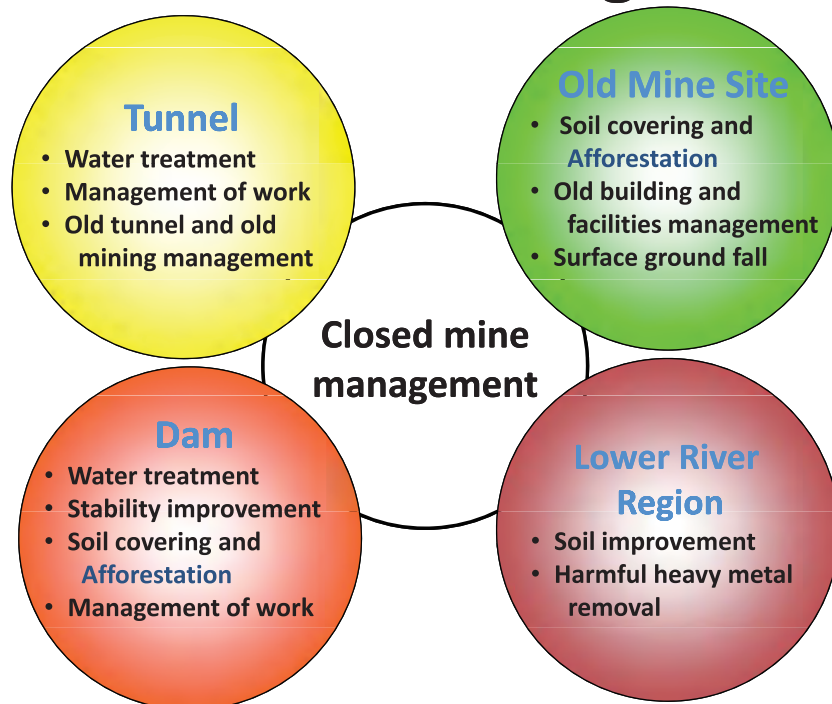
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Mine Pollutions beside the Closed Mine



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Approach of concerning closed mines management



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An Example of Surface in Closed Mine



Tailings dam (H=85.5m)



Cave and piezometer



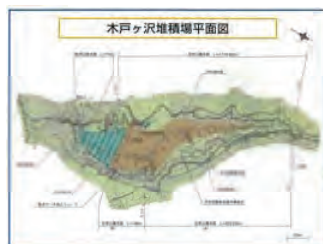
Cave (W=5m, D=4m)

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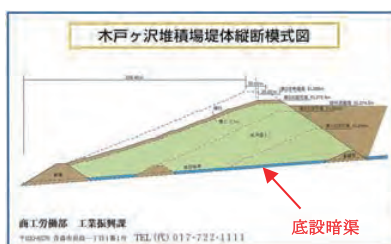
An Example of Tailings in Closed Mine



Tailings dam and Mine water treatment facility (Aomori Pref.)



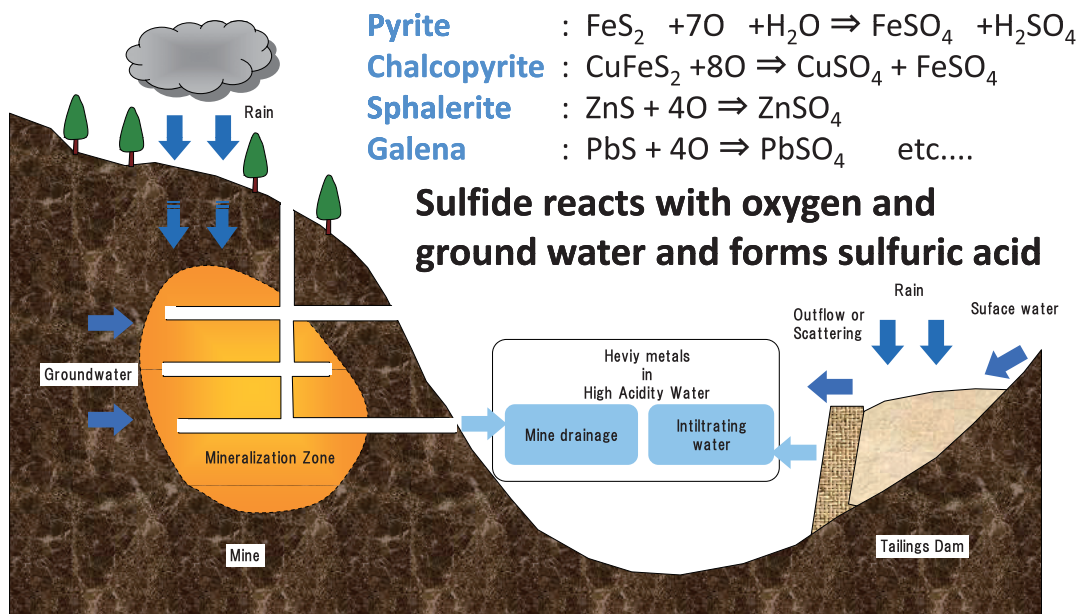
Plan



Section (Aomori Pref.)

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How to generate AMD from the closed and abandoned mine ?



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Standards for discharged water by Japanese regulation

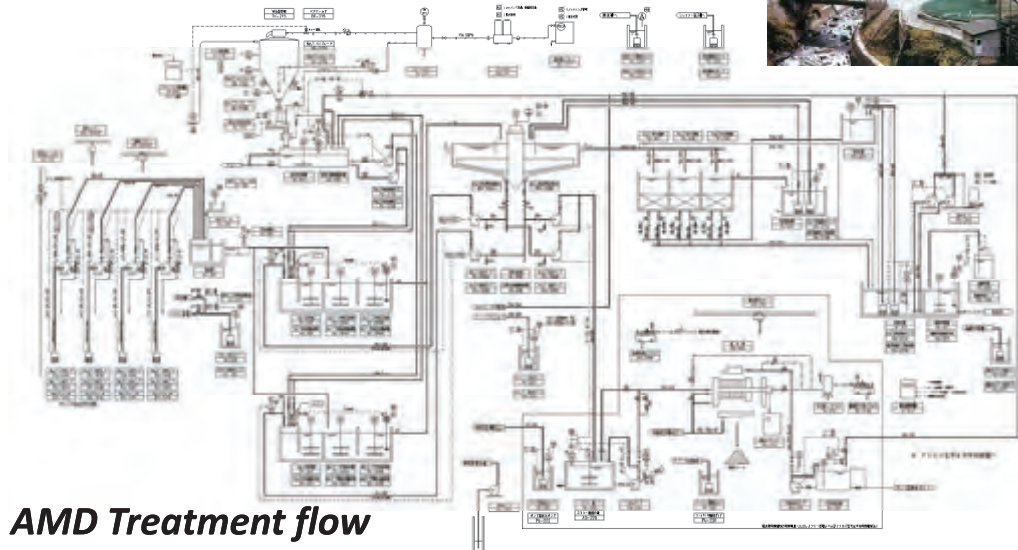
Items	Environmental standard	Industrial effluent discharge limit	Drinking water
Iron(soluble)	-	<10 mg/L	<0.3 mg/L
Copper	-	<3 mg/L	<1mg/L
Cadmium	<0.01 mg/L	< 0.1 mg/L	<0.01 mg/L
Arsenic	<0.01 mg/L	< 0.1 mg/L	<0.01 mg/L
Lead	<0.01 mg/L	< 0.1 mg/L	<0.01 mg/L
Zinc	<0.03 mg/L	<2 mg/L	<1 mg/L
Manganese(soluble)	-	<10 mg/L	<0.05 mg/L
T-Chromium	-	<2 mg/L	-
Chromium(VI)	<0.05 mg/L	< 0.5 mg/L	<0.05 mg/L
Mercury	<0.0005 mg/L	< 0.005 mg/L	<0.0005 mg/L
Selenium	<0.01 mg/L	< 0.1 mg/L	<0.01 mg/L
Fluorine	<0.8 mg/L	< 8 mg/L	<0.8 mg/L
Boron	<1 mg/L	< 10 mg/L	<1 mg/L
Cyanide	N.D.	< 1 mg/L	<0.01 mg/L
Aluminium	-	-	<0.2 mg/L
pH	6.5 - 8.5	5.8 - 8.6	5.8 - 8.6

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How to control the AMD - choice the treatment type -

Type	Method and input		Remark
Alkaline Chemicals	<ul style="list-style-type: none"> - Calcium carbonate - Quick Lime - Slaked Lime - Caustic soda etc. 		<ul style="list-style-type: none"> - Powder (Pressure feed truck) - Powder (Bag) (Truck) - Liquid, Suspension (Tank truck)
Neutralization	<ul style="list-style-type: none"> - General Neutralization - Two-Step Neutralization - NPCS - Reverse-Neutralization etc. 		N/R
Flucculant	<ul style="list-style-type: none"> - Anionic polymer - Cationic polymer - Nonionic polymer etc. 		N/R
Sedimentation	<ul style="list-style-type: none"> - Thickner - Sedimentation Pond 		- Dredging of sedimentation sludge of pond
Sludge Disposal	Dewatering	- Cake	<ul style="list-style-type: none"> - Dam (Truck, Belt conveyer) - Industrial waste disposal (Truck)
	No-Dewatering	- Slurry	<ul style="list-style-type: none"> - Dam (pump, tank truck) - Industrial waste disposal (tank truck)
Treated Water	- Filtering by Sand Filter		<ul style="list-style-type: none"> - Tower (by Pressure) - Tank (by gravity)
	- No-Filtering		N/R

An Example of Flow Sheet for AMD Treatment

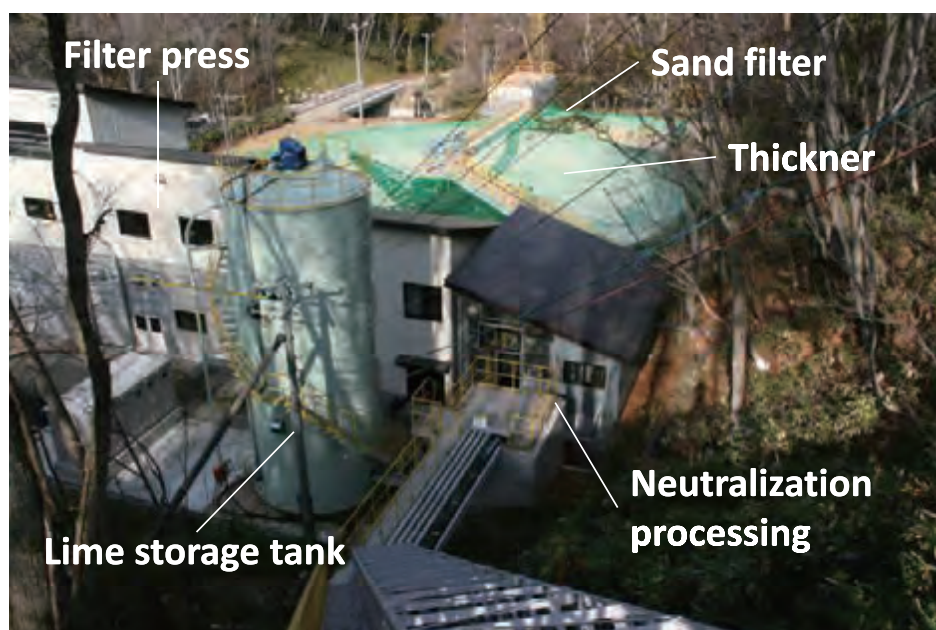


AMD Treatment flow

Japanese private companies and consultants in respect to the mining and water treatment area have good experiences for the AMD treatment and the planning

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An Example of Treatment Facility to improve AMD



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Other Examples of Management for Closed Mines - Reforestation -



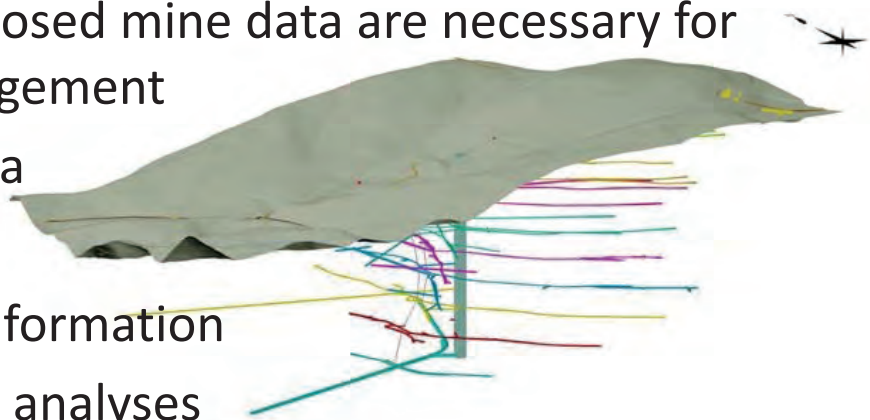
- Soil can be easily eroded by weathering
- Vegetation assists to prevent acid infiltration water
- Landscape would be improved as well



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Other Examples of Management for Closed Mines - Data configuration -

- Existing closed mine data are necessary for the management
- These data are used for basic information to conduct analyses the prevention of pollutions



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Overview of Mine Safety

(1) Safety hazard control to people working

in the mine site.

- * Roof fall, collapse, flush flood, gas explosion, etc.
- * Gas and dust, rock waste, tailings, mine water, etc.
- * Use of machines, etc. and treatment of gunpowder.
- * Ventilation for health and first aid at disaster.

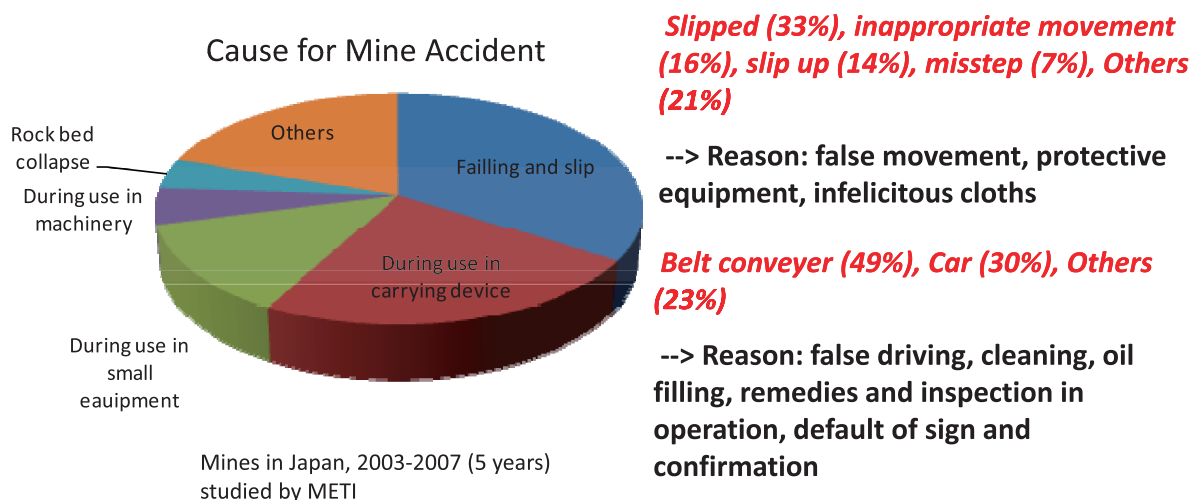
(2) Protection of mineral resources

(3) Prevention of mine facilities

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Mine Accidents

What kind of accident happens in mines?



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Mine Safety: Countermeasures

Control artificial accident (safety equipment)



Captured from JOGMEC

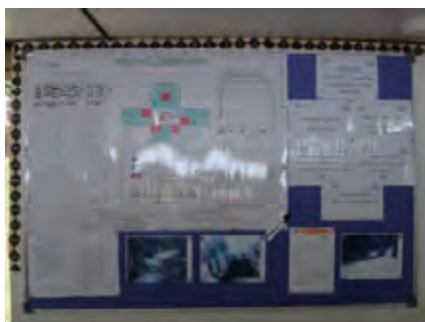


Figures are from JSAA

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Mine Safety Training

*Control
artificial accident
(Safety meetings on
daily and monthly)*



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Risky Mining and Operation (need improvement for the safety)



There are no strong pillars, digging only



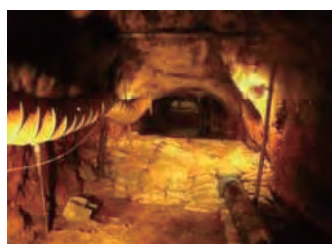
There are no safety fences for facilities

*Internal references JICA Seminar for
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Mine Safety in Underground Control engineered accidents (for rock falling and inundation in underground)



*After
the accident*



*Construction
and improvement*



Internal references

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Mine Disasters

Control engineered accidents (for underground and open pit)



Control ground water and avoid rock falling in the underground by well maintained tunnel systems

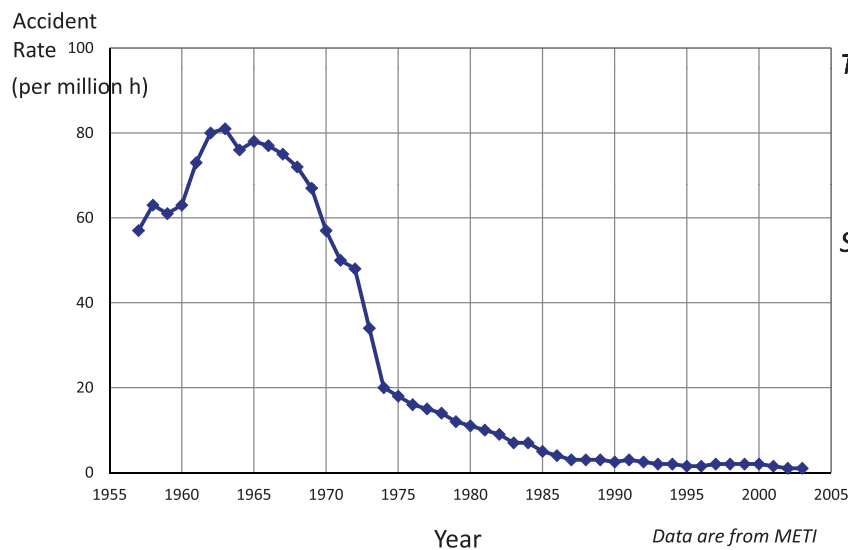


Control rock falling in the open pit by using monitoring system

Internal references

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Mine Safety Measures Mining accident rate in Japan (rate per million hour operation)



The rate of mining accident has been degraded from mid of 70's

Safety managements are well controlling in the related company and government from the 70's

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For Conduct of the Sustainable Mining

Key points of view are summarized as follows;

- To respect regulations
- To respect social and environmental responsibility
- To establish total management systems in respect to the mining including closure
- To keep profits for the all



Issues of mine environment in the developing and industrializing Countries

Following considerations would be needed to be solved for the issues,

- To adjust regulations for the mining and mine environment
- To learn and develop concerned person's skill for the analysis of mining and the environment
- To gain the opportunities for the upskilling
- To gather experiences for the above
- etc....

JICA Strategy in Mining Sector

The strategy is able to assist the improvement in the issues through the schemes

I

Infrastructure and
Regional Development

II

Policy Support and
Legal System
Development

III

Mineral Resource
Management

IV

Mine Safety and
Environmental
Measures for Mines

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*Watarase Pond and Ashio Mountain
50km north from Tokyo*

Thank You

Watarase Flood Control Pond was inscribed as
a registered wetland under **the Ramsar Convention**
on July 2012, which the time to improve reached
90 years after the construction to prevent flow out mine
waste water from **the Closed Ashio Copper Mine**

This photo was captured from HP of the Tochigi City

<http://www.city.tochigi.lg.jp/hp/menu000010000/hpg000002085.htm>