UNECE Safety Guidelines and Good Practices for Tailings Management Facilities and lessons learned from past tailings accidents in the UNECE region, including in view of NaTech risks

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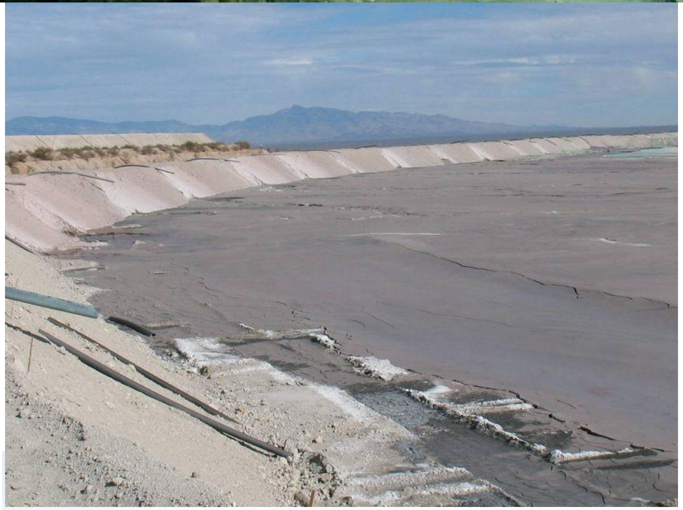
Motto

Satellite imagery has lead us to the realization that tailings facilities are probably the largest man-made structures on earth.

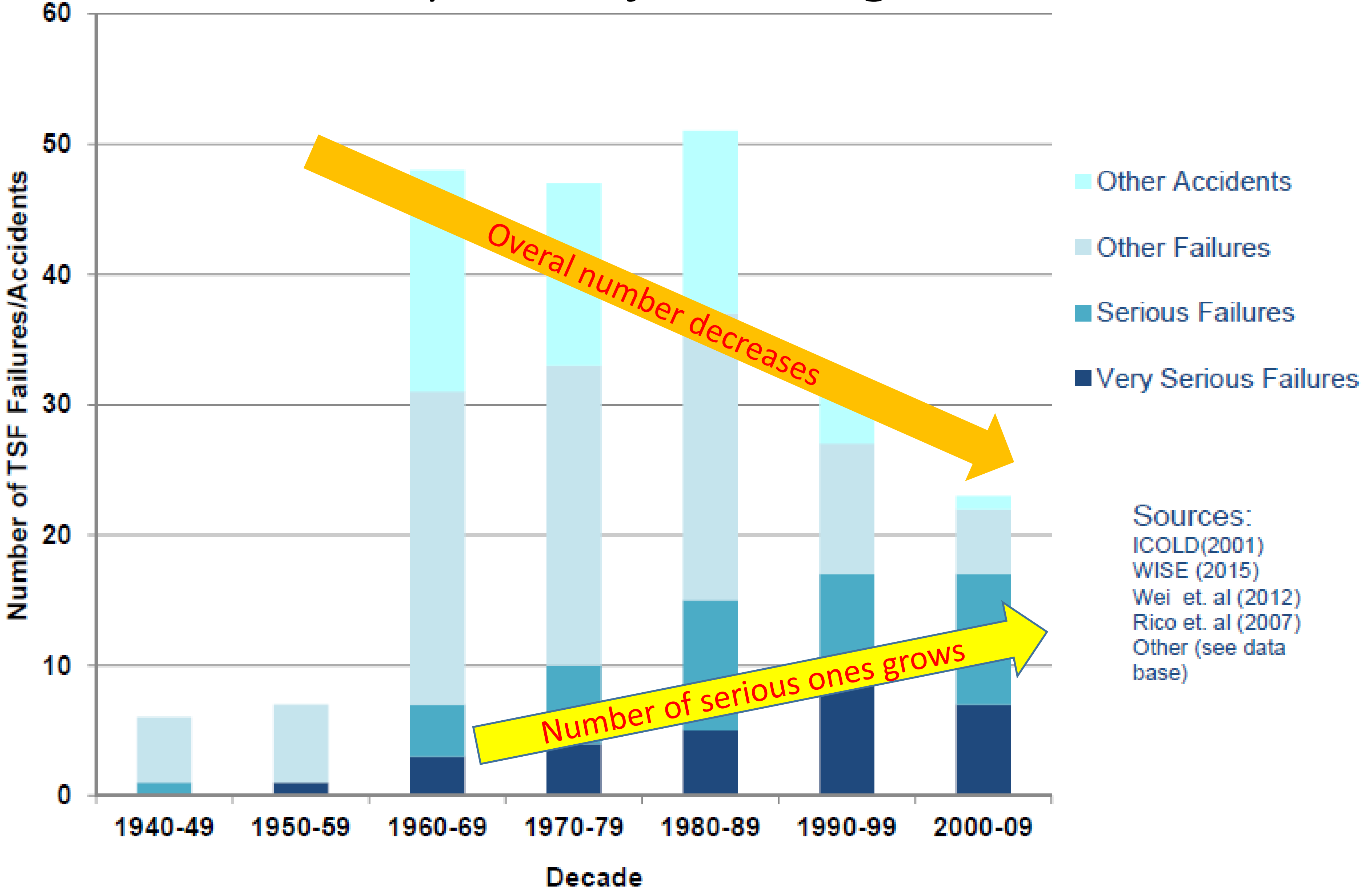
Their safety, for the protection of life, the environment and property is an essential need in today’s mining operations.

These factors, and thev elatively poor safety record revealed by the numbers of failures in tailings dams have led to an increasing awareness of the need for enhanced safety provisions in the design and operation of tailings dams.

ICOLD 2001



History of major tailing dams accidents



Sources:
ICOLD(2001)
WISE (2015)
Wei et. al (2012)
Rico et. al (2007)
Other (see data base)

Some examples and case studies in Europe

- Kolontár (Aika) 2010
- Stava 1985
- Baia Mare 2000
- Los Frailes 1998
- Atik 2000

Kolontár (Ajka), Hungary 4.10.2010: "Redsludge" tragedy

On 4 October 2010, a “red mud” spill had occured following a tailings pond failure at an aluminum processing plant in Hungary.
Red mud driven by the pond water flooded downstream 2 villages and travelled through a creek leading to the Danube River, approx. 160 km.

Source: Dr. C. Zanbak, TCMA report

Kolontár (Ajka), Hungary

Kolontár (Ajka),
Hungary

Effect of sludge

Lessons learned from Ajka accident

- The information that content of the tailing is not characterized as „hazardous“ does not assure safety
- Behaviour of sludge as pH, particulates, viscosity, inertial force etc. must be evaluated as well
- Signs of coming accidents were overviewed and neglected
- Without real emergency plan, efficiency of accident mitigation may be very limited

Case study: STAVA

On July 19, 1985, a fluorite tailings dam of Prealpi Mineraia failed at Stava, Trento, Italy. 200,000 m3 of tailings flowed 4.2 km downstream at a speed of up to 90 km/h, killing 268 people and destroying 62 buildings. The total surface area affected was 43.5 hectares.

Stava accident

- The tailings dam consisted of two basins built on a slope. The failure with a collapse of the up-slope basin. The inflow of the released material caused the overtopping and subsequent collapse of the lower basin.
- Dams were constructed with an unacceptably low factor of safety and that the failure probably was triggered by a blocked decant pipe located within the tailings.

Stava lessons learned

- Tailing location had been badly chosen in view of the vulnerability of the downstream town and hotels.
- Bad safety management

Case study:

BAIA MARE

January 30, 2000 in Baia Mare (Romania)

the biggest freshwater disaster in Central and Eastern Europe.

Nearly 100,000 m3 of cyanide and heavy metal-contamined liquid spilled into the Lupus stream, reaching the Szamos, Tisza, and finally Danube rivers and killing hundreds of tones of fish and poisoning the drinking water of more than 2 million people in Hungary.

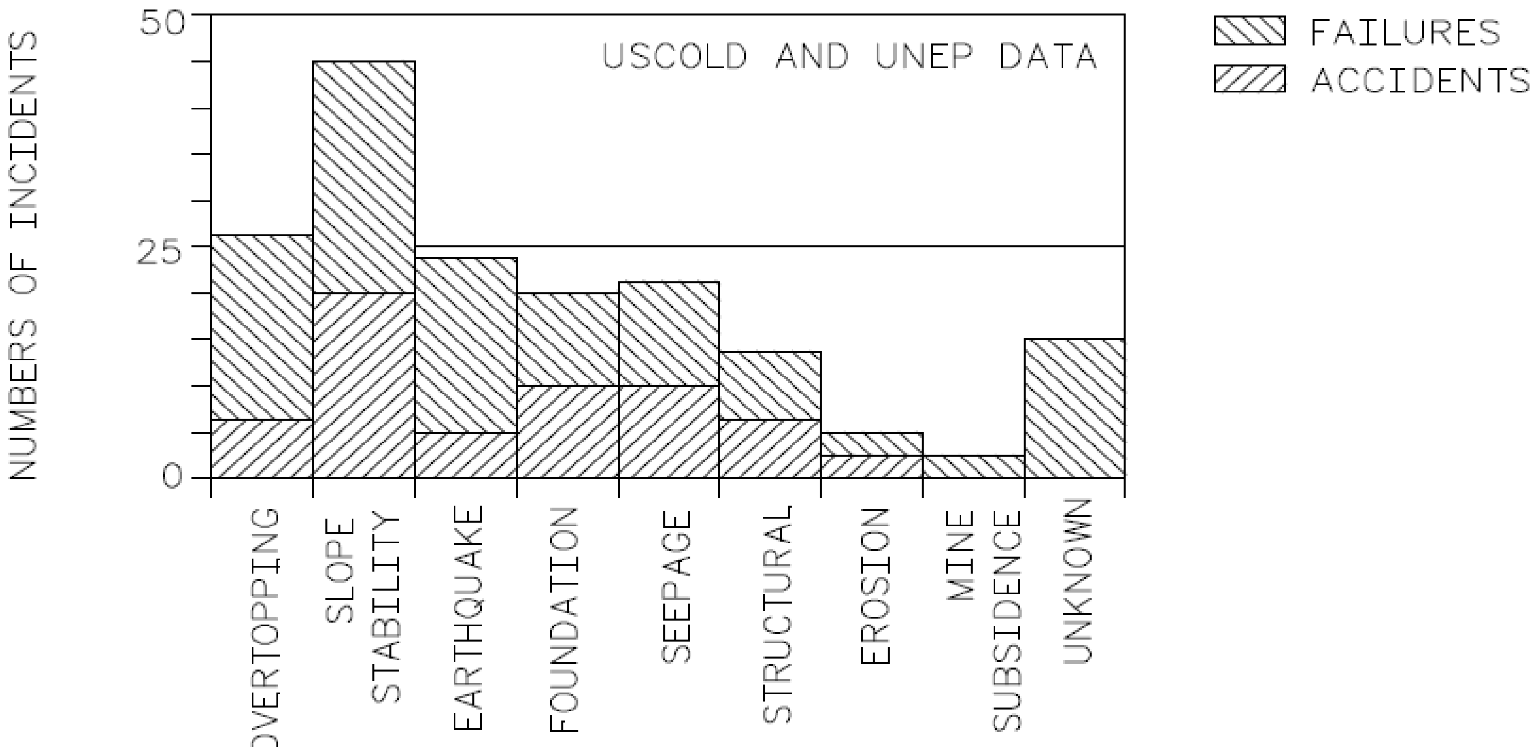
VARIABILITY OF CAUSES OF ACCIDENT

- Inadequate management
- Lack of control of hydraulical system
- Error in site selection and investigation
- Unsatisfactory foundation, lack of stability of downstream slope
- Seepage
- Overtoping
- Earthquake
- Landsliding

MAIN ROOT CAUSE:

RISK ANALYSIS AND MANAGEMENT NEGLECTED

Distribution of causes of tailing dams accidents



Tailings dam incident cause comparison with incident type for active dams.

Source: ICOLD Bulletin 121

VARIABILITY OF CONSEQUENCES

1. Flooding, wave of slurry
2. Contamination of surface water, living organisms intoxication
3. Drinking and irrigation surface water contamination
4. Drinking and irrigation underground water contamination
5. Soil contamination
6. As consequence of 2),3),4)ad.5 : Food chain contamination

» **FREQUENTLY INVOLVES TRANSBOUNDARY EFFECT**

CONSEQUENCES II:

- Consequences to human lives, health and well being.
  Evaluation of consequences with stakeholders necessary
- Direct costs (remediation, compensation, ...)
- Social disturbance
- Consequence to environment – short time and long time impacts
- Economical consequences and operability
- Indirect costs

Costs of TMF Failures

Physical failure: recent large failures $30 to $100 millions in direct costs

Environmental failure: some recent clean-up liabilities to several $100's of millions

Closure liability: some recent examples in $ 500 milon to $ 4 billion range

Industry/investor impacts: Shareholder value losses and industry imposed constraints and costs amounting to many billions of dollars

Emergency preparedness needs

- Preparedness to accident, even with low probability
- Early warning system necessary
- Training and not only desktop one
- Information of all subjects potentially involved
- Crisis management including training
- Open and honest communication with municipalities, emergency response teams, government bodies (inspection…)
- Communication with media

What is needed in the case of accident ?

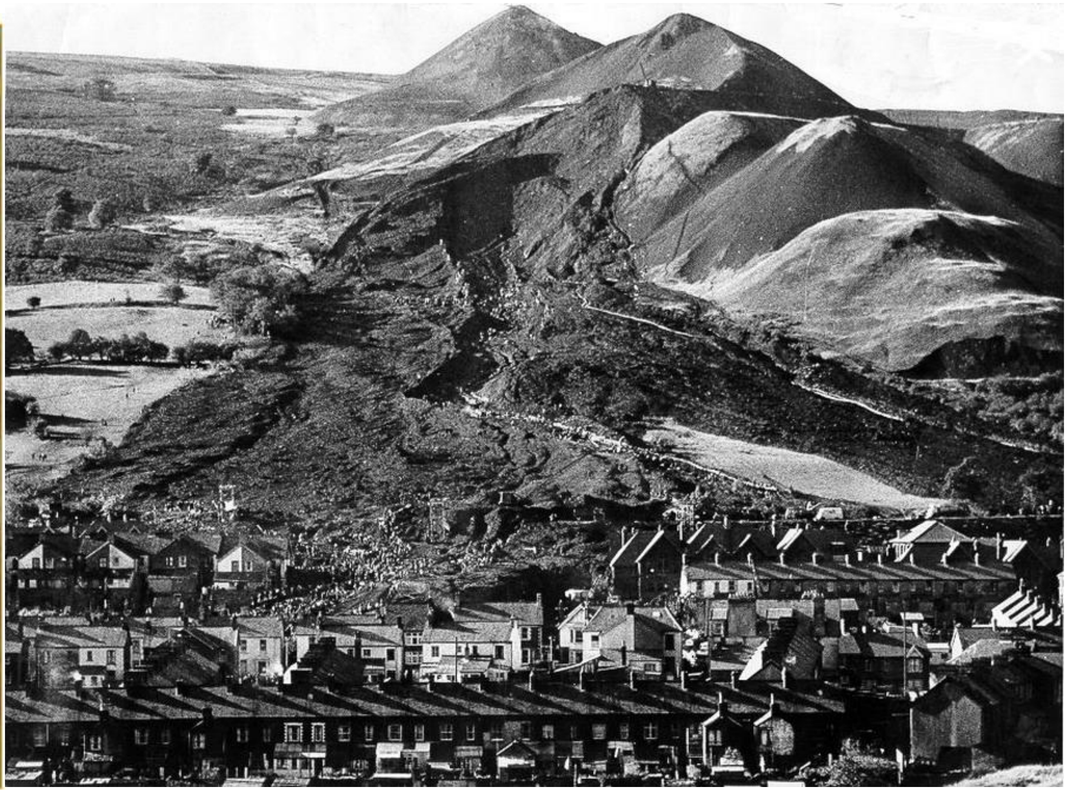
One mythus:

We will manage accident by improvisation…

Another mythus:

„We operate it long time without any accident, so safety is prooved“

Lassing Talk Mine, Austria 1998



Aberfan, Wales (UK) 1966

What is it „NATECH“?

Natural hazard triggered technological accident

Source: JRC Ispra

NATECHs and TMF accidents

example: Baia Mare

Source: JRC Ispra


Flood, 2007


Earthquake, 2011

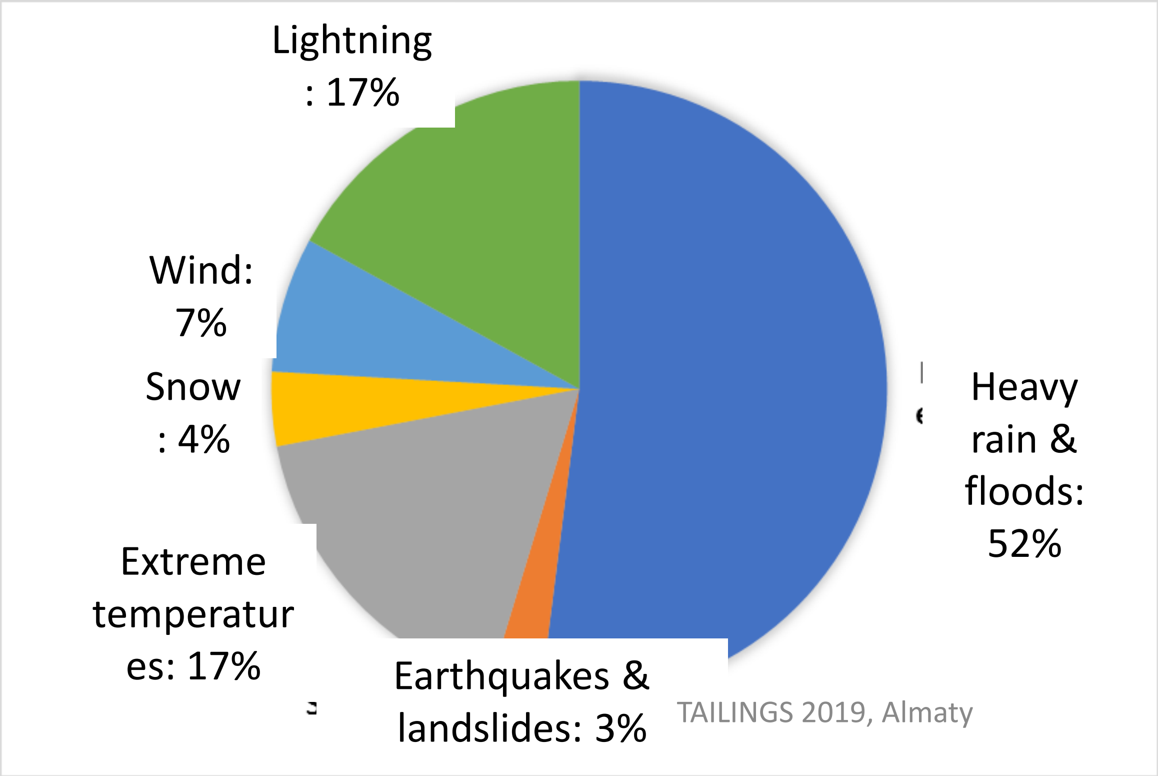
Hurricane, 2005


Landslide, 2013

Source: JRC Ispra

French experience – dabase BARPI /MoE

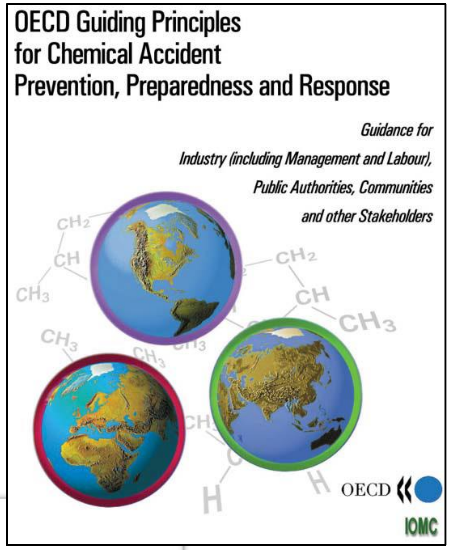
- Represent about 5% of the known industrial accidents in France
- The BARPI lists 920 NaTech accidents between 1992 et 2012 in its ARIA database.



Near-miss: Ostramo waste deposit

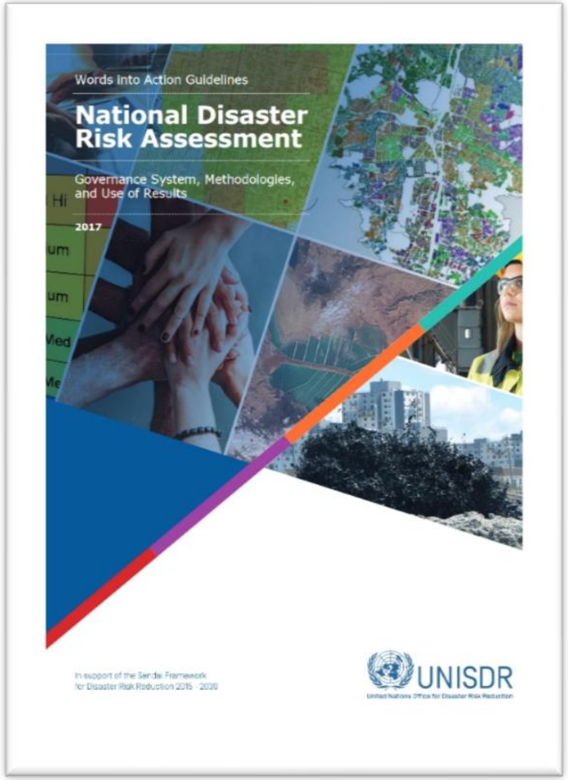
Some international actions

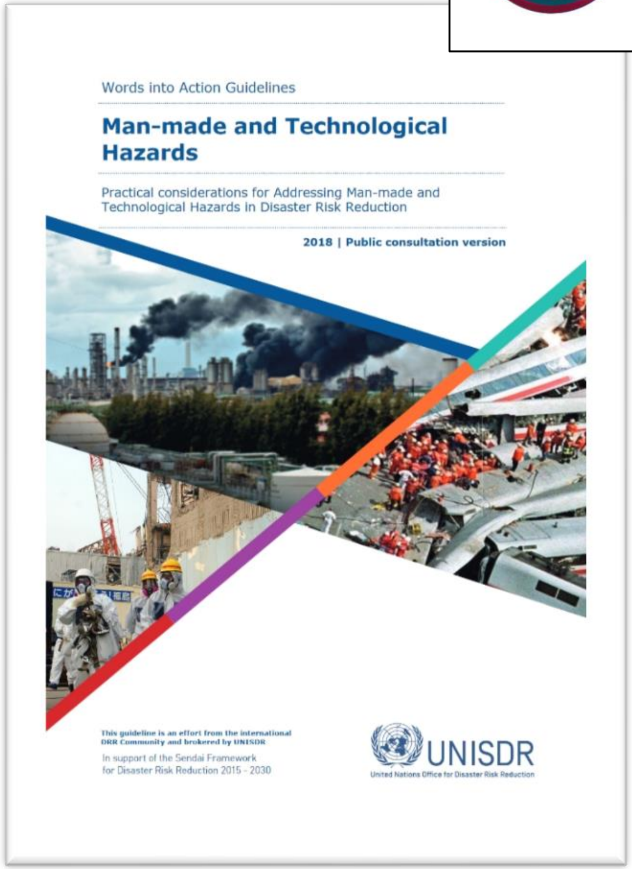
- The OECD Guiding Principles on Chemical Accident Prevention, Preparedness and Response:
  Chapter 18 Natechs (2nd Addendum 2015)



- UNDRR (formely UNISDR)

actions





Exchange of experiences and good practices

Seminar on Land-Use Planning & Industrial Safety
16-17th May 2018 in Mechelen, Belgium. Co-organized by UNECE, the government of Flanders (Belgium) and the EIB, with participation by UNISDR.

UNECE Flanders State of the Art European Investment Bank The EU bank UNISDR The United Nations Office for Disaster Risk Reduction

Seminar on Risk Assessment Methodologies under the Convention on the Transboundary Effects of Industrial Accidents
4th December 2018. Organized by UNECE, with participation by UNISDR.

UNECE UNISDR The United Nations Office for Disaster Risk Reduction

Development of UNECE guidance materials

available usually in Russian language as well

- **Safety Guidelines and Good Practices for Tailings Management Facilities**
- **Improving the safety of industrial tailings management facilities based on the example of Ukrainian facilities**
- Guidance on Land-Use Planning, the Siting of Hazardous Activities and related Safety Aspects
- Overview of Methodologies for Hazard Rating of Industrial Sites
- Sectoral Checklist for Preparation and Inspection of a Safety Report
- Guidelines (to the Sectoral Checklist) for Preparation and Inspection of a Safety Report

Conclusions

- Tailing facilities are necessary for industrial development, but without proper safety management they can cause major accidents
- To ensure safety, overall process of risk management including both prevention and preparedness should be applied and continuously improved
- International experience sharing, good practices exchange and cooperation is one from keys for success

Thank you for your kind attention