Preventing Water Pollution Based on the UNECE Safety Guidelines and Good Practices for Tailings Management Facilities

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Content

- Introduction.
- UNECE Safety Guidelines as a tool for preventing TMF accidents.
- The GEA project to develop TMF Methodology based on the example of Ukrainian facilities (2013-2015).
- The TMF Methodology as the key product of the GEA project.
- Application and improvement of the TMF Methodology within the education project of GEA on TMF safety at National Mining University (Ukraine).

GEA = German Environmental Agency
TMF = Tailings Management Facilities
Introduction

• Dramatic growth of mining waste amount in the world last decades.


Volumes of different mining wastes in the world (G.V. Mudd, 2007)

The TMF at Ajkai (Hungary) after the dam failure (2010)

The river after dam failure at the TMF of Ridder in East Kazakhstan (2016)
Introduction.
Incidents at TMFs in XX-th Century
(ICOLD Bulletin No. 121)

- Dramatic increase in the mid 1960s due to the intensive development of mining industry and creation of a large number of TMFs,
- Reducing number of incidents since 1990s due to the introduction of stricter safety standards, contraction of mining production in some countries, the introduction of new technologies of sustainable mining.
Introduction.
Environmental After-effects of TMF Accidents

- Releases of heavy metals and other contaminants to rivers and seepage to groundwater.
- Acidification of rivers.
- Growth of organic micro-pollutants.
- Biota degradation.
UNECE “Safety Guidelines and Good Practices for Tailings Management Facilities”

- The Guidelines were developed by the Joint Expert Group on Water and Industrial Accidents, with the support of the United Nations Economic Commission for Europe (UNECE) secretariat.
- The Guidelines were endorsed by the Conference of the Parties to the Industrial Accidents Convention (2008) and by the Meeting of the Parties to the Water Convention (2009).
- The document was updated in 2014.
### Issues Addressed

<table>
<thead>
<tr>
<th>Part A</th>
<th>Part B</th>
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<tr>
<td>• Safety principles for tailings management facilities,</td>
<td>Technical and organizational aspects such as</td>
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<td>• Recommendations to member countries, competent authorities, and</td>
<td>• pre-construction and construction,</td>
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<td>tailings management facility operators.</td>
<td>• operation and management,</td>
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<td></td>
<td>• facility inspections,</td>
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<td>• identification, assessment and management of abandoned sites,</td>
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<td>• internal and external emergency planning.</td>
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The Project to Develop the TMF Methodology

In 2013 German Environmental Agency has started a project in Ukraine to develop a **Methodology to improve the safety of tailings management facilities** as a practical tool for the implementation of the UNECE Guidelines with minimum requirements to tailings safety.

**INITIATOR**

United Nations Economic Commission for Europe (UNECE)

**SUPPORT**

International Commission for the Protection of the Danube River (ICPDR)
The Project to Develop the TMF Methodology

Contractor

- International HCH and Pesticides Association (IHPA), Denmark

Executors

- Ukrainian project team (5 people)
- A group of international experts from 11 countries including Armenia, Austria, Czech Republic, Georgia, Finland, Germany, Hungary, Romania, Sweden, Switzerland, and the USA.

Host country

- Ukraine
The Project to Develop the TMF Methodology

Project Products

TMF Methodology

Method of Evaluation “Tailings Hazard/risk Index” (THI)

is intended for prompt preliminary evaluation of tailings hazard for the large amount of TMFs on the national/regional level

TMF Checklist

is developed for evaluation of the safety level of individual TMFs
Project Products. Tailings Hazard Index (THI)

**THIBasic**
- **THICap** is the hazard caused by the amount of tailings materials (TMF capacity)
- **THITox** is the hazard caused by toxicity of substances contained in tailings

**THIExtended**
- **THICap** is the hazard caused by the amount of tailings materials (TMF capacity)
- **THITox** is the hazard caused by toxicity of substances contained in tailings

**THI**
- **THIManag** is the hazard caused by improper management of facilities
- **THISite** is the hazard induced by siting the TMF in the area with specific geological and hydrological conditions
- **THIDam** is the dam failure hazard (weaknesses in structural and component integrity and functionality)
Project Products.
Ranking 153 Ukrainian TMFs by THI<sub>EXTENDED</sub>

Minimum value of THI is 5.2
Maximum value of THI is 15.3

<table>
<thead>
<tr>
<th>THI&lt;sub&gt;Extended&lt;/sub&gt; value</th>
<th>TMF quantity</th>
</tr>
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<tbody>
<tr>
<td>below 6</td>
<td>11</td>
</tr>
<tr>
<td>from 6 to 8</td>
<td>42</td>
</tr>
<tr>
<td>from 8 to 10</td>
<td>47</td>
</tr>
<tr>
<td>from 10 to 12</td>
<td>38</td>
</tr>
<tr>
<td>over 12</td>
<td>15</td>
</tr>
</tbody>
</table>
Project Products. Map of 153 Ukrainian TMFs Ranked by THI$_{EXTENDED}$
Project Products. Locations of 15 Most Potentially Hazardous Ukrainian TMFs
**Project Products. TMF Checklist**

**TMF Checklist** is based on minimum safety requirements adopted in the UNECE «Safety guidelines and good practices for tailings management facilities».
Project Products. Evaluation Matrix

Evaluation Matrix includes the criteria for:
- Answer interpretation and quantification;
- Overall and categorial evaluation;
- Assessment of evaluation credibility.

The overall safety level summarizes numerical contributions of all answers to Checklist questions.

The categorial evaluation reveals the TMF safety in different aspects and details of TMF performance.
**Project Products. Measure Catalogue**

- Measure Catalogue includes the list of actions to be taken in case of establishing incompliances of TMF conditions to applicable safety requirements or regulations.
- Measure Catalogue includes the measures from the UNECE “Reference Document on Best Available Techniques for Management of Tailings and Waste-Rock in Mining Activities” and successful national practices in post-mining environment restoration.

<table>
<thead>
<tr>
<th>#</th>
<th>Problem to be solved</th>
<th>Measures prescribed</th>
<th>Priority</th>
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<tbody>
<tr>
<td><strong>1</strong></td>
<td>Design documentation is incomplete</td>
<td><strong>1A.</strong> Update design documentation made by a licensed company</td>
<td>Short-term</td>
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<tr>
<td></td>
<td></td>
<td><strong>1B.</strong> Update design documentation involving licensed and skilled staff</td>
<td>Short-term</td>
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<td></td>
<td></td>
<td><strong>1C.</strong> Perform expert analysis of design documents for authorities</td>
<td>Short-term</td>
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<tr>
<td></td>
<td></td>
<td><strong>1D.</strong> Prepare or complete design documentation according to regulatory requirements</td>
<td>Short-term</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>1E.</strong> Prepare a detailed map of the TMF site and the surrounding area</td>
<td>Short-term</td>
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</table>
Project Products. Advantages of the Developed TMF Checklist in MS Excel template

- Automatic Check of Answers
- Momentary Calculation of the TMF safety level
- Links to the recommended measure list, which facilitates prescription of measures for each specific case
**Location.** Ivano-Frankivsk region 0.85 km from the city of Kalush,  
**Name.** TMF No. 2 of State Enterprise “Potassium Plant” JSC “Oriana”  
**Constructed in 1984**  
**Tailing materials.** Solid waste of potassium production including halite, sludge, gypsum and brines  

**Waste volume.**  
Solid phase $9 \times 10^6 m^3$; liquid phase $1.7 \times 10^6 m^3$  

**Kalush TMFs threat to**  
• local aquifers  
• and rivers in the Dniester basin
TMF Checklist Application for the Kalush Site

2010 Emergency situation declared
2011 Recommendations of UN OCHA mission for assistance given what has to be done
2014 TMF project experts stated no progress in the site safety level except elimination of non-TMF HCB waste
TMF Checklist Application for the Kalush TMF Site

Overall evaluation

Credibility, 58.2%
Overall Safety evaluation 51.7%

Categorial evaluation
Education project of GEA on TMF safety at National Mining University (Ukraine) as the current activities

Raising Knowledge among Students and Teachers on Tailings Safety and its Legislative Review in Ukraine

**Contractor**
- National Mining University (Dnipro, Ukraine)

**Host country**
- Ukraine

**Duration**
- June 2016 – May 2017
Education project of GEA on TMF safety at National Mining University (Ukraine)

**Project Participants**

- Ukrainian project team (5 people)
- Tutors and trainees from 4 universities of the city of Dnipro (24 people)
- Ukrainian experts (10 representatives of competent authorities)
- International experts in tailings safety including Joint Expert Group of UNECE
- TMF operator representatives
Education project of GEA on TMF safety at National Mining University (Ukraine)

Project Objectives

- Dissemination of the TMF Methodology among its potential users
- Familiarization of the target audience with European principles of the TMF safety (UNECE “Safety Guidelines and Good Practices for TMFs”)
- Adaptation of the education course to the audience (students and teachers of universities, state inspectors, and TMF operating staff)
- Increase of the qualification level through training modules that comprise both theoretical lectures and practical exercises including TMF site visits
Education project of GEA on TMF safety at National Mining University (Ukraine)

First Training
3–7 October 2016

- Lectures on the TMF Methodology
- Site visit to the TMF
- Filling in the TMF Checklist (visual inspection)
- Presentation on TMF safety level evaluation

Second Training
22–26 November 2016

- Lectures on THI method and Legislative review
- Filling in the TMF Checklist (check of documentation)
- Presentation on TMF safety level evaluation
Education project of GEA on TMF safety at National Mining University (Ukraine)

Two project components

1. Training on TMF Methodology application
   - Education on-line training course on TMF Methodology
2. Review of Competent authorities' strategy on TMF issues in terms of the Ukraine's European integration course
   - Proposals for TMF Methodology improvement
   - Roadmap containing Action plan for implementation of Directive 2006/21/EC through the instrumentality of UNECE TMF Guidelines

Expected results

- Education on-line training course on TMF Methodology
- Proposals for TMF Methodology improvement
- Roadmap containing Action plan for implementation of Directive 2006/21/EC through the instrumentality of UNECE TMF Guidelines

Follow-up activities

- Education course inclusion in university curricula
- Application of the education course on the level of UNECE IAC and UNDP
- TMF Methodology improvement
- Creation of Ukrainian National Training Center on TMF problems
- Implementation of Action plan under Directive 2006/21/EC
You are kindly invited to take part in the Final International Workshop within the project “Raising Knowledge among Students and Teachers on Tailings Safety and its Legislative Review in Ukraine” at National Mining University to be held in Dnipro (Ukraine) on May, 17-18 2017.

Learn more about the TMF Methodology and current project activities on our website www.tmf-ukraine.org.
Thank you for your attention!

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