

TEXTE

34/2018

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

TEXTE 34/2018

ADVISORY ASSISTANCE PROGRAMME (AAP)

of

the Federal Ministry for the Environment, Nature
Conservation and Nuclear Safety

Project No. 72963

Report No. (UBA-FB) 002638/E

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

by

Dmytro Rudakov

State Higher Educational Institution “National Mining
University”, Dnipro, Ukraine

In cooperation with

Iryna Nikolaieva

Ecoplatform LLC, Kyiv, Ukraine

On behalf of the German Environment Agency

Report completed in November 2017

Imprint

Publisher

Umweltbundesamt
Wörlitzer Platz 1
06844 Dessau-Roßlau
Tel: +49 340-2103-0
Fax: +49 340-2103-2285
info@umweltbundesamt.de
Internet: www.umweltbundesamt.de

[f/umweltbundesamt.de](https://www.facebook.com/umweltbundesamt.de)

[t/umweltbundesamt](https://twitter.com/umweltbundesamt)

Report performed by:

State Higher Educational Institution “National Mining University”
19 D. Yavornitsky Av.
Pos Dnipro
Ukraine

Ecoplatform LLC
5a Dobryi shliakh Str.
Kyiv
Ukraine

Report completed in:

November 2017

Edited by:

Section I 1.2 International Sustainability Strategies, Policy and Knowledge Transfer
Dr. Sonja Otto
Section III 2.3 Safety of Installations
Gerhard Winkelmann-Oei

Publication as pdf:

<http://www.umweltbundesamt.de/publikationen>

ISSN 1862-4804

Dessau-Roßlau, April 2018

This project was financed by the German Federal Environment Ministry’s Advisory Assistance Programme (AAP) for environmental protection in the countries of Central and Eastern Europe, the Caucasus and Central Asia and other countries neighbouring the EU. It was supervised by the German Environment Agency.

The responsibility for the content of this publication lies with the author



Federal Ministry
for the Environment, Nature Conservation
and Nuclear Safety

Abstract

State HEI "National Mining University" (Dnipro, Ukraine) and LLC "Ecoplatform" (Kyiv, Ukraine) have carried out the Project "Raising Knowledge on Tailings Safety and its Legislative Review in Ukraine", which encompasses two components: educational and legislative. It is implemented within the framework of the Advisory Assistance Programme (AAP) of the German Federal Environment Ministry for environmental protection in the countries of Central and Eastern Europe, the Caucasus and Central Asia and other countries neighbouring the European Union.

Tailings management facilities (TMFs) store large amount of mining wastes, which can become a source of environment contamination, damaging biota and affecting human health. In Ukraine 344 officially known TMFs are potentially dangerous for humans and environment. Based on the *UNECE Safety Guidelines and Good Practices for TMFs*, the previously developed *Methodology for improving TMF safety* as well as a *Tailings Hazard Index (THI)* to evaluate and establish a common safety standard in TMFs addresses this problem with a sustainable solution.

To address the problems related to TMFs in Ukraine on a practical level, the Project intended to raise knowledge on TMF safety among Ukrainian students of environmental and mining sciences. For this purpose, relevant courses given by leading international and national experts in industrial safety have provided both theoretical and practical trainings on the above-mentioned instruments.

The Project team developed an educational course on TMF safety for the inclusion in the curricula of participating universities and to the state educational programmes that was appreciated by the relevant ministries and universities. A new e-learning tool based on the TMF Methodology tested on the NMU online platform has proved its appropriacy for further use and applications, providing its long-term existence.

In addition, the Project team reviewed the legislative background of Ukraine on the management of mining waste. The review revealed how Ukraine fulfils the requirements of the EU-Ukraine Association Agreement and its obligations under Directive 2006/21/EC on the management of waste from extractive industries, and suggested a roadmap and recommendations on the improvement of TMF safety management in Ukraine. Based on the results of the review, an Action Plan for implementation of the Directive in Ukraine was proposed and approved by the relevant national authorities.

This summary compiles the most important Project results, which showed that the sustainable solution of the TMF problems in Ukraine is possible by addressing the TMF issue on the practical and legislative levels. The results of the Project will be valuable for universities, training students in mining and environmental sciences worldwide, and for the countries facing similar environmental problems caused by mining activities.

Kurzbeschreibung

Im Rahmen des Beratungshilfeprogramms (BHP) für den Umweltschutz in den Staaten Mittel- und Osteuropas, des Kaukasus und Zentralasiens sowie weiteren an die EU angrenzenden Staaten – ein Programm des Bundesministeriums für Umwelt, Naturschutz, Bau und Reaktorsicherheit wurde das Projekt „Anlagensicherheit und ihre legislativen Rahmenbedingungen, ein Lehrgang für Studenten und Lehrkräfte in der Ukraine“ implementiert.

In der Ukraine gibt es 344 offiziell bekannte industrielle Rückhaltebecken (IRB), die potentiell gefährlich für Mensch und Umwelt sind. Auf der Grundlage der *UNECE-Sicherheitsrichtlinien für IRBs* entwickelte das Beratungshilfeprojekt "Verbesserung der Sicherheit industrieller Abwassermanagement-systeme am Beispiel ukrainischer Anlagen" schon 2015 eine *Methodik zur Verbesserung der IRB-Sicherheit* sowie einen *Tailings Hazard-Index (THI)* zur Bewertung und Etablierung eines gemeinsamen Sicherheitsstandards in IRBs.

Um die Probleme im Zusammenhang mit IRBs in der Ukraine auf einer praktischen Ebene zu lösen, wurde ukrainischen Studenten der Umwelt- und Bergbauwissenschaften die Möglichkeit geboten ihre Kenntnisse über IRB-Sicherheit zu vertiefen. Schulungen, welche unter Einbindung nationaler und internationaler Experten für Anlagensicherheit entwickelt wurden, boten dazu den theoretischen und praktischen Rahmen. Der im Projekt entwickelte Studiengang wurde für die Aufnahme in die Lehrpläne der beteiligten Hochschulen und für die Umsetzung im staatlichen Bildungsprogramm vorgeschlagen. Dies wurde von den verantwortlichen Ministerien offiziell gewürdigt. Neben dem analogen Kursprogramm liegt nun auch eine e-learning Plattform vor, welche von den Projekttrainees mehrerer Universitäten getestet und verbessert wurde. Darüber hinaus analysierte das Projekt inwieweit die Ukraine ihre Verpflichtungen aus der EU-Richtlinie 2006/21/EG über die Bewirtschaftung von Abfällen aus der mineralgewinnenden Industrie erfüllt, die Teil der Anforderungen des Assoziationsabkommens mit der EU ist. Ein entsprechender Aktionsplan zur Umsetzung der Richtlinie wurde den zuständigen nationalen Behörden vorgelegt.

Table of Contents

List of Figures.....	7
List of Tables.....	8
List of Abbreviations.....	9
Summary.....	10
Zusammenfassung.....	13
Resume (in Ukrainian)	17
Resume (in Russian).....	21
1 Introduction.....	25
1.1 Background.....	25
1.2 Aim and tasks of the Project	26
1.3 Brief Project Information	27
2 Project activities	29
2.1 Preparatory works.....	29
2.1 Starting workshop	32
2.2 First training	33
2.3 Second training.....	34
2.4 Round table on the strategy of competent authorities on TMF issues	35
2.5 Final workshop	36
3 Achieved results.....	38
3.1 Educational Project component.....	38
3.1.1 Training course on TMF safety	38
3.1.2 E-learning course “Safety of tailings management facilities”	39
3.2 Legislative Project component.....	41
3.2.1 Report on the implementation of EU requirements on TMF safety by Ukraine: EU Directives, UNECE Guidelines and TMF Methodology.....	41
3.2.2 Methodology for Comprehensive Evaluation of Tailings Management Facilities Safe- ty – updated version 2017	42
3.2.3 Updated Ukrainian TMF database.....	44
3.2.4 Recommendations on Improving Tailings Safety Management System	46
4 Evaluation of Project results.....	47
4.1 Dissemination of Project results	50
4.2 Evaluation of the Project by the beneficiaries	53
4.2.1 Ministry of Ecology and Natural Resources of Ukraine	53

4.2.2	Ministry of Education and Science of Ukraine.....	54
4.3	Estimation of the potential impacts of the Project.....	55
5	Conclusions and recommendations	56
6	Proposals on Project follow up activities.....	58
6.1	Proposals on follow up activities in Ukraine	58
6.2	Recommendations for the UNECE Joint Expert Group on Industrial Accidents	58
7	List of Annexes.....	60
8	References	62

List of Figures

Figure 1:	Working packages and events held under the Project. Source: Own illustration, LLC "Ecoplatform"	29
Figure 2:	The First training stages. Source: Own illustration, LLC "Ecoplatform"	34
Figure 3:	Brief content of the training course "Safety of TMFs". Source: Own illustration, NMU, LLC "Ecoplatform"	39
Figure 4:	E-learning course structure. Source: Own illustration, NMU, LLC "Ecoplatform"	40

List of Tables

Table 1:	Brief Project Information.....	27
Table 2	Tutors and trainees participated in the Project	30
Table 3:	Round table participants	35
Table 4:	Top 10 potentially the most hazard TMFs in Ukraine	45
Table 5:	Tasks, anticipated outcomes and corresponding results	48
Table 6:	Web links to the news on the Project events.....	52
Table 7:	Media accredited by the Ministry and presented at a press briefing	53

List of Abbreviations

AAP	Advisory Assistance Programme
BAT	Best Available Technologies
CA	Competent authority
JEG	Joint Expert Group
MENR	Ministry of Ecology and Natural Resources of Ukraine
TEIA	Transboundary Effects of Industrial Accidents
TMF	Tailings management facility
THI	Tailings Hazard Index
UNECE	United Nations Economic Commission for Europe

Summary

Project background

Tailings management facilities (TMFs) store large amount of mining wastes. They have become a source of environment contamination, which damages biota and can have negative effects to human health. In many countries, tailings are still in need of taking urgent safety measures with the special attention to developing knowledge in this area of responsible persons and raising their awareness of potential risks and damages.

Ukraine is a very good example of inappropriate storage of mining wastes. The vast majority of more than 1.7 billion m³ of liquid industrial wastes in the country are stored in obsolete or abandoned facilities created over 50 years ago, not meeting modern safety requirements. The common practice of TMF construction was creation of dams across the ravines, gullies and small rivers. The bottom and borders of impoundments were not covered with waterproof screens or lined, so these TMFs became a source of ground and surface water contamination. The Ukrainian authorities need further support to achieve sustainable solutions to avoid dangerous TMF leakages on both practical and legislative levels.

Within the framework of the Project "Improving the safety of industrial tailings management facilities based on the example of Ukrainian facilities" supported by German Environment Agency and successfully performed in 2013-2015 Ukrainian experts developed a Methodology for Comprehensive Evaluation of Tailings Management Facilities Safety (TMF Methodology) based on a checklist approach. The methodology was approved by the German Environment Agency and leading international experts in the field.

The UN Economic Commission for Europe (UNECE) and the German Environment Agency called on the ECE Member States to distribute the TMF methodology for its practical use by relevant and competent authorities and TMF operators.

The main project results are:

- ▶ Legal assessment of Ukrainian legislation and administrative situation on TMFs in Ukraine
- ▶ Methodology for Comprehensive Evaluation of Tailings Management Facilities Safety

The results and conclusions of this project showed that the sustainable solution of the TMF problem in Ukraine is possible only by addressing the TMF issue on the practical level (dissemination and training of the TMF Methodology) and legislative level (review of the Competent Authorities' strategy) in equal measure.

Project essence and activities

During 2016-2017 the Project "Raising Knowledge among Students and Teachers on Tailings Safety and its Legislative Review in Ukraine" was implemented. It was funded and coordinated by German Environment Agency with the assistance of the Joint Expert Group (JEG) of the UNECE "Industrial Accident" and "Water" Convention and supported by the Ministry of Ecology and Natural Resources of Ukraine and the Ministry of Education and Science of Ukraine.

The Project consists of two Project components according to its main objectives:

- ▶ Educational component intends to raise the knowledge in the TMF safety among Ukrainian students in environmental and mining sciences and young university teachers dealing with education on environmental protection as an advanced European approach to improve safety of hazardous mining sites by a modern educational course

- ▶ Legislative component intends to improve the TMF safety level by addressing this issue on the legislative level in terms of how Ukraine fulfills its obligations under the EU-Ukraine Association Agreement, Directive 2006/21/EC on the management of waste from the extractive industries.

The activities of educational component took place at the State Higher Educational Institution “National Mining University” which specializes in training students for mining. The University is located in the city of Dnipro, which is the center of the developed mining region in Central Ukraine. Its specialists have teaching experience in relevant areas of education and participation in various international scientific and educational Projects.

LLC “Ecoplatform” implemented the legislative Project component at the national level in the capital of Ukraine, Kyiv, in coordination with the Ministry of Ecology and Natural Resources of Ukraine and representatives of all concerned authorities.

The Project activities included a Starting Workshop (July 2016, Dnipro), the First Training (October 2016, Dnipro), the Second Training (November 2016, Dnipro), a RoundTable (February 2017, Kyiv) and the Final Workshop (May 2017, Dnipro). A great number of works have been done in between and after these events. It encompasses preparation of training materials, analysing the participants’ feedback, agreeing the TMF methodology with competent authorities for its further implementation, development of an e-learning course and its integration into the teaching/learning process etc.

Educational Project component

The main Project activities in the framework of the educational Project component included conducting two trainings on TMF safety for 20 university students and 4 teachers from four universities at the National Mining University and the development of an e-learning course “Safety of tailings management facilities”.

The trainees for the trainings have been selected among students of environmental curricula related to mining, industrial safety, environment protection and restoration from the universities located in Dnipropetrovsk region: State HEI “National Mining University”, Prydniprovsk State Academy of Civil Engineering and Architecture, the National Metallurgical Academy of Ukraine and Dnipropetrovsk State Economic and Agrarian University. In total 20 trainees (5 students from each university) supervised by four tutors took part in the trainings. The trainings participants were the university students and tutors from four technical universities located in Dnipro, international and national experts including the members of UNECE Joint Expert Group on Water and Industrial accidents (JEG) and representatives of Ukrainian competent authorities on the national and regional level. International experts represented Switzerland, Belarus, Romania, Georgia, Armenia, Kyrgyz Republic, Republic of Serbia, Hungary and Austria. A TMF operator was represented by DTEK Company which is the biggest Ukrainian company in power generation. DTEK provided the opportunities for practical trainings within the Project.

The trainings comprised different types of learning activities such as lectures, reviews, visit to the TMF, interviews of TMF staff, reporting and others. Beside trainings on TMF safety held at NMU, all trainees passed a UNECE online training on industrial safety.

All the materials, formats and instruments tested during two trainings held at the NMU, were collected and aligned with the format of the e-learning course on the webpage of NMU hosted at Moodle platform¹.

¹ <http://do.nmu.org.ua/course/index.php?categoryid=281>

Legislative Project component

LLC “Ecoplatform” have fulfilled the legislative Project component in the following areas:

- ▶ Legislative assessment includes:
 - The analysis of Ukrainian legislation compliance with the requirements of Directive 2006/21/EC on the management of wastes from extractive industries
 - Brief overview of the provisions of Directive 2012/18/EC on the control of major-accident hazards involving dangerous substances (SEVESO-III Directive)
 - Ways for implementing the UNECE TMF Guidelines and TMF Methodology in Ukraine
- ▶ The Roadmap of Directive 2006/21/EC implementation through the instrumentality of UNECE Safety Guidelines and Good Practices for Tailings Management Facilities in the national legislation was developed based on the results of legislative assessment
- ▶ A Round table with the representatives of competent authorities on the implementation of Directive 2006/21/EC provisions was held aimed to unite the efforts of all responsible parties on TMF safety:
 - TMF Methodology and TMF interactive map were presented as a practical tool for implementation Directive 2006/21/EC provisions,
 - valuable feedbacks of competent authorities enabled the adaptation the TMF Methodology to be used in Ukraine as a tool to improve the safety of mining sites,
 - Resolution of the Round table was agreed by the participants as meeting results,
- ▶ LLC “Ecoplatform” drafted Recommendations on Improving Tailings Safety Management System for competent authorities according to the Resolution of the Round Table proposing the further implementation of the Project.

The Ukrainian version of the TMF Methodology was adapted for inspection bodies based on the comments received from competent authorities. The feedbacks and comments from two trainings held in Dnipro within the Project activities were taken into account to improve the TMF methodology.

LLC “Ecoplatform” in cooperation with the Ministry of Ecology and Natural Resources of Ukraine processed the Register of waste disposal sites given in reporting documents and selected appropriate objects that are considered as TMFs with relevant information. Thus, LLC “Ecoplatform” complemented the existing database of 145 TMFs from the previous UBA project with additional 199 TMFs with hazardous potential. The updated Ukrainian TMFs database containing 344 TMFs since April 2017 has been used as a data source for updating an interactive TMF map on Google Maps.

The Project document “Recommendations on Improving Tailings Safety Management System” that includes the report on the analysis of Directive 2006/21/EC implementation, TMF Methodology adapted for Ukraine, updated Database of Ukrainian TMFs was submitted to the Ministry of Ecology and Natural Resources of Ukraine. The Ministry provided the positive feedback on the Project developments with gratitude to the Project.

Resulting documents

The developed products of the Project are:

- ▶ E-learning course “Safety of tailings management facilities” developed on Moodle Platform of the National Mining University,
- ▶ Report on Analysis of Ukrainian legislation compliance with the requirements of EU law and Roadmap of its implementation in the context of improving TMFs safety (Directive 2006/21/EC, SEVESO-III Directive and TMF Safety Guidelines),
- ▶ Improved Methodology for Comprehensive Evaluation of Tailings Management Facilities Safety,
- ▶ Updated Ukrainian TMF database and an interactive map based on Google-maps,
- ▶ Recommendations on Improving Tailings Safety Management System for Ukraine.

Zusammenfassung

Projektbegründung

In den industriellen Rückhaltebecken (IRB) werden große Mengen an Bergbauabfällen aufbewahrt. Sie wurden zu Quellen der Umweltverschmutzung, die der Biota großen Schaden anrichten, sowie negative Auswirkungen auf die Gesundheit der Menschen haben. In vielen Ländern benötigen die IRBs dringende Sicherheitsmaßnahmen. Besondere Aufmerksamkeit soll dabei der Erweiterung und Vertiefung der Kenntnisse auf diesem Gebiet geschenkt werden. Von großer Bedeutung ist auch die Vergrößerung des Wissens um potenzielle Risiken und eventuelle Schäden.

Die Ukraine dient als anschauliches Beispiel dafür, wie unsachgemäß die Bergbauabfälle gelagert und behandelt werden. Meistens werden gefährliche Industrieabfälle, deren Umfang im Lande mehr als 1,7 Milliarden Kubikmeter beträgt, in veralteten, verlassenen Rückhaltebecken aufbewahrt, die vor über 50 Jahren eingerichtet wurden und den heutigen Anforderungen an Sicherheit nicht entsprechen. Bei der Errichtung von IRBs war es damals eine übliche Praxis, die Dämme in Schluchten, Tälern und an kleinen Flüssen zu bauen. Der Boden und die Ränder der Absetzbecken hatten keine wasserdichte Abschirmung oder irgendwelche andere Abdeckung. Als Folge sind sie heute die stete Quelle der Verschmutzung von Grund- und Oberflächenwasser. Zuständige Behörden in der Ukraine benötigen heute praktische Hilfe und neue gesetzliche Normierung, um das Problem mit den gefährlichen IRBs zu lösen.

Im Rahmen des Projektes „Die Erhöhung der Sicherheit von industriellen Rückhaltebecken am Beispiel der ukrainischen Anlagen“, das mit Unterstützung des Deutschen Umweltbundesamtes im Laufe von Jahren 2013-2015 erfolgreich realisiert wurde, haben ukrainische Experten eine Methodik zur allseitigen Bewertung der Sicherheit von IRBs basierend auf der Checkliste entwickelt. Diese Methodik wurde von dem Deutschen Umweltbundesamt, sowie den führenden internationalen Experten in diesem Bereich akzeptiert.

Europäische Wirtschaftskommission der Vereinten Nationen für Europa (UNECE) und das Umweltbundesamt forderten auf, diese für die ausgearbeitete IRB Methodik durch die zuständigen Behörden und IRB Operatoren zu verbreiten und zur Anwendung zu bringen.

Die Hauptergebnisse des Projektes waren:

- ▶ Juristische Bewertung der ukrainischen Gesetzgebung und der Verwaltungsstruktur der Betriebe;
- ▶ die Methodik zur allseitigen Bewertung der Sicherheit von IRBs.

Ergebnisse und Schlussfolgerungen dieses Projektes zeigten, dass das Problem von IRBs in der Ukraine nur vorbehaltlich der Verbreitung und praktischen Anwendung der neuen Methodik und in gleichem Maße der Änderung der gesetzlichen Vorschriften auf diesem Gebiet gelöst werden kann.

Inhalt und Realisierung des Projektes

In den Jahren 2016-2017 wurde das Projekt „Anlagensicherheit und ihre legislativen Rahmenbedingungen, ein Lehrgang für Studenten und Lehrkräfte in der Ukraine“ realisiert. Die Finanzierung und Koordinierung des Projektes verwirklichte das Deutsche Umweltbundesamt mit Bewilligung der Europäischen Kommission in Anwendung des UNECE-Abkommens über die grenzüberschreitenden Auswirkungen von Industrieunfällen. In der Ukraine wurde das Projekt vom Ministerium für Ökologie und Naturressource und vom Ministerium für Bildung und Wissenschaft unterstützt.

Das Projekt besteht, gemäß den Hauptaufgaben, aus zwei Komponenten:

- ▶ Die Bildungskomponente setzt voraus: die Verbesserung der Kenntnisse der Studenten der Fachrichtung Ökologie und Bergbau im Bereich der Sicherheit von IRBs, die Bekanntschaft der jungen Lehrkräften der Universität mit Inhalten der Lehrgänge auf dem Gebiet des Umweltschutzes, um führende Erfahrung der europäischen Länder im Bereich der Sicherheitserhöhung auf Objekten des Bergbaus durch den Unterricht zu verbreiten.
- ▶ Die legislative Komponente des Projektes ist darauf gerichtet, das Problem der Sicherheit von IRBs auf der gesetzgebenden Ebene zu lösen. Das verlangt von der Ukraine die Erfüllung ihrer Verpflichtungen und Bindungen im Rahmen des Abkommens zwischen der Ukraine und EU (Richtlinie 2006/21/EG über die Bewirtschaftung von Abfällen aus der mineralgewinnenden Industrie).

Die Aktivitäten der Bildungskomponente des Projektes wurden an der Nationalen Bergbauuniversität (NBU) für verwirklicht. Die Universität befindet sich in der Stadt Dnipro, die im zentralen Teil des Landes liegt, in der Region mit gut entwickelter Bergbauindustrie. Die Lehrkräfte der Universität besitzen große Erfahrung im Bereich der Ausbildung und nehmen an vielen internationalen Forschungs- und Bildungsprojekten teil.

GmbH „Ecoplaform“ in Zusammenarbeit mit dem Ministerium für Ökologie und Naturressourcen der Ukraine und interessierten Machtorganen verwirklichten ein Projekt (legislative Komponente) auf nationaler Ebene in Kyjiw „Die Strategie der zuständigen Behörden bezüglich der IRBs“.

Es wurden folgende Veranstaltungen laut Projektplan durchgeführt: Anfangsseminar (Juni 2016, Dnipro), das erste Training (Oktober 2016, Dnipro), das zweite Training (November 2016, Dnipro), Runder Tisch (Februar 2017, Kyjiw) und Abschlussseminar (Mai 2017, Dnipro). Viel Arbeit wurde auch im Zeitraum zwischen diesen Veranstaltungen geleistet, z. B. die Entwicklung von Lehrmaterialien, die Analyse der Rückmeldungen von Teilnehmern, die Abstimmung der Methodik für die IRBs mit zuständigen Behörden für ihre weitere praktische Anwendung, die Erarbeitung des Lehrganges (elektronische Version) zur Verwendung im Lehrprozess usw.

Bildungskomponente des Projektes

Die Bildungskomponente des Projektes schloss folgende Tätigkeiten ein:

- ▶ Durchführung von zwei Trainingsmaßnahmen im Bereich der Sicherheit von IRBs für die Studierenden und Lehrenden der Nationalen Universität für Bergbau;
- ▶ Die Entwicklung der elektronischen Version des Lehrganges „Die Sicherheit von IRBs“.

Die Teilnehmer des Trainings waren die Studenten und die Lehrkräfte aus vier technischen Hochschulen, die sich in der Stadt Dnipro befinden, ausländische und nationale Experten, einschließlich die Mitglieder der vereinten Expertengruppe UNECE für Unfälle in der Industrie und im und auf dem Wasser, die Vertreter der zuständigen ukrainischen Behörden auf nationaler und regionaler Ebene. Es waren solche Länder wie die Schweiz, Belarus, Rumänien, Georgien, Armenien, Kirgisien, Serbien, Ungarn und Österreich durch ihre Experten vertreten. Der IRB - Operator wurde durch das DTEK – das größte energieproduzierende Unternehmen der Ukraine – vorgestellt, was das Praktikum im Rahmen des Projektes ermöglichte.

Die am Training beteiligten Studenten kamen aus vier Hochschulen, die sich im Dnipropetrowsker Gebiet befinden. Es waren Nationale Universität für Bergbau, Prydniprowska Staatliche Akademie für Bauwesen und Architektur Dnipro, Nationale Akademie für Hüttenwesen, Dnipropetrowsker Staatliche agrarwirtschaftliche Universität, deren Lehrprogramme die Lehrgänge zu „Bergbauwesen“, „Sicherheit in der Industrie“, „Schutz und Wiedererneuerung der natürlichen Systeme“ beinhalten. Insgesamt nahmen 20 Studenten (fünf Personen aus jeder Hochschule) am Training teil, geleitet von 4 Hochschullehrern.

Die Trainings bestanden aus verschiedenen Studententätigkeiten: Vorlesungen, Dokumentenbearbeitung, Besuch des IRB, das Interviewen der Mitarbeiter des Rückhaltebeckens, das Berichten usw. Außerdem wurde auch das Online-Training UNECE für „Sicherheit in der Industrie“ an der Nationalen Universität für Bergbau durchgeführt, als Zusatz zum Training zum Thema „Sicherheit von IRBs“.

Alle Materialien, Formaten und Instrumenten wurden bei dem an der Bergbauuniversität durchgeführten Training überprüft, gesammelt und transformiert, gemäß dem Format des Lehrganges in der elektronischen Version auf der Plattform Moodle, die auf der Webseite der Universität für die Fernausbildung platziert ist.

Legislative Komponente des Projektes

Bei der Umsetzung der legislativen Projektkomponente hat GmbH „Ecoplattform“ folgende Arbeit durchgeführt:

- ▶ Bei der juristischen Bewertung der legislativen Rahmenbedingungen für Projektrealisierung
 - wurde analysiert, ob die ukrainischen rechtlichen Rahmenbedingungen den Anforderungen der Richtlinie 2006/21/EG über die Bewirtschaftung von Abfällen aus der mineralgewinnenden Industrie entsprechen;
 - wurde ein kurzer Überblick über die Bestimmungen der Richtlinie 2012/18/EG zur Beherrschung der Gefahren schwerer Unfälle mit gefährlichen Stoffen (SEVESO – II – Richtlinie) durchgeführt;
 - wurden die Wege zur Umsetzung der UNECE - IRB – Richtlinien in der Ukraine entwickelt und Anwendung der IRB-Methodik angeboten.
- ▶ Auf der Grundlage der Ergebnisse der juristischen Bewertung der ukrainischen legislativen Rahmenbedingungen und den UNECE – IRB – Sicherheitsrichtlinien folgend wurde eine Roadmap der Richtlinie 2006/21/EG für die Ukraine erarbeitet.
- ▶ Es wurde der Runde Tisch zur Umsetzung der Richtlinie 2006/21/EG durchgeführt, um die Bemühungen aller verantwortlichen Parteien bezüglich der IRB – Sicherheit zu vereinen. Am Runder Tisch
 - wurden die IRB – Methodik und die interaktive Karte als Instrument zur Umsetzung der Richtlinie 2006/21/EG vorgestellt;
 - die wertvollen Rückmeldungen der zuständigen Behörden wurden zur Anpassung der IRB-Methodik zur Anwendung in der Ukraine bereitgestellt;
 - die Resolution des Runder Tisches wurde von allen Teilnehmern als das Sitzungsergebnis vereinbart.
- ▶ Gemäß Resolution des Runder Tisches wurde von GmbH „Ecoplattform“ das Dokument „Empfehlungen zur Verbesserung des Sicherheitssystems von IRBs“ als Vorschlag zur weiteren Umsetzung der Projektentwicklungen erstellt.

Auf der Grundlage der von zuständigen Behörden erhaltenen Kommentare wurde ukrainische IRB – Methodik den Anforderungen von Inspektionsorganen angepasst. Berücksichtigt wurden auch die Ansichten und Kommentare, die nach den zwei in Dnipro durchgeführten Trainings geäußert und auf die Vervollkommnung der Methodik gerichtet wurden.

GmbH „Ecoplattform“ in der Zusammenarbeit mit dem Ministerium für Ökologie und Naturressource der Ukraine haben das Register von Abfalldeponien in Berichtsunterlagen geändert, sowie bestimmte Objekte ausgesucht, die als eventuelle IRBs mit entsprechenden Charakteristiken betrachtet werden. Die aktuelle, aus dem vorherigen Projekt des Deutschen Umweltbundesamtes resultierende Datenbank mit 145 IRBs wurde durch die zusätzlichen 199 IRBs ergänzt. Die erneuerte ukrainische Datenbank von IRBs, die im April 2017 344 Anlagen betrug, wurde zur Aktualisierung der interaktiven Karte in der Google-Maps Ressource genutzt.

Das Dokument „Empfehlungen zur Verbesserung des Sicherheitssystems von IRBs“, das den Bericht über die Umsetzung der Richtlinie 2006/21/EG im Lande, über die für die Ukraine angepasste IRB – Methodik und die erneuerte Datenbank von IRBs enthielt, wurde dem Ministerium für Ökologie und Naturressource der Ukraine vorgelegt. Das Ministerium gab positive Rückmeldungen zu weiteren Projektentwicklungen mit Dankbarkeit für das Projekt.

Projektergebnisse

Die im Rahmen des Projektes im Jahre 2016-2017 entwickelten Produkte:

- ▶ Der E-Lehrgang „Sicherheit von IRBs“, entwickelt auf der Moodle Plattform der NBU;
- ▶ Der Bericht über die Analyse der ukrainischen legislativen Rahmenbedingungen und ihre Entsprechung den Anforderungen der europäischen Gesetzgebung, sowie die Erarbeitung einer Roadmap für die Ukraine im Zusammenhang mit der Verbesserung der IRB –Sicherheit (Richtlinie 2006/21/EG, SEVESO-III-Richtlinie und IRB-Sicherheitsrichtlinien)
- ▶ Die verbesserte Methodik zur allseitigen Bewertung der IRB – Sicherheit;
- ▶ Aktualisierte ukrainische IRB –Datenbank und interaktive Karte, basiert auf den Google-Maps;
- ▶ Empfehlungen zur Verbesserung des Verwaltungssystems von IRBs in der Ukraine.

Resume (in Ukrainian)

Підґрунтя проекту

У хвостосховищах зберігається великий обсяг відходів видобувної галузі, які стали джерелом забруднення навколишнього середовища, що завдає шкоди біоті і має негативні наслідки для здоров'я населення. У багатьох країнах хвостосховища все ще потребують вжиття невідкладних заходів безпеки, при цьому особлива увага приділяється поглибленню знань у цій сфері та підвищенню обізнаності щодо потенційних ризиків та збитків.

Україна є дуже показовим прикладом неналежного зберігання відходів видобувної галузі. Більшість рідких промислових відходів, обсяг яких перевищує 1,7 млрд. м³, зберігаються на застарілих або покинутих об'єктах, створених у країні понад 50 років, що не відповідають сучасним вимогам безпеки. Звичайна практика будівництва хвостосховищ полягала у створенні дамб в яругах, долинах та малих річках. Дно та межі накопичувачів не були вкриті водонепроникними екранами або облицьовані будь-яким способом. Отже, ці хвостосховища стали джерелом забруднення ґрунтових та поверхневих вод. Органам влади в Україні потрібна підтримка для сталого вирішення проблеми небезпечних хвостосховищ, як на практичному, так і на законодавчому рівні.

В рамках проекту «Підвищення безпеки промислових хвостосховищ на прикладі українських об'єктів», підтриманого Німецьким відомством з охорони навколишнього середовища та успішно виконаним протягом 2013-2015 рр., українськими експертами була розроблена Методологія всебічної оцінки безпеки хвостосховищ (Методологія для хвостосховищ) на основі методу контрольного списку. Ця методологія була схвалена Німецьким агентством з навколишнього середовища та провідними міжнародними експертами у цій галузі.

Європейська економічна комісія ООН (ЄЕК ООН) та Німецьке відомство з охорони навколишнього середовища закликали держави-члени ЄЕК поширювати розроблену методологію для хвостосховищ для її практичного використання відповідними компетентними органами та операторами цих об'єктів.

Основними результатами проекту були:

- ▶ Правова оцінка законодавства України та адміністративної ситуації з хвостосховищами в Україні,
- ▶ Методологія всебічної оцінки безпеки хвостосховищ.

Результати та висновки цього проекту показали, що стійкий розв'язок проблеми хвостосховищ в Україні можливий лише шляхом впровадження відповідних заходів як на практичному рівні (поширення методології), так і на законодавчому рівні (огляд стратегії компетентних органів).

Зміст та діяльність проекту

Протягом 2016-2017 років було реалізовано проект «Підвищення рівня знань серед студентів і викладачів з безпеки хвостосховищ та її законодавчий огляд в Україні». Проект фінансувався та координувався Німецьким відомством з охорони навколишнього середовища за сприяння Конвенції ЄЕК ООН про трансграничний вплив промислових аварій та підтримувався Міністерством екології та природних ресурсів України та Міністерством освіти і науки України.

Проект складається з двох компонентів відповідно до основних завдань:

- ▶ Освітній компонент передбачає підвищення рівня знань в галузі безпеки хвостосховищ серед українських студентів у напрямках екології та гірничих наук, а також молодих освітян з університетів, які викладають дисципліни з тематики охорони навколишнього

- середовища, для поширення передового європейського підходу до підвищення безпеки небезпечних об'єктів у видобувній галузі на основі сучасного навчального курсу,
- ▶ законодавчий компонент проекту передбачає підвищення рівня безпеки хвостосховищ шляхом вирішення цієї проблеми на законодавчому рівні, з точки зору виконання Україною своїх зобов'язань за Угодою про асоціацію між Україною та ЄС, Директиви 2006/21/ЄС щодо управління відходами видобувної промисловості.

Виконання освітнього компоненту проекту проходило в Державному вищому навчальному закладі "Національний гірничий університет" (далі – НГУ), який спеціалізується на підготовці студентів для гірничої галузі. Університет знаходиться у місті Дніпро, який є центром розвиненого гірничодобувного регіону в центральній Україні. Його спеціалісти мають відповідний викладацький досвід та досвід участі в різних міжнародних наукових та освітніх проектах.

ТОВ "Екоплатформа" у співпраці з Міністерством екології та природних ресурсів України та представниками усіх зацікавлених органів влади здійснило законодавчий компонент проекту "Стратегія компетентних органів щодо питань хвостосховищ" на національному рівні, в столиці України Києві.

Виконання проекту включало початковий семінар (липень 2016, Дніпро), перший тренінг (жовтень 2016 р., Дніпро), другий тренінг (листопад 2016 р., Дніпро), круглий стіл (лютий 2017 р., Київ) та фінальний семінар (травень 2017 р., Дніпро). Великий обсяг робіт було проведено між цими заходами та після них, він включав підготовку навчальних матеріалів, аналіз відгуків учасників, погодження методології для хвостосховищ з компетентними органами для її подальшого впровадження, розробку електронного навчального курсу та його впровадження у навчальний процес тощо.

Освітній компонент проекту

Основна діяльність проекту в рамках компоненту освітнього проекту включала проведення двох тренінгів з безпеки хвостосховищ для студентів університетів та викладачів з чотирьох університетів у НГУ та розробку курсу електронного навчання «Безпека хвостосховищ».

Учасники тренінгів були відібрані серед студентів екологічних спеціальностей, що відносяться до гірничої промисловості, промислової безпеки, захисту та відновлення довкілля з університетів, розташованих у Дніпропетровській області: Державного ВНЗ «Національний гірничий університет», Придніпровської державної академії будівництва та архітектури, Національної металургійної академії України та Дніпропетровського державного аграрно-економічного університету. Загалом у тренінгах взяли участь 20 слухачів (5 студентів з кожного університету) під керівництвом 4 викладачів. Також у тренінгах брали участь міжнародні та національні експерти, в тому числі члени Об'єднаної експертної групи ЄЕК ООН з водних та промислових аварій, представники компетентних органів України на національному та регіональному рівнях. Міжнародні експерти представляли Швейцарію, Білорусь, Румунію, Грузію, Вірменію, Киргизьку Республіку, Республіку Сербію, Угорщину, та Австрію. Оператор хвостосховища був представлений компанією ДТЕК, яка є найбільшою українською компанією з виробництва електроенергії. Компанія ДТЕК забезпечила можливості для проведення практичних занять в рамках проекту.

Тренінги включали різні види навчальної діяльності, такі, як лекції, аналіз документів, відвідування хвостосховища, інтерв'ювання його персоналу, підготовку звіту тощо. Крім тренінгів з безпеки хвостосховищ всі слухачі пройшли онлайн-тренінг ЄЕК ООН з промислової безпеки.

Всі матеріали, формати та інструменти_протестовані під час двох тренінгів, проведених в НГУ, були зібрані та приведені у відповідність до формату курсу електронного навчання на платформі Moodle, який розміщено на веб-сторінці дистанційного навчання НГУ.

Законодавчий компонент проекту

ТОВ "Екоплатформ" виконало законодавчий компонент проекту у таких сферах.

- ▶ Законодавча оцінка включає:
 - аналіз відповідності українського законодавства вимогам Директиви 2006/21/ЄС щодо поводження з відходами з видобувної промисловості,
 - Короткий огляд положень Директиви 2012/18/ЄС щодо контролю великих аварій, пов'язаних з небезпечними речовинами (Директива SEVESO-III),
 - Способи впровадження в Україні Керівних принципів ЄЕК ООН щодо хвостосховищ та методології для хвостосховищ.
- ▶ Дорожня карта з впровадження Директиви 2006/21/ЄС через інструментарій Керівних принципів ЄЕК ООН щодо хвостосховищ в рамках національного законодавства була розроблена на основі результатів оцінки законодавства.
- ▶ Був проведений Круглий стіл з представниками компетентних органів щодо імплементації положень Директиви 2006/21/ЄС, спрямований на об'єднання зусиль усіх відповідальних сторін щодо безпеки хвостосховищ, на якому
 - Методологія для хвостосховищ та інтерактивна карта хвостосховищ були представлені як практичний інструмент для імплементації Директиви 2006/21/ЄС,
 - цінні відгуки компетентних органів дозволили адаптувати методологію для хвостосховищ, яка буде використовуватися в Україні як інструмент підвищення безпеки хвостосховищ,
 - Резолюція Круглого столу була узгоджена учасниками як результати засідання.
- ▶ ТОВ «Екоплатформа» розробило проект "Рекомендацій щодо вдосконалення системи управління безпекою хвостосховищ" відповідно до резолюції Круглого столу як пропозиції щодо подальшої реалізації проекту.

Українська версія Методології для хвостосховищ була адаптована для інспекційних органів на основі коментарів, отриманих від компетентних органів. В рамках проекту було враховано відгуки та коментарі для удосконалення методології з двох тренінгів, проведених у Дніпрі.

ТОВ "Екоплатформа" у співпраці з Міністерством екології та природних ресурсів України переробило Реєстр місць зберігання відходів у звітних документах та вибрало відповідні об'єкти, які розглядаються як хвостосховища з відповідною інформацією. Таким чином, ТОВ «Екоплатформа» доповнило існуючу базу даних з 145 хвостосховищами з попереднього проекту Німецького відомства з охорони навколишнього середовища додатково 199 хвостосховищами, що мають потенціал екологічної небезпеки. Оновлена українська база даних хвостосховищ, яка станом на квітень 2017 р. містить 344 об'єкти, була використана як джерело даних для оновлення інтерактивної мапи хвостосховищ на ресурсі Google Maps.

Проект документу "Рекомендації щодо вдосконалення системи управління безпекою хвостосховищ", який включає звіт про аналіз впровадження Директиви 2006/21/ЄС, адаптовану для України методологію для хвостосховищ, оновлену базу даних хвостосховищ України, було подано до Міністерства екології та природних ресурсів України. Міністерство надало позитивні відгуки щодо розвитку проекту з вдячністю за проект.

Результати проекту

Розроблені продукти проекту, що створені у 2016-2017 рр., включають

- ▶ Електронний навчальний курс «Безпека хвостосховищ», розроблений на платформі Moodle НГУ,
- ▶ Доповідь про аналіз відповідності українського законодавства вимогам законодавства ЄС та Дорожня карта щодо її реалізації в контексті підвищення безпеки хвостосховищ (Директива 2006/21/ЄС, Директива SEVESO-III та Керівні принципи ЄЕК ООН з безпеки хвостосховищ).
- ▶ Удосконалена методологія всебічної оцінки безпеки хвостосховищ,
- ▶ Оновлена база даних українських хвостосховищ та інтерактивна карта на основі карт Google.
- ▶ Рекомендації щодо вдосконалення системи управління безпекою хвостосховищ для України.

Resume (in Russian)

Обоснование проекта

В хвостохранилищах хранится большой объём отходов добывающей отрасли, которые стали источником загрязнения окружающей среды, наносят вред биоте и оказывают негативное влияние на здоровье населения. Во многих странах хвостохранилища все еще требуют принятия неотложных мер безопасности, при этом особое внимание уделяется углублению знаний в этой сфере и повышению осведомленности о потенциальных рисках и убытках.

Украина является показательным примером ненадлежащего хранения отходов добывающей отрасли. Большая часть жидких промышленных отходов, объём которых превышает 1,7 млрд. м³, хранится на устаревших или заброшенных объектах, созданных в стране более 50 лет, не отвечающим современным требованиям безопасности. Обычная практика строительства хвостохранилищ заключалась в создании дамб в оврагах, долинах и малых реках. Дно и борта накопителей не были покрыты водонепроницаемыми экранами или облицованы каким-либо способом. Таким образом, эти хвостохранилища стали источником загрязнения подземных и поверхностных вод. Органы власти в Украине нуждаются в поддержке для устойчивого решения проблемы опасных хвостохранилищ, как на практическом, так и на законодательном уровне.

В рамках проекта «Повышение безопасности промышленных хвостохранилищ на примере украинских объектов», поддержанного Немецким ведомством по охране окружающей среды и успешно выполненном в течение 2013-2015 гг., украинскими экспертами была разработана методология всесторонней оценки безопасности хвостохранилищ (Методология для хвостохранилищ) на основе метода контрольного списка. Эта методология была одобрена Немецким ведомством по охране окружающей среде и ведущими международными экспертами в этой области.

Европейская экономическая комиссия ООН (ЕЭК ООН) и Немецкое ведомство по охране окружающей среды призвали государства-члены ЕЭК распространять разработанную методологию для хвостохранилищ для ее практического использования соответствующими компетентными органами и операторами этих объектов.

Основными результатами проекта были:

- ▶ Правовая оценка законодательства Украины и административной ситуации с ТМФ в Украине,
- ▶ Методология всесторонней оценки безопасности хвостохранилищ.

Результаты и выводы этого проекта показали, что устойчивый решение проблемы хвостохранилищ в Украине возможно лишь путем реализации соответствующих мероприятий как на практическом уровне (распространение методологии), так и на законодательном уровне (обзор стратегии компетентных органов).

Содержание и деятельность проекта

В течение 2016-2017 гг. был реализован проект "Повышение уровня знаний среди студентов и преподавателей по безопасности хвостохранилищ и её законодательный обзор в Украине". Проект финансировался и координировался Немецким ведомством по охране окружающей среды при содействии Конвенции ЕЭК ООН о трансграничном воздействии промышленных аварий, и поддерживался Министерством экологии и природных ресурсов Украины и Министерством образования и науки Украины.

Проект состоит из двух компонентов в соответствии с основными задачами:

- ▶ образовательный компонент предусматривает повышение уровня знаний в области безопасности хвостохранилищ среди украинских студентов по направлениям экологии и горных наук, а также молодых сотрудников университетов, преподающих дисциплины по тематике охраны окружающей среды, для распространения передового европейского подхода по повышению безопасности опасных объектов в добывающей отрасли на основе современного учебного курса,
- ▶ законодательный компонент проекта предусматривает повышение уровня безопасности хвостохранилищ путем решения этой проблемы на законодательном уровне с точки зрения выполнения Украиной своих обязательств по Соглашению об ассоциации между Украиной и ЕС, Директивы 2006/21/ЕС по управлению отходами добывающей промышленности.

Выполнение образовательного компонента проекта проходило в Государственном высшем учебном заведении "Национальный горный университет" (далее – НГУ), который специализируется на подготовке студентов для горной отрасли. Университет находится в городе Днепр, который является центром развитого горнодобывающего региона в центральной Украине. Его специалисты имеют соответствующий опыт преподавания и опыт участия в различных международных научных и образовательных проектах.

ООО "Экоплатформа" в сотрудничестве с Министерством экологии и природных ресурсов Украины и представителями всех заинтересованных органов власти выполнило законодательный компонент проекта "Стратегия компетентных органов по вопросам хвостохранилищ" на национальном уровне, в столице Украины Киеве.

Выполнение проекта включало вводный семинар (июль 2016 Днепр), первый тренинг (октябрь 2016, Днепр), второй тренинг (ноябрь 2016, Днепр), круглый стол (февраль 2017, Киев) и финальный семинар (май 2017 г., Днепр). Большой объем работ был проведен между этими мероприятиями и после них; они включали подготовку учебных материалов, анализ отзывов участников, согласование методологии для хвостохранилищ с компетентными органами для дальнейшего внедрения, разработку электронного учебного курса и его внедрение в учебный процесс и т. д.

Образовательный компонент проекта

Основная деятельность проекта в рамках компонента образовательного проекта включала проведение двух тренингов по безопасности хвостохранилищ для студентов университетов и преподавателей из четырех университетов в НГУ и разработку курса электронного обучения «Безопасность хвостохранилищ».

Участники тренингов были отобраны среди студентов экологических специальностей, относящихся к горной промышленности, промышленной безопасности, защиты и восстановления окружающей среды из университетов, расположенных в Днепропетровской области: Государственного ВУЗ "Национальный горный университет», Приднепровской государственной академии строительства и архитектуры, Национальной металлургической академии Украины и Днепропетровского государственного аграрно-экономического университета. Всего в тренингах участвовали 20 слушателей (5 студентов из каждого университета) под руководством 4 преподавателей. Также в тренингах участвовали международные и национальные эксперты, в том числе члены Объединенной экспертной группы ЕЭК ООН по водным и промышленным авариям, представители компетентных органов Украины на национальном и региональном уровнях. Международные эксперты представляли Швейцарию, Беларусь, Румынию, Грузию, Армению, Кыргызскую Республику, Республику Сербию, Венгрию и Австрию. Оператор хвостохранилища был представлен компанией ДТЭК, которая является крупнейшей украинской компанией по производству электроэнергии.

Компания ДТЭК обеспечила возможности для проведения практических занятий в рамках проекта.

Тренинги включали различные виды учебной деятельности, такие, как лекции, анализ документов, посещение хвостохранилища, интервьюирование его персонала, подготовка отчета и т.д. Кроме тренингов по безопасности хвостохранилищ все слушатели прошли онлайн-тренинг ЕЭК ООН по промышленной безопасности.

Все материалы, форматы и учебные инструменты, протестированные во время двух тренингов, проведенных в НГУ, были собраны и приведены в соответствии с форматом курса электронного обучения на платформе Moodle, и размещены на веб-странице дистанционного обучения НГУ.

Законодательный компонент проекта

ООО "Экоплатформа" выполнило законодательный компонент проекта в таких сферах.

- ▶ Законодательная оценка включает:
 - анализ соответствия украинского законодательства требованиям Директивы 2006/21 / ЕС по обращению с отходами добывающей промышленности
 - Обзор положений Директивы 2012/18/ЕС по контролю крупных аварий, связанных с опасными веществами (Директива SEVESO-III)
 - Способы внедрения в Украине Руководящих принципов ЕЭК ООН по хвостохранилищам и методологии для хвостохранилищ.
- ▶ Дорожная карта по внедрению Директивы 2006/21 / ЕС через инструментарий Руководящих принципов ЕЭК ООН по хвостохранилищам в рамках национального законодательства была разработана на основе результатов оценки законодательства.
- ▶ Был проведен Круглый стол с представителями компетентных органов по имплементации положений Директивы 2006/21/ЕС, направленный на объединение усилий всех ответственных органов по безопасности хвостохранилищ: На Круглом столе
 - Методология для хвостохранилищ и интерактивная карта хвостохранилищ были представлены как практический инструмент для имплементации Директивы 2006/21/ЕС.
 - Ценные отзывы компетентных органов позволили адаптировать методологию для хвостохранилищ, которая будет использоваться в Украине как инструмент повышения безопасности хвостохранилищ,
 - Резолюция Круглого стола была согласована участниками как результаты заседания.
- ▶ ООО «Экоплатформа» разработало проект "Рекомендаций по совершенствованию системы управления безопасностью хвостохранилищ" в соответствии с резолюцией Круглого стола как предложения по дальнейшей реализации проекта.

Украинская версия Методологии для хвостохранилищ была адаптирована для инспекционных органов на основе комментариев, полученных от компетентных органов. В рамках проекта были учтены отзывы и комментарии по совершенствованию методологии из двух тренингов, проведенных в Днепре.

ООО "Экоплатформа" в сотрудничестве с Министерством экологии и природных ресурсов Украины переработало Реестр мест хранения отходов в отчетных документах и выбрало соответствующие объекты, которые рассматриваются как хвостохранилища с соответствующей информацией. Таким образом, ООО «Экоплатформа» пополнило существующую базу данных из 145 хвостохранилищ с предыдущего проекта Немецкого

ведомства по охране окружающей среды дополнительно 199 объектами, имеющих потенциал экологической опасности. Обновленная украинская база данных хвостохранилищ, которая по состоянию на апрель 2017 содержит 344 хвостохранилищ, была использована как источник данных для обновления интерактивной карты хвостохранилищ на ресурсе Google Maps.

Проект документа "Рекомендации по совершенствованию системы управления безопасностью хвостохранилищ", который включает отчет об анализе внедрения Директивы 2006/21/ЕС, адаптированную для Украины методологию для хвостохранилищ, обновленную базу данных хвостохранилищ Украины, было подано в Министерство экологии и природных ресурсов Украины. Министерство предоставило положительные отзывы по развитию проекта с благодарностью за проект.

Результаты проекта

Разработанные продукты проекта, созданные в 2016-2017 гг., включают

- ▶ Электронный учебный курс «Безопасность хвостохранилищ», разработанный на платформе Moodle НГУ,
- ▶ Доклад об анализе соответствия украинского законодательства требованиям законодательства ЕС и Дорожная карта по её реализации в контексте повышения безопасности хвостохранилищ (Директива 2006/21/ЕС, Директива SEVESO-III и Руководящие принципы ЕЭК ООН по безопасности хвостохранилищ).
- ▶ Усовершенствованная методология всесторонней оценки безопасности хвостохранилищ,
- ▶ Обновленная база данных украинских хвостохранилищ и интерактивная карта на основе карт Google.
- ▶ Рекомендации по совершенствованию системы управления безопасностью хвостохранилищ для Украины.

1 Introduction

1.1 Background

The last two decades demonstrated a growing concern with environmental degradation caused by large-scale movement of hazardous materials because of failures of tailings management facilities (TMFs) where large amounts of mining wastes are stored. These wastes pose serious threats to humans and the environment, especially if tailings facilities are improperly designed, constructed, operated or managed. Pollution of waterways and the related damage or risk to human health, infrastructure and environmental resources has often a negative effect on relations between neighbouring countries. Such risks may emanate from all TMFs, including active, inactive, neglected, temporarily or permanently closed, abandoned or orphaned ones.

Within the framework of an earlier AAP project, running the completed UBA project 2013 - 2015 ("Improving the safety of industrial tailings management facilities based on the example of Ukrainian facilities") the Methodology for improving the safety of Tailings Management Facilities with the TMF Checklist (hereinafter TMF Methodology) has been developed by an Ukrainian project team. The project was technically and scientifically managed by the German Environment Agency and the leading international experts. The project team developed the TMF Methodology to be used as the practical tool to implement the existing UNECE TMF Guidelines. Further it assessed the Ukrainian legislation in accordance with UNECE TMF Guidelines. Both documents were submitted to the Ministry of Ecology and Natural Resources of Ukraine (hereinafter MENR) that made proposals to revise, amend and adapt the project documents for putting the TMF Methodology into practice, leading to further harmonization of Ukrainian legislation with EU laws in the field of tailings management.

The results and conclusions of the aforementioned project showed that a sustainable solution of the TMF problem in Ukraine is only possible by addressing the TMF issue on both the practical level (dissemination, training and consequent usage of the TMF Methodology by environmental inspectors and TMF operators and) and legislative level (review of the Competent Authorities' strategy). On this basis the State Higher Educational Institution "National Mining University" in cooperation with LLC "Ecoplatform" implemented the Project "Raising Knowledge among Students and Teachers on Tailings Safety and its Legislative Review in Ukraine" (hereinafter – Project) during 2016-2017. It was funded and coordinated by the German Environment Agency and supported by the Ministry of Ecology and Natural Resources of Ukraine and the Ministry of Education and Science of Ukraine (the letters of support are presented in Annex 1).

At present, the available curricula in mining and environment safety provided by Ukrainian technical universities include only insufficient knowledge on TMF safety or provide only little theoretical knowledge due to the time allotted. Consequently, there is the lack of comprehensive training and advanced courses on TMF safety issues in the state educational programs provided by Higher Educational Institutions in Ukraine. In this context, inspectors and TMF staff have to be prepared in this issue at a highly skilled level still in universities.

The Project aimed to familiarize the target audience with the European principles of the TMF safety such as the UNECE Safety Guidelines and Good Practices for TMFs, through a training course on the TMF Methodology, which included modules of intensive theoretical studies and visit(s) to a representative TMF site for practical exercises.

Apart from the educational component, the Project intended on sustainable solution of the TMF problem on the legislative level. The legal assessment of the previous UBA project showed the need for streamlining, transparency and simplification to ensure the effective functioning of the national legal system. The legislative Project component covered the evaluation of competent authorities' (CAs) strategy on TMF issues aligned with the European integration course of Ukraine that obliges the country to perform serious commitments in various areas.

The key provisions of Directive 2006/21/EC on waste management for extractive industries and the amending Directive 2004/35/EC (hereinafter Directive 2006/21/EC) shall be implemented by Ukraine within five years of the entry into force of the Association Agreement between the European Union and the European Atomic Energy Community and their Member States, of the one part, and Ukraine, of the other part (hereinafter Association Agreement). As per Annex XXX to Association Agreement the following provisions of Directive 2006/21/EC shall be implemented:

- ▶ adoption of the national legislation and designation of competent authority/ies;
- ▶ establishment of a system that makes TMF operators to draw up waste management plans (identification and classification of waste facilities; characterisation of the waste) (art. 4 and 9);
- ▶ establishment of a permit system, financial guarantees and an inspection system (art. 7, 14 and 17);
- ▶ establishment of procedures for the management and monitoring of excavation voids (art. 10);
- ▶ establishment of closure and after-closure procedures for mining waste facilities (art. 12);
- ▶ drawing up an inventory of closed mining waste facilities (art. 20).

As the TMF issues are laid down in provisions of Directive 2006/21/EC, they become mandatory to be considered by Ukrainian CAs in their strategies. In this regard the TMF Methodology can be easily applied by the state authorities and by TMF operators to meet their future obligations under Directive 2006/21/EC as the methodology for TMF inventory, facility prioritization and establishment of action plans to reduce the risks posed by TMFs.

Although the implementation of the Association Agreement has started on November 1, 2014, at present only the Implementation plan of Directive 2006/21/EC with general measures developed on the legislative level by Ministry of Energy and Coal Industry of Ukraine is available. MENR was indicated as the main body responsible for the implementation of this plan. Therefore, the national authorities need further support in evaluation and development of the detailed actions to be performed under the obligations of Directive 2006/21/EC.

1.2 Aim and tasks of the Project

Based on the above mentioned the main Project objectives were:

- ▶ raising the knowledge in the TMF safety among Ukrainian students in environmental and mining sciences and young university teachers dealing with education on environmental protection as an advanced European approach to improve safety of hazardous mining sites by modern education course (educational Project component);
- ▶ improving the TMF safety level by addressing this issue on the legislative level in terms of how Ukraine fulfils its obligations under the EU-Ukraine Association Agreement, Directive 2006/21/EC on the management of waste from the extractive industries (legislative Project component).

The long-term goals of the Project are:

- ▶ to ensure the sustainability of the TMF Methodology as the modern organisational and managerial toolkit easy to organise and manage. To improve the safety of TMF sites through the use of the comprehensive education module that provides an opportunity to get full and consecutive information including the introduction to the subject, the importance, scopes, operation problems of TMFs as high-risk facilities, and application of the TMF Methodology in practice. It is suggested to introduce the education modules developed within the Project to teaching/learning process in the participating universities on an annual basis.
- ▶ to put the UNECE TMF Guidelines requirements into action in the form of a summary of good practice for TMFs, which will promote the implementation of an Action plan under Directive 2006/21/EC adapting the Ukrainian legislation to the European law.

The following Project tasks declared in the Project concept were:

- ▶ Familiarization of students with international safety standards in the field of tailings management outlined in relevant documents, including the UNECE document "Safety guidelines and good practices for tailings management facilities (2008, updated version 2014)" and the TMF Methodology.
- ▶ Completion of the UNECE online training course on industrial accidents followed by taking an appropriate certificate.
- ▶ Improvement and adaptation of the training course on the TMF Methodology for the students' audience based on the modern training experience.
- ▶ Creation of a new interactive training module that can be used for remote (distance) education, using modern technologies.
- ▶ Active learning of efficient procedures of environmental audit and inspection based on TMF Checklist application.
- ▶ Testing the TMF Methodology through new application experience. Collection and analysis of the participants' feedback (questions, remarks, recommendations) on the methodology improvement within this Project activity.
- ▶ Review of the CAs' strategy on TMF issues in terms of Ukraine's European integration course.
- ▶ Review of Directive 2006/21/EC requirements on waste management from extractive industries that become mandatory for Ukraine to complete the Association Agreement.
- ▶ Collection of the comments and recommendations of all concerned national authorities on how to implement Directive 2006/21/EC.
- ▶ Development of the Roadmap containing Action plan for implementation of Directive 2006/21/EC through the instrumentality of UNECE TMF Guidelines.

1.3 Brief Project Information

The general Project information is summarized below in Table 1.

Table 1: Brief Project Information

Project title	Raising Knowledge among Students and Teachers on Tailings Safety and Its Legislative Review in Ukraine
Project applicant	State Higher Educational Institution "National Mining University"
Project executors	State Higher Educational Institution "National Mining University" LLC "Ecoplatform"
Beneficiary	Ministry of Ecology and Natural Resources of Ukraine Ministry of Education and Science of Ukraine
Duration	June 2016 – May 2017
Thematic area	Improving the safety of industrial tailings management facilities
Main objectives	<ul style="list-style-type: none"> ▶ Raising the knowledge in the TMF safety among future specialists; ▶ Improving the TMF safety level on the legislative level in terms of how Ukraine fulfils its obligations under the EU-Ukraine Association Agreement, Directive 2006/21/EC on the management of waste from the extractive industries
Expected results	<ul style="list-style-type: none"> ▶ The development of training course on TMF Methodology application; ▶ E-learning course "Safety of tailings management facilities" ▶ Roadmap, containing Action plan for implementation of Directive 2006/21/EC provisions;

<p>Key Project participants</p>	<ul style="list-style-type: none"> ▶ Adaptation the TMF Methodology for the state inspection bodies of Ukraine ▶ German Environment Agency (UBA; Project coordinator): <ul style="list-style-type: none"> Mr. Gerhard Winkelmann-Oei Ms. Dr. Sonja Otto ▶ National Mining University (Project executor) ▶ Ecoplatform (Project executor) ▶ International experts: <ul style="list-style-type: none"> Mr. Peter Kovacs (Hungary) Ms. Claudia Kamke (UNECE TEIA Secretariat) Mr. Adam Kovacs (ICPDR-Secretariat) Mr. Konstantine Burjanadze (Georgia) Mr. Dušan Kostić (Republic of Serbia) Ms. Lubov Hertman (Belarus) Mr. Zoltán Török (Romania) Mr. Septimius Mara (Romania) Mr. Medetbek Omurbekov (Kyrgyz Republic) ▶ National experts: representatives of the Ministry of Ecology and Natural Resources of Ukraine, Ministry of Education and Science of Ukraine, Ministry of Energy and Coal Industry of Ukraine, State Emergency Service, State ecological inspection, Dnipro local administration ▶ DTEK company (industrial partner): Ms. Tetiana Zavgorodnia ▶ Tutors and trainees of technical universities located in Dnipro: <ul style="list-style-type: none"> National Mining University Prydniprovsk State Academy of Civil Engineering and Architecture National Metallurgical Academy of Ukraine Dnipropetrovsk State Agrarian and Economic University ▶ Ukrainian Project team: <ul style="list-style-type: none"> Mr. Dmitry Rudakov – Project director, trainer Ms. Iryna Nikolaieva – Project manager, trainer Mr. Grygorii Shmatkov – key expert, trainer Ms. Kateryna Okhotnyk – education course developer, trainer Ms. Tetiana Omelyanenko – lawyer (key expert) on competent authorities’ strategy, trainer Ms. Hanna Zadnipriana – Project manager assistant
<p>Project website</p>	<p>http://science.nmu.org.ua/en/conferences/grant-of-german-environment-agency/ http://www.ecoplatform.org/en</p>

2 Project activities

All Project events on educational component took place at the State Higher Educational Institution “National Mining University” (NMU) specialised in mining issues. The Ukrainian company “Ecoplatform” was the executor of the legislative Project component under the Agreement with NMU. Besides, LLC “Ecoplatform” supported NMU in preparation and conduction of the trainings.

The activities under the Project were performed in the cities of Dnipro and Kyiv. In between and after the Project events, the preparation of training materials, analysing the participants’ feedback, agreeing the TMF methodology with competent authorities for its further implementation, development of an e-learning course and its integration into the teaching/learning process etc. and other preparatory works were accomplished.

Figure 1: Working packages and events held under the Project. Source: Own illustration, LLC “Ecoplatform”



This section describes the actions, taken according to Working packages indicated in the Project’s application. The figure below illustrates the actual sequence and dates of the events held during the Project implementation.

2.1 Preparatory works

Preparatory works for the trainings during June – September 2016 included arrangements of the Project activities with the university top managers and the preliminary visit to the TMF site. Then, the trainees have been selected among university students of environmental curricula related to mining, industrial safety, environment protection and restoration from the universities located in Dnipro region.

Selection of tutors and trainees

Four tutors for the trainees were selected from young teachers of the following universities located in the Dnipropetrovsk region:

- ▶ State Higher Educational Institution “National Mining University”;
- ▶ State Higher Educational Institution “Prydniprovsk State Academy of Civil Engineering and Architecture”;
- ▶ National Metallurgical Academy of Ukraine;
- ▶ Dnipropetrovsk State Agrarian and Economic University

The Project team provided the correct interpretation of the TMF Methodology by the tutors, and explained their tasks in the Project and the expected results.

Then, with the help of the tutors 20 trainees (5 students from each University) were selected from undergraduate and postgraduate students of environmental sciences related to mining and the industries trained for at the tutors’ universities. The trainees had to pass interviews before the first workshop, with English knowledge being considered as one of the crucial selection criteria.

The list of the tutors and trainees participating in the Project is provided in Table 2.

Table 2 Tutors and trainees participated in the Project

No.	Name	Position and Department	University
Tutors			
1.	Oleksandr Kovrov	Professor of Ecology Department, PhD	National Mining University
2.	Serhii Kravtsov	Assistant of Ecology, Heat Technics and Labour Protection Department	National Metallurgical Academy of Ukraine
3.	Tetiana Yakovyshyna	Associate Professor of Ecology and Environment Protection Department, PhD	Prydniprovsk State Academy of Civil Engineering and Architecture
4.	Dmytro Pikarenia	Professor of Ecology and Environment Protection Department, Doctor of Sciences	Dniprodzerzhinsk State Technical University
Trainees (students)			
5.	Olha Ivanova	Master’s student of the first year of study, Mining faculty, Ecology specialty	National Mining University
6.	Tetyana Deryabkina	Student of the fourth year of study, Mining faculty, Ecology specialty	National Mining University
7.	Kyrylo Zvoryhin	Student of the fourth year of study, Mining faculty, Ecology specialty	National Mining University
8.	Svitlana Zakharenko	Student of the fourth year of study, Mining faculty, Open cast mining specialty	National Mining University
9.	Yevhen Cheblia	PhD student, 1st year of study, Mining faculty, Underground mining specialty	National Mining University

No.	Name	Position and Department	University
10.	Viacheslav Skubchenko	Master's student of the first year of study, Faculty of Mechanical Engineering, Ecology and Environmental Protection specialty	National Metallurgical Academy of Ukraine
11.	Kyrylo Zosymenko	Master's student of the first year of study, Faculty of Mechanical Engineering, Ecology and Environmental Protection specialty	National Metallurgical Academy of Ukraine
12.	Alina Puhach	Master's student of the first year of study, Faculty of Mechanical Engineering, Ecology and Environmental Protection specialty	National Metallurgical Academy of Ukraine
13.	Olena Lapina	Student of the fourth year of study, Faculty of Mechanical Engineering, Ecology and Environmental Protection specialty	National Metallurgical Academy of Ukraine
14.	Vita Meshcheriakova	Student of the fourth year of study, Faculty of Mechanical Engineering, Ecology and Environmental Protection specialty	National Metallurgical Academy of Ukraine
15.	Olena Matiahina	Master's student of the first year of study, Faculty of Civil Engineering and Ecology, Ecology specialty	Prydniprovska State Academy of Civil Engineering and Architecture
16.	Yuliia Kriachek	Master's student of the second year of study, Faculty of Technology sustenance and Ecology, Ecology specialty	Prydniprovska State Academy of Civil Engineering and Architecture
17.	Roman Toloshnyi	Master's student of the first year of study, Faculty of Technology sustenance and Ecology, Ecology specialty	Prydniprovska State Academy of Civil Engineering and Architecture
18.	Viktoriia Kulyk	Master's student of the first year of study, Faculty of Technology sustenance and Ecology, Ecology specialty	Prydniprovska State Academy of Civil Engineering and Architecture
19.	Serhii Chervinskyi	Student of the third year of study, Faculty of Technology sustenance and Ecology, Ecology specialty	Prydniprovska State Academy of Civil Engineering and Architecture
20.	Kateryna Kobzar	Master's student of the first year of study, Water management engineering and Ecology Faculty, Ecology specialty	Dnipropetrovsk State Agrarian and Economic University
21.	Tetiana Taran	Master's student of the first year of study, Water management engineering and Ecology Faculty, Construction and civil engineering specialty	Dnipropetrovsk State Agrarian and Economic University

No.	Name	Position and Department	University
22.	Liubov Tsaruk	Student of the fourth year of study, Ecology, Water management engineering and Ecology Faculty, Environmental Protection and Balanced Nature Management specialty	Dnipropetrovsk State Agrarian and Economic University
23.	Illia Vasylov	Student of the third year of study, Ecology, Water management engineering and Ecology Faculty, Environmental Protection and Balanced Nature Management specialty	Dnipropetrovsk State Agrarian and Economic University
24.	Nataliia Maksymova	Senior teacher of Ecology and environmental protection Department, PhD, Water management engineering and Ecology Faculty	Dnipropetrovsk State Agrarian and Economic University

Contacting the managers of the TMF

During the Project implementation, the Project team has worked closely with the Donbas Fuel Energy Company (DTEK, TMF operator) as a Project partner. It is Ukraine's largest energy group with assets in coal mining, electricity generation and distribution, alternative energy and gas production. The DTEK company provided the opportunities for practical trainings within the Project on the local thermal power plant and TMF.

The agreement with DTEK as the Project partner contained the development of a brief description of the training course on tailings safety and the draft plan for a site-visit to the thermal power station. Project summary, the TMF Checklists "Visual inspection" and "Document check", and template for a brief summary of TMFs in Ukraine were included. The brief summary of the TMF of the thermal power plant prepared by DTEK and LLC "Ecoplatform" is based on the provided template used as training materials (refer to section 3.1.1).

At the beginning of the Project LLC "Ecoplatform" staff has developed the Program of DTEK participation in conducting the training course (Annex 2) as an introductory document on upcoming works on Project activities. The Program contained brief description of the training course and draft Plan of a site-visit to the thermal power station. The Project summary, TMF Checklist "Visual inspection" and "Document check", and the template for brief summary of TMF were included as Annexes to the Program. Later Project trainers used the brief summary of the TMF of the thermal power plant, prepared by DTEK and LLC "Ecoplatform" based on the provided template as training material (refer to section 3.1.1).

DTEK provided the necessary documentation for practical work with the TMF Checklist. Its staff participated in all Project events as a representative of an industrial enterprise and were actively involved in theoretical and practical parts of the trainings, discussions on TMF issues etc.

2.1 Starting workshop

The Kick-off meeting with representatives of the UBA, NMU as a host University, Ukrainian team, tutors and representatives of the key competent authorities, was held at the National Mining University on July 12-13, 2017. The meeting objectives were:

- ▶ official opening of the Project;
- ▶ introducing all Project participants;
- ▶ presenting the previous TMF Project results;

- ▶ setting Project objectives, terms of reference/ work specifications;
- ▶ agreeing on logistics of the Project events and activities at the host university (timetable, rooms for trainings, equipment);
- ▶ identifying interaction ways for Project parties;
- ▶ developing follow-up activities program.

Within the workshop, the Ukrainian team and tutors visited the TMF of a thermal power plant for preliminary visual inspection and interviewing the TMF personnel to become familiar with the specifics of the site and local features. The field trip also served to obtain the actual data on the TMF history and its performance that facilitated filling in the TMF Checklist during the workshop. The participants discussed the issues of preparation to the next Project activities.

The Minutes of the meeting including agenda, meeting results and photos are provided in Annex 3.

2.2 First training

The Project team, consisting of five trainers, held the First training on TMF safety at the National Mining University on October 3 -7, 2016. The trainees and the tutors from four technical universities, located in Dnipro, international and national experts with the members of UNECE Joint Expert Group on Water and Industrial accidents (JEG) included, representatives of Ukrainian competent authorities on the national and regional levels participated in the training. The international experts represented Armenia, Belarus, Georgia, Kyrgyzstan, Romania, Serbia, and Switzerland. The TMF operator was represented by the DTEK company.

The First training activities (Figure 2) aimed to:

- ▶ educate students in the safety of tailings in the context of global experience, European standards and Ukrainian practice;
- ▶ train the students of the participating universities on how to apply the TMF Methodology practically;
- ▶ prepare the tutors for the further teaching of the TMF Methodology;
- ▶ test the TMF Methodology and the developed training course;
- ▶ and improve the educational materials and means.

During the First training the students were educated in the key issues of the TMF Methodology including the Tailings Hazard Index (THI) method, the TMF Checklist structure and its practical application. The Project team and the invited international and national experts highlighted the significance of the TMF problem and the advanced approaches of how this challenge is coped with in different countries, taking into consideration the experiences of the countries examined.

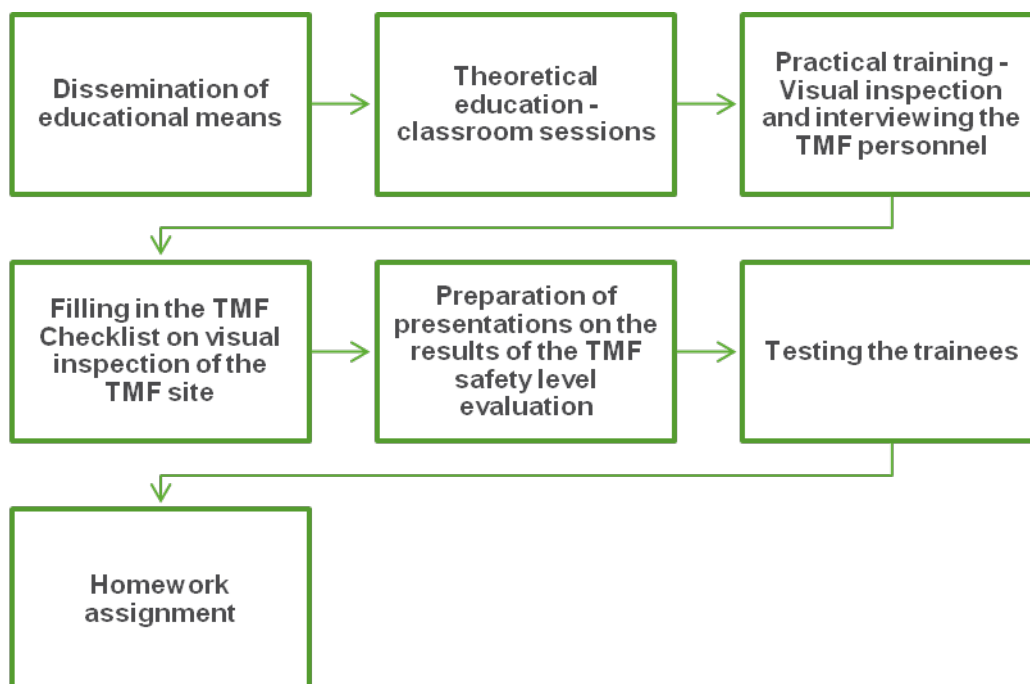
The first training included the visit to the TMF site operated by the thermal power plant, where the company staff and the Project trainers guided the trainees. The TMF operator provided relevant documentation for visual inspection, necessary for applying the THI method and filling in the TMF Checklist.

After the practical on-site training, the students presented the results of their evaluation the TMF safety level, had been received by applying the Checklist part for ‘Visual inspection’. Afterwards these presentations have been forwarded to the TMF operator representative, who participated in the event, which facilitates disclosing safety deficiencies at the checked TMF.

In parallel with the First training, the 15th meeting of the Joint Expert Group on Water and Industrial accidents took place at the NMU.

The Minutes of the First training including its agenda, activity report and photos are provided in Annex 4.

Figure 2: The First training stages. Source: Own illustration, LLC "Ecoplatform"



2.3 Second training

The second training focused on the important aspects of TMF Methodology application, such as evaluation of THI, recommendations of how to give correct answers to Checklist questions, the ways of reporting on the results of safety level evaluation, working with enterprise documentation. The implementation of Directive 2006/21/EC in Ukraine and the related legislative issues were also in the focus of the training, where the analysis of TMF accidents based on global statistics was presented too.

The trainees filled in Subgroup B2 "Detailed document check" of the TMF Checklist in spreadsheets, using the TMF site summary based on the TMF operator documentation and the results of the visual inspection. This work was followed by selecting measures from "Measure Catalogue" for the program to be proposed for safety improvement of the checked TMF. The students presented the results of their evaluation of the TMF safety level based on the assessment done, applying the Checklist part for Document check.

After the theoretical and practical sessions, the trainees took the consolidation knowledge tests developed with the help of electronic Google form. The results of the tests demonstrated that the trainees gave 61% correct answers on the average that is construed as an acceptable result if to consider the initial knowledge of the students in TMF specifics and the TMF Methodology.

For self-study the students were assigned to pass the [UNECE online course](#) on industrial accidents and given a home task to prepare presentations for the Final workshop. They should have reflected on their learning experience during the Project and have been ready to present the outcomes of their evaluation TMF safety level.

The participants of the Second training were asked to fill in the online Questionnaire (developed in a Google form) to evaluate the quality of the training. Analysis of the participants' answers helped the Project team to find the weakest points. The feedback given by the trainees allowed to find the gaps in the educational materials and contributed to their further improvement. The overall assessment of the event by the trainees was very high: 4.8 out of 5.

The Minutes of the Second training including agenda, activity report, photos and overall evaluation of the training quality are provided in Annex 5.

2.4 Round table on the strategy of competent authorities on TMF issues

The Round Table entitled "Implementation ways of Directive 2006/21/EC on the management of waste from the extractive industries" held in Kyiv on February 7, 2017 was conducted by LLC "Ecoplatform" with the support of the Ministry of Ecology and Natural Resources of Ukraine.

The Round Table aimed to unite the efforts of the national competent authorities, TMF operators, national and international experts to elaborate the strategy of competent authorities on TMF legislative issues and the practical ways of implementation the relevant European law provisions to Ukrainian legislation.

The representatives of the Project including the concerned competent authorities attended the event are indicated in Table 3 below.

Table 3: Round table participants

No.	Participant of the Round table	Participant's role
1.	Ministry of Ecology and Natural Resources of Ukraine	Main responsible executor of Implementation Plan for Directive 2006/21/EC
2.	Ministry of Energy and Coal Industry of Ukraine	Responsible executor of Implementation Plan for Directive 2006/21/EC
3.	Ministry of Economic Development and Trade of Ukraine	Responsible executor of Implementation Plan for Directive 2006/21/EC
4.	Verkhovna Rada Committee on Environmental Policy, Nature Resources Utilization and Elimination of the Consequences of Chornobyl Catastrophe	Competent authority
5.	State ecological inspection of Ukraine	Inspection body
6.	State Labour Service of Ukraine	Responsible executor of Implementation Plan for Directive 2006/21/EC
7.	State Emergency Service of Ukraine	Responsible executor of Implementation Plan for Directive 2006/21/EC
8.	State Service for Food Safety and Consumer Protection of Ukraine	Responsible executor of Implementation Plan for Directive 2006/21/EC
9.	German Environment Agency (UBA)	Project party
10.	United Nations Economic Commission for Europe	Project party
11.	LLC "Ecoplatform"	Project party
12.	National Mining University	Project party
13.	Institute of environmental economics and sustainable development of National Academy of Sciences of Ukraine	Project party
14.	DTEK company	Representatives of industrial enterprises
15.	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)	Expert on National waste management strategy

No.	Participant of the Round table	Participant's role
16.	National Environmental Agency, Georgia	Invited expert
17.	Leading scientists and experts on TMF safety	National experts

The participants of the Round table discussed the document “Analysis of Ukrainian legislation compliance with the requirements of Directive 2006/21/EC on the management of waste from the extractive industries and the Roadmap of its implementation in the context of improving TMFs safety” which had been developed by the Project team. During two discussion panels, the responsible representatives outlined their vision on the implementation of Directive 2006/21/EC in Ukraine. The focus of the second discussion panel was on the methodological support for tailings management in terms of the provisions of Directive 2006/21/EC. The Project team presented the methodology of improving TMFs safety developed within the Project where the Ukrainian version of TMF Methodology was based on the comments received from competent authorities. The feedback and comments from two trainings held in Dnipro within the Project activities had been taken into account when making changes in the Ukrainian version of TMF Methodology adapted for inspection bodies.

The interactive map "Locations of large-tonnage storages of industrial wastes in Ukraine" was presented by the Minister of Environment and Natural Resources of Ukraine during press briefing "Tailings Management Facilities Safety in Ukraine; European standards for industrial waste management".

The Round Table resolution summarized the proposals to the responsible competent authorities, namely the Ministry of Energy and Coal Industry of Ukraine, Ministry of Ecology and Natural Resources of Ukraine, Ministry of Economic Development and Trade of Ukraine, the State Environmental Inspection of Ukraine, State Service of Ukraine on Labour, State Emergency Service of Ukraine. It was recommended to:

- ▶ review the proposals presented in the document “The analysis of Ukrainian legislation compliance with the requirements of Directive 2006/21/EC on the management of waste from the extractive industries and Roadmap of its implementation in the context of improving TMFs safety”;
- ▶ revise the implementation terms and introduce relevant amendments to the Implementation Plan for Directive 2006/21/EC (approved by Resolution of the Cabinet of Ministers of Ukraine No. 346-p of 8 April 2015);
- ▶ consider the possibility of approval the “Methodology for Comprehensive Evaluation of Tailings Management Facilities Safety” and its subsequent use as a regulatory or guidance document at waste disposal sites operation and while state supervision (control) activities in the relevant areas.

The Minutes of the meeting including agenda, meeting results and photos are provided in Annex 6. The Resolution of the Round table is presented in Annex 7.

2.5 Final workshop

The Final workshop was held in the National Mining University on May 16-18, 2017. Apart from the sessions for all the participants, it included the UNECE JEG meeting held on May 18, 2017.

The workshop objectives were to present the accomplishments in educational and legislative Project components, and to discuss the proposals on follow-up activities and recommendations to the UNECE JEG.

The workshop participants were the UBA representatives, the Project team, international experts, and the representatives of Ukrainian competent authorities, the representative of the TMF operator, and the tutors and students from the participating universities.

During the Final Workshop the students presented the results of their work within the Project, including its practical part: TMF safety evaluation on an inspected thermal power plant. All relevant materials are provided in Annex 8.

Within the framework of the Final workshop, the Project team presented the Project results from the perspective of development its educational and legislative components, discussed them with the workshop participants. The proposals on the Project follow up activities were considered – for details please refer to section 6 of this Report.

The Certificate award ceremony officially closed the Final workshop. The certificates of successful completion of the training course were awarded by the representatives of UBA, UNECE, NMU and LLC “Ecoplatform” to the teachers and students of four participating universities, who took part in the Project.

The agenda, main statements and conclusions of the Final Workshop are indicated in the Minutes of meeting provided in Annex 9.

Annex 10 contains all photos in electronic format sorted by Project events.

3 Achieved results

During the Project implementation the following results were achieved

Under educational Project component:

- ▶ Training course for university students and teachers on TMF safety issues by applying TMF Checklist
- ▶ The e-learning course “Safety of tailings management facilities” hosted on Moodle Platform of the NMU website
- ▶ Brief Summary of a TMF of the Thermal Power Plant “Prydniprovsk” as a training material
- ▶ Students’ presentations on safety evaluation of the TMF of the Thermal Power Plant “Prydniprovsk”
- ▶ Education modules on TMF safety based on the TMF Methodology, Training and e-learning courses on TMF safety integrated in curricula of the participating universities

Under legislative Project component:

- ▶ Report on Analysis of Ukrainian legislation compliance with the requirements of EU law and Roadmap of its implementation in the context of improving TMFs safety (Directive 2006/21/EC, SEVESO-III Directive and TMF Safety Guidelines)
- ▶ The improved Methodology for Comprehensive Evaluation of Tailings Management Facilities Safety based on participants’ feedbacks received during all Project events
- ▶ Ukrainian version of Methodology for Comprehensive Evaluation of Tailings Management Facilities Safety adapted for inspection bodies
- ▶ The updated Ukrainian TMF database including the interactive map on Google-maps
- ▶ Recommendations on Improving Tailings Safety Management System submitted to the Ministry of Ecology and Natural Resources of Ukraine

3.1 Educational Project component

3.1.1 Training course on TMF safety

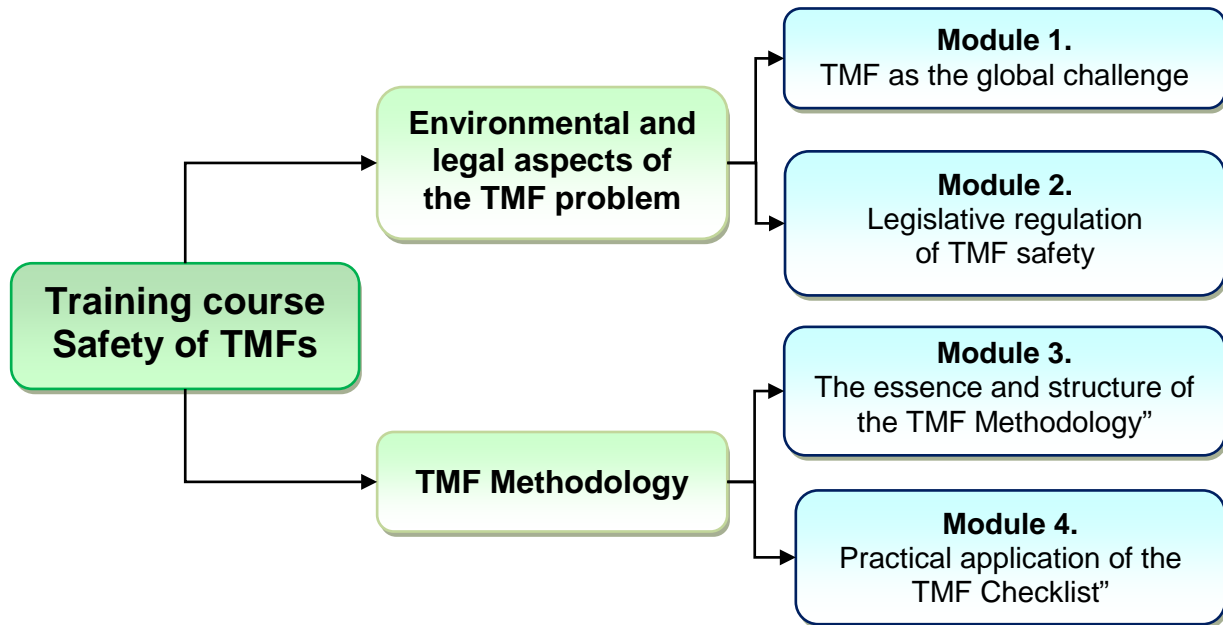
The training course on TMF safety issues was developed for university students as a target audience. It included presentations of world experience and Best Available Technologies (BAT), some statistics on TMF exploitation, using interactive tools and various educational means. The training course content is shown below (Figure 3).

Training course included the following materials:

- ▶ the theoretical knowledge package, including basic international and Ukrainian documents on TMF safety, texts and links to regulatory documents, guidelines, and publications;
- ▶ brief summary of the TMF site inspected during practical part of trainings;
- ▶ presentations with the core of the training modules;
- ▶ templates of TMF Checklist and THI method in MS Excel for practical work;

- ▶ tests and examples based on the experience of TMFs in Ukraine, templates and recommendations to making reports after having applied the TMF Checklist;

Figure 3: Brief content of the training course "Safety of TMFs". Source: Own illustration, NMU, LLC "Ecoplatform"



In addition, the trainees had the opportunity to get additional knowledge on the work essence of UNECE Convention on the Transboundary Effects of Industrial Accidents (TEIA) by passing the UNECE online training course on industrial accidents during trainings. At the end, students got appropriate certificates on successful completion the training course on TMF safety.

The brief summary of the TMF of the thermal power plant prepared by DTEK company and LLC "Ecoplatform" was used as training materials. This document provided the necessary initial information to the trainees studying the TMF Checklist for assessment of tailings safety and the set of measures for improvement its environmental safety to prevent emergencies at tailings ponds. The brief summary of the thermal power plant's TMF is provided in Annex 11 that contains confidential information and not intended for the public version of this Report. The document is presented in Russian and contains the summary in English.

Based on the materials improved during two trainings for the university students, the Project team developed the e-learning course "Safety of tailings management facilities" described below.

3.1.2 E-learning course "Safety of tailings management facilities"

The e-learning course "Safety of tailings management facilities" was developed as a tool to familiarize students, teachers and specialists with the principles of safe operation of industrial waste storages based on the TMF methodology.

All the materials, formats and instruments tested during two trainings held at the NMU were collected and redesigned to fit the Moodle system requirements to e-learning courses that made it possible to be hosted on the NMU e-learning portal.

The Project team have chosen Moodle platform among the other e-learning systems for the following reasons.

- ▶ It is free to use.
- ▶ The system is distributed in open source with the ability to adapt it to specific problems appear.

- ▶ It provides built-in tools for developing e-learning courses.
- ▶ The system is modular and easy to be installed.
- ▶ It is used in the NMU and other Ukrainian universities as the Project contractor(s); it is also used in many educational institutions worldwide.
- ▶ The platform complies with the Western system of education, where one course can be taken concurrently by several student groups.
- ▶ Any e-learning course developed in the Moodle platform can be easily hosted on any institution website which uses this platform.

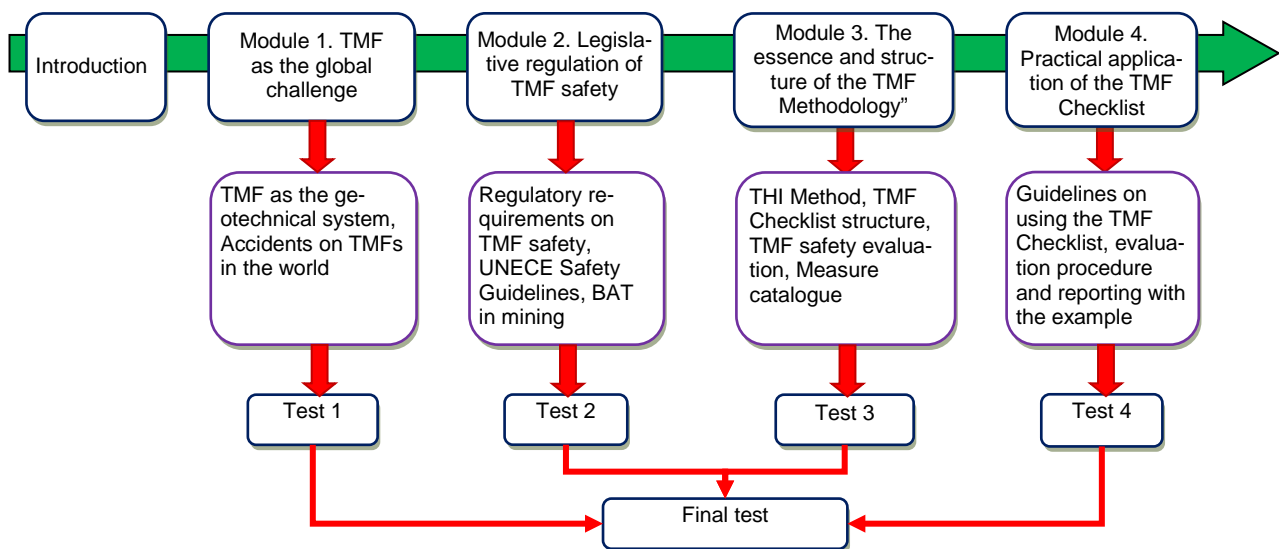
It should be noted that this course could be reworked in any e-learning format with minimum adjustments. All lectures, tests and tasks are proved and checked.

At present the design of the course has been fully completed, most part of the course content including structured lectures, videos, presentations and knowledge tests has been uploaded to the external Google storage linked with the NMU e-platform. The course design allows its easy shifting to another site, keeping the course content in the same external storage.

The instruments of the developed e-learning course include structured text, audio and video (screen movie).

Apart from Introduction, the course comprises four modules including (i) TMF safety as a global challenge, (ii) Legislative regulation of TMF safety, (iii) The essence and structure of the TMF Methodology, and (iv) TMF Checklist application. The lectures held during the trainings and knowledge consolidation tests were updated, taking into account the trainees’ and students’ feedback. The e-learning course content is shown below on Figure 4.

Figure 4: E-learning course structure. Source: Own illustration, NMU, LLC “Ecoplatform”



The developed course was opened for trainees in order to pilot it, gather comments and ideas on what should be changed in the course and/or added in accordance with trainees’ needs and wants. The main concerns were the extent of information, font settings, test formats etc. After all the necessary corrections had been done, the course was tested by students and university teachers. Now it can be offered to the wider audience. The course is presented in Annex 12; it is available at the NMU portal for e-learning at the link <http://do.nmu.org.ua/course/index.php?categoryid=280> (English version) and <http://do.nmu.org.ua/course/view.php?id=1982> (Ukrainian version). The requests for a password to get access to the e-learning NMU portal should be sent to Prof. D. Rudakov (rudakovdv21@gmail.com).

The backup version of the course provided on CD in electronic form allows reproduce the developed e-learning course in any server that uses Moodle platform.

3.2 Legislative Project component

The legislative Project component was implemented by LLC “Ecoplatform” in close cooperation with the Ministry of Ecology and Natural Resources of Ukraine. In the framework of legislative assessment experts analysed the Ukrainian legislation compliance with the requirements of Directive 2006/21/EC on the management of wastes from extractive industries, searched the ways for implementing the UNECE TMF Guidelines and TMF Methodology in Ukraine and made brief overview of the provisions of Directive 2012/18/EC on the control of major accident hazards involving dangerous substances (SEVESO-III Directive).

The Roadmap of Directive 2006/21/EC implementation through the instrumentality of UNECE Safety Guidelines and Good Practices for Tailings Management Facilities in the national legislation was developed based on the results of legislative assessment.

The Round table on the implementation of Directive 2006/21/EC provisions was held with the aim to unite the efforts of all responsible parties on TMF safety. Under this event, the TMF Methodology and TMF interactive map were presented as practical tools for implementation Directive 2006/21/EC provisions.

The Ukrainian version of TMF Methodology was adapted for inspection bodies based on the comments received from competent authorities and taking into account the feedback and comments from two trainings held in Dnipro within the Project activities. Resolution of the Round table was agreed by the participants as meeting results. “Recommendations on improving Tailings Safety Management System” were formed according to the Resolution of the Round Table as the proposals on further implementation of the Project developments. For more detailed information, please refer to below indicated subsections and Annexes mentioned there.

3.2.1 Report on the implementation of EU requirements on TMF safety by Ukraine: EU Directives, UNECE Guidelines and TMF Methodology

The research conducted by specialists of LLC “Ecoplatform” and State Enterprise “Institute of Environmental Economics and Sustainable Development of National Academy of Sciences of Ukraine” included the analysis of compliance of Ukrainian legislation to the provisions of Directive 2006/21/EC on the management of wastes from extractive industries as well as the development of a Roadmap (Action Plan) for the implementation of Directive 2006/21/EC, using the UNECE Safety guidelines and good practices for TMFs. The experts have faced a need to analyse the compliance of Ukrainian legislation to the provisions of Directive 2012/18/EC on the control of major accident hazards involving dangerous substances. This report contains the aforementioned analysis without indicating possible ways for the implementation of this Directive.

The signing of the EU-Ukraine Association Agreement and further approval of plans for the implementation of EU Directives has elevated the priority of implementing the Directive 2006/21/EC in practical terms (both for the experts and the government).

Directive 2006/21/EC on the management of waste from extractive industries is considered to be a framework enactment under the European practices, which is used to identify and regulate objectives designed to increase the safety of TMFs. Reaching the safety objectives would contribute to the “Guidelines on safety and good practices at TMFs” developed under the aegis of the UNECE. International experience also shows the feasibility of developing guidelines and policy documents, regulating the safety of TMFs at the national and corporate levels. The latter would serve as a set of minimum requirements to ensure the acceptable level of safety at the facilities.

The adoption of the respective national legislation, development of proper administrative rules and mechanisms, approval of the TMF Methodology drafted by a team of Ukrainian experts should be organically combined with the implementation of Directive 2006/21/EC.

The basic steps of the Roadmap of Directive 2006/21/EC implementation in national legislation are the following:

- ▶ Amendments to the implementation plan of the Directive 2006/21/EC regarding:
 - ▶ list of the implementation measures
 - ▶ revising the timing of their implementation
 - ▶ laying the responsibility for the implementation of the Directive 2006/21/EC on the Ministry of Ecology and Natural Resources of Ukraine
- ▶ Implementation of the transposition measures of Directive 2006/21/EC.

For detailed information, please refer to Annex 13, where the analysis of the Ukrainian legislation compliance with the requirements of Directive 2006/21/EC on the management of waste from the extractive industries and the Roadmap of its implementation in the context of improving TMFs safety is presented.

3.2.2 Methodology for Comprehensive Evaluation of Tailings Management Facilities Safety – updated version 2017

Within the Project activity, the TMF Methodology was tested and improved through new application experience. The participants' feedback (questions, remarks, recommendations) received during all the Project events were collected and analysed.

During the Project implementation the TMF Methodology was improved based on the per training participants' feedback, its upgraded and updated 2017 version was developed (both Ukrainian and English versions). Moreover, the Ukrainian version of TMF Methodology was adapted for inspection bodies based on the comments received from competent authorities. As a result, the Project team developed TMF Methodology in Ukrainian, which is adapted to the needs of the national inspection bodies. The main amendments made in both versions of TMF Methodology. The English version improved in 2017 and the adapted Ukrainian version for inspection bodies are described below.

Improved 2017 version of TMF Methodology

During two trainings held in Dnipro, the trainers and tutors submitted their feedback and proposals on how to improve the TMF Methodology and the education modules, which were summarized by the Project team afterwards. In total, there were 56 proposals and recommendations related to the TMF Methodology improvements. The participants also assessed the quality of the event organization and the trainers' performance. The training feedback was taken into account when developing the proposals for the TMF Methodology improvement.

Most of the proposals were focused on the TMF Methodology and its elements; about 20 proposals were concerned with formatting and layout. They related to wording, checklist template design etc. According to the opinions of most of the tutors and the majority of trainees, the TMF Methodology is well thought-out, logically structured, easy to use and understand; it did not cause principal difficulties; it does not have substantial deficiencies; the methodology needs minor adjustments, re-wording of some questions, and software improvement.

The main amendments made in the improved 2017 version of TMF Methodology (compared to the 2016 version published on UBA website) are indicated below:

- ▶ The Methodology title has been changed to “Methodology for Comprehensive Evaluation of Tailings Management Facilities Safety”,

- ▶ Section “Abbreviations” has been moved after Contents,
- ▶ Section “Terminology” has been moved to “Chapter 1. TMF Methodology Concept” as a new subsection “Methodology application scope and key definitions”. A paragraph, describing the applicability of the Methodology, has been added,
- ▶ The numbering of tables and figures throughout the document has been corrected,
- ▶ In section Foreword the headings have been changed to “The relevance of the Methodology” and “Aims and scope of the Methodology”,
- ▶ Both TMF-Projects implemented in Ukraine are mentioned: “Improving the safety of industrial tailings management facilities based on the example of Ukrainian facilities” (2013-2015) and “Raising Knowledge among Students and Teachers on Tailings Safety and its Legislative Review in Ukraine” (2016-2017),
- ▶ The Figure “TMF Checklist structure” has been corrected in the arrangement of a block “Measure Catalogue”,
- ▶ The format of Table “TMF Checklist question groups” was changed in order to display the indicated information better,
- ▶ As for the TMF Checklist template in MS Excel – based on the results of comments received the figure was edited (corrected the axes titles), typos were corrected and the protection of cells was changed (there is a ban on two or more answers to one question, the cell in the column "not applicable" is protected from editing for uniquely applicable questions).

The improved 2017 version of the *Methodology for Comprehensive Evaluation of Tailings Management Facilities Safety* is provided in Annex 14. For the recent versions of TMF Checklist template and THI Template in MS Excel, please refer to Annexes 15-16.

Adapted version of TMF Methodology for Ukrainian inspection bodies

During 2016 LLC “Ecoplatform” officially submitted the TMF Methodology to relevant competent authorities dealing with TMF safety issues with the request to consider the Methodology as a practical tool for assessing the TMFs safety and to provide a review of the methodology with suggestions and comments. The TMF Methodology was officially submitted to:

- ▶ Ministry of Energy and Coal Industry of Ukraine – as the main body in central executive authorities’ system forming and implementing government policy of Energy Sector;
- ▶ Ministry of Economic Development and Trade of Ukraine – which is responsible for regulating the industrial sector of Ukraine;
- ▶ State ecological inspection of Ukraine – as a central executive body that ensures the implementation of state policy on the state supervision (control) in the field of environmental protection, rational use, reproduction and protection of natural resources;
- ▶ State Labour Service of Ukraine – which is responsible for implementing government policy on industrial safety and carrying out the state mining supervision;
- ▶ State Emergency Service of Ukraine – which is responsible for implementing government policy on technogenic safety;
- ▶ State Service for Food Safety and Consumer Protection of Ukraine – which is responsible for implementation within its competence the control on environmental factors that may have harmful effects on human health and on which the function of the State Sanitary and Epidemiological Service was assigned;
- ▶ State Water Resources Agency of Ukraine – which is responsible for monitoring the technical condition of hydrotechnical constructions subject to its jurisdiction.

LLC “Ecoplatform” received the positive feedback from the relevant competent authorities, namely from the Ministry of Energy and Coal Industry of Ukraine, Ministry of Economic Development and Trade of Ukraine, State ecological inspection of Ukraine, State Labour Service of Ukraine and State Emergency Service of Ukraine. They highly appreciated the TMF Methodology as actual and essential

tool for practical use in Ukraine. Annex 17 provides the official letters-responses received from authorities (in Ukrainian).

The Project team revised the Ukrainian version of TMF Methodology and adapted it for the national inspection bodies based on the written replies from competent authorities, the proposals received during the Round Table, and taking into account the feedback and comments from the participants of two trainings held in Dnipro within the Project activities. The adapted version of TMF Methodology for Ukrainian inspection bodies contains the following significant amendments in addition to those made as per to the feedback of the trainees in the improved 2017 version:

- ▶ The Ukrainian terms concerning TMFs operating were revised;
- ▶ The Measure Catalogue was removed and the appropriate changes were made in the Checklist template;
- ▶ The text through the Methodology was revised in the terms of Methodology application by inspection bodies.

The Ukrainian version of the TMF Methodology adapted for inspection bodies is included in “Recommendations on Improving Tailings Safety Management System” that ‘Ecoplatform’ formed and submitted to the Ministry of Ecology and Natural Resources of Ukraine – for details, please refer to section 3.2.4 and Annex 19 of this Report.

3.2.3 Updated Ukrainian TMF database

Within the framework of the previous completed UBA’s project (2013-2015)² the Project team created the database of Ukrainian TMFs including the data on 145 tailings of different hazard/risk. LLC “Ecoplatform” in cooperation with the Ministry of Ecology and Natural Resources of Ukraine has processed the Registers of waste disposal sites (state reporting documents) and selected the appropriate objects that are considered as TMFs with relevant information to complement the existing database. As a result, the updated Ukrainian TMFs database contains 344 TMFs as of April 2017 and has been used as a data source for updating interactive TMF map on Google Maps resource.

The updated database is provided in Annex 18 in MS Excel and contains the following information for each object:

- ▶ Hazard ranking
- ▶ Name of the TMF site
- ▶ Industry scope
- ▶ Year of commissioning
- ▶ Location (region of location and address)
- ▶ Material stored
- ▶ Hazard class
- ▶ Capacity (Mil m³)
- ▶ Geographic coordinates
- ▶ Value of Tailings Potential Hazard Index.

Objects in the database were sorted by the basic index of potential hazard, which takes into account the hazard class and the amount of waste. Potential hazard rating indicates the priority of the sites for taking action in order to improve safety in the country. The table below shows the top 10 objects that are potentially the most hazard.

² International Project „Improving the safety of industrial tailings management facilities based on the example of Ukrainian facilities”

Table 4: Top 10 potentially the most hazard TMFs in Ukraine

No.	Name of the TMF site	Location	Material stored	Hazard class	Capacity (Mil m ³)
1	TMF No.2 of Novorozdilsk State Mining and Chemical Enterprise "Sirka"	2, Hirnycha str., Novyi Rozdil, Lviv region	Flotation slurry, I class	1	18.6000
2	TMF of Stebnyk State Mining and Chemical Enterprise "Polimineral"	127, Drohobyska str., Stebnyk, Lviv region	Brine, II class	2	13.1000
3	Sludge storage of PJSC "Avdiivka Coke and Chemical Plant"	1, Industrial ave., Avdiivka, Donetsk region	Tails	2	8.0000
4	Sludge storage PJSC "Yasinovsky Coke Plant"	62, Lermontova str., Vasylivka, Yasynuvata district, Donetsk region	Sludge, III class	2	7.6680
5	Sludge storage pond of PJSC "Central Ore Mining and Processing Plant"	Zhovtneve district, Kryvyy Rih, Dnipropetrovsk region	Sludge, I class	4	328.9800
6	Sludge storage of PJSC "Makiivskiy Coke-Chemical Plant"	Zhovtneve district, Kryvyy Rih, Dnipropetrovsk region	Coal preparation wastes, II class	2	2.4900
7	Sludge storage PJSC "Sumykhimprom"	Kharkivska str., Sumy	Sludge, III class	3	20.1660
8	Sludge storage of JSC "Makiivka Integrated Iron and Steel Works"	47, Metalurhiyna str., Makiivka, Donetsk region	Calx, II class	2	1.7600
9	TMF of State Enterprise "Directorate of Kryvyy Rih Mining and Processing Plant of Oxidized Ore"	Industrial site of Kryvyy Rih Mining and Processing Plant of Oxidized Ore, Dolynska, Kirovohrad region	Coal preparation sludge, I class	4	125.0000
10	Acid storage, PJSC "Crimea TITAN"	Pershokostyantynivka, Chaplinka district, Kherson region	Waste of II and IV class	2	0.927883

Based on the updated TMFs database with 344 objects, the Project team built the Ukrainian TMFs interactive map on Google Maps (by entering coordinates of the objects in the online module). The current version of this map is available under [this link](#).

The purposes of the database existence are:

- ▶ to store the complete, relevant, structured information about TMFs in Ukraine;
- ▶ to have fast and convenient access to the information by all the stakeholders.

The database can be applied for:

- ▶ updating information about such facilities in Ukraine,
- ▶ calculating the TMF hazard/risk index (THI),

- ▶ mapping of the hazardous objects.

Database prospects include the following:

- ▶ This is the first step to create GIS database of TMFs for a country/region with the modern software, using the THI evaluation method.
- ▶ A country can identify the hazardous areas mostly affected by tailings and water bodies under risk and establish measure priorities based on interactive Google maps.
- ▶ Tools such as TMF database, calculating method of potential hazard/risk index, and cartographic representation of the calculation results represent a holistic system that can be used for different purposes.
- ▶ Efficient use of TMF database is important on the level of state management of hazardous objects.

3.2.4 Recommendations on Improving Tailings Safety Management System

LLC “Ecoplatform” elaborated the proposals on further implementation of the Project developments as “Recommendations on Improving Tailings Safety Management System” according to the Resolution of the Round Table “Implementation ways of Directive 2006/21/EC on the management of waste from the extractive industries” (please refer to section 2.5). This document is presented in Annex 19 (Ukrainian version including English-language summary). It contains the following Project developments that were described in the previous sections:

- ▶ The analysis of Ukrainian legislation compliance with the requirements of Directive 2006/21/EC on the management of waste from the extractive industries and Roadmap of its implementation in the context of improving TMFs safety;
- ▶ Methodology for Comprehensive Evaluation of Tailings Management Facilities Safety (Adapted version for inspection bodies, May 2017); the Database of Ukrainian TMFs (344 objects as of April 17, 2017).

LLC “Ecoplatform”, authorized by German Environment Agency (UBA), submitted “Recommendations on Improving Tailings Safety Management System” to the Ministry of Ecology and Natural Resources of Ukraine and received the positive feedback with the gratitude to the Project. The Ministry has indicated in its letter that the developed Project materials meet the Ukrainian political course in European integration, they will be further used in the work of the Ministry. For details, please refer to the next section 4.2.

4 Evaluation of Project results

The results achieved during the Project implementation can be summarized as follows:

- ▶ 5 international meetings were conducted in Dnipro and Kyiv that have brought together the leading national and international experts in TMF safety;
- ▶ All the participants (in total above 50 people) were acquainted with and have become aware of UNECE *TMF Safety Guidelines* and *TMF Methodology*;
- ▶ The Project has involved the representatives of the Ministry of Ecology and Natural Resources of Ukraine, Ministry of Education and Science of Ukraine, Ministry of Energy and Coal Industry of Ukraine, State ecological inspection of Ukraine, State Emergency Service of Ukraine, local competent authorities responsible for environmental safety in the industry. The meetings with representatives of the competent authorities allowed to get a good grasp of the state and the specifics of TMF management in Ukraine;
- ▶ The issues relevant to the practical ways of harmonizing Ukrainian legislation to European law were highlighted. Close cooperation of the Project lawyer and representatives of the concerned national authorities in reviewing CAs' strategy have provided the valuable feedback, comments and recommendations for developing the appropriate Roadmap, containing an Action plan for implementation of Directive 2006/21/EC in Ukraine;
- ▶ Additional 199 TMFs were identified in cooperation with Ministry of Ecology and Natural Resources of Ukraine, and respective updates have been made in the existing database and interactive map of Ukrainian TMFs;
- ▶ The Project was implemented in cooperation with an industrial partner – DTEK energy company that is the biggest Ukrainian company in power generation, and provided the opportunities for practical training within the Project;
- ▶ 10 international experts from 9 countries (Switzerland, Belarus, Romania, Georgia, Armenia, Kyrgyz Republic, Republic of Serbia, Hungary, Austria) participated in the First training and the Final workshop. They made presentations for students, highlighting the state-of-the-art of tailings safety in different countries;
- ▶ Two trainings on TMF safety were conducted, including theoretical lectures and practical works at the TMF. This allowed to combine effectively theory and practice in one training course on TMF methodology;
- ▶ 20 students and 4 teachers from Dnipro technical universities have been educated in the safety of tailings in the context of global experience, European standards and Ukrainian practice. They were trained how to practically apply the TMF Methodology;
- ▶ 4 tutors (teachers from four universities) have been prepared for further teaching /training students in the TMF safety issues, including TMF Methodology application;
- ▶ The safety level of TMF that is located on thermal power plant has been evaluated applying TMF Checklist;
- ▶ The e-learning course “Safety of tailings management facilities” has been developed on the basis of the materials improved during two trainings for the university students and tested. It can be offered to wider audience by placing it on any of the modern educational platform;
- ▶ Almost all training and workshop participants highly assessed the quality of the documents developed within the Project and the events, on whole;
- ▶ The Project recommendations will be further used by competent authorities in improving TMF safety;
- ▶ Exchange of ideas within the framework of the round table, trainings for students and teachers, developers of the TMF Methodology, local and international experts has helped to incorporate properly the findings gained during trainings to improve the methodology and the training course itself;

- The Project team members selected in Ukraine for this Project, being the developers of the TMF Methodology, have proven their competence, responsibility and diligence on tailings safety in Ukraine.

According to the objectives declared in the Project's concept, all of them have been successfully achieved as it is approved in Table 5.

Table 5: Tasks, anticipated outcomes and corresponding results

No	Tasks and anticipated outcomes	Project Results and Products
Tasks		
1	Familiarization of students with international safety standards in the field of tailings management outlined in relevant documents including the UNECE document "Safety guidelines and good practices for tailings management facilities (2008, updated version 2014)" and the TMF Methodology	Ukrainian Project team have conducted two trainings on TMF safety in National Mining University (Dnipro) for students and teachers of 4 technical universities (please refer to sections 2.3 and 2.4)
2	Completion of the UNECE online training course on industrial accidents followed by taking an appropriate certificate	All trainees have passed the UNECE online training on industrial safety and get appropriate certificates on successful completion
3	Improvement and adaptation of the education course on the TMF Methodology for the university students' audience based on modern training experience	Within the trainings trainees participate in different types of learning activities: lectures, reviewing the documents, reporting, field trips, calculations, interviewing of the TMF staff and others (please refer to sections 2.3 and 2.4)
4	Creation of a new interactive training module that can be used for remote (distance) education using modern technologies	The e-learning course "Safety of tailings management facilities" was developed. It is located on the distance educational webpage of the NMU under Moodle platform. The course design allows easy shifting it to another site keeping the course content in the same external storage (section 3.1.2)
5	Active learning of efficient procedures of environmental audit and inspection based on TMF Checklist application	The trainees practically applied the TMF methodology at the TMF of thermal power plant: during the First training, applying Checklist part for visual inspection, and filling in the Subgroup of questions "Detailed document check" (section 2.3 and 2.4) within the Second training. Annex 8 describes the results of TMF safety evaluation performed by students
6	Testing the TMF Methodology through new application experience. Collection and analysis of the participants' feedback (questions, remarks, recommendations) on the methodology improvement within this Project activity	The Project team has improved the TMF Methodology (both Ukrainian and English versions) as per training participants' feedback collected during all Project events. Moreover, the Ukrainian version of TMF Methodology has been adapted for inspection bodies based on the comments received from the competent authorities (for details see section 3.2.2)
7	Review of the CAs' strategy on TMF issues in terms of Ukraine's European integra-	LLC "Ecoplatform" has reviewed the CA's strategy on TMF issues within legislative Project component. The

No	Tasks and anticipated outcomes	Project Results and Products
	tion course	
8	Review of Directive 2006/21/EC requirements on waste management from extractive industries that become mandatory for Ukraine to complete the Association Agreement	developed “Analysis of Ukrainian legislation compliance with the requirements of Directive 2006/21/EC on the management of waste from the extractive industries and a Roadmap of its implementation in the context of improving TMFs safety” (presented in Annex 13) includes the review of regulatory considerations on TMFs safety in Ukraine as well as analysis of compliance of Ukrainian legislation to the provisions of Directive 2006/21/EC on the management of wastes from extractive industries. Moreover, the report also considers the provisions of Directive 2012/18/EC on the control of major-accident hazards involving dangerous substances.
9	Collection of the comments and recommendations of all the concerned national authorities on how to implement Directive 2006/21/EC	To collect the comments and recommendations from all the concerned national authorities LLC “Ecoplatform” with the support of the Ministry of Ecology and Natural Resources of Ukraine the Round Table entitled "Implementation ways of Directive 2006/21/EC on the management of waste from the extractive industries" held (for details please refer to section 2.5)
10	Development of the Roadmap containing Action plan for implementation of Directive 2006/21/EC through the instrumentality of UNECE TMF Guidelines	Report on Analysis of Ukrainian legislation compliance with the requirements of EU law (Annex 13) includes the Roadmap of Directive 2006/21/EC implementation in the context of improving TMFs safety
Final Project products		
11	The educational course on the TMF Methodology adopted to acquaint students with tailings safety issues	E-learning course “Safety of tailings management facilities” – section 3.1.2
12	The list of the proposals for the further update/improvement of the TMF Methodology	The improved 2017 version of TMF Methodology – Annex 14. The adapted Ukrainian version of TMF Methodology for inspection bodies is included in “Recommendations on Improving Tailings Safety Management System” – Annex 19.
13	Putting the educational course in teaching/learning process confirmed by the participating universities	The educational course on tailing safety has been integrated into teaching/learning process in the form of thematic modules supplementing the existing courses on environmental safety taught at the participating universities beginning from 2017/2018 academic year – Annex 20. The course is available at the NMU portal for e-learning at the link http://do.nmu.org.ua/course/index.php?categoryid=280 (English version) and http://do.nmu.org.ua/course/view.php?id=1982 (Ukrainian version). The requests for a password to get access to the e-learning NMU portal should be sent to Prof. D. Rudakov (rudakovdv21@gmail.com).
14	The Project summary submitted to the Ministry of Education and Science of Ukraine with the recommendation to use	Under the conditions of university autonomy and self-administration the Ministry of Education and Science of Ukraine has recommended the NMU to directly inform

No	Tasks and anticipated outcomes	Project Results and Products
	the developed course in education of students of environmental curricula	Ukrainian universities of new e-learning course on tailings safety. The NMU has sent relevant information on the course and opportunities to use it in teaching/learning process to 36 universities from 17 regions of the country as the most likely course users – Annex 22.
15	A Roadmap that contains Action plan for implementation of Directive 2006/21/EC through the instrumentality of UNECE TMF Guidelines agreed by representatives of concerned national authorities	“Analysis of Ukrainian legislation compliance with the requirements of Directive 2006/21/EC on the management of waste from the extractive industries and Roadmap of its implementation in the context of improving TMFs safety” – section 3.2.1 and Annex 13
16	The final report in English and the summary in English, Ukrainian, and Russian on all working packages completed within Project activities	Final Report on the Project “Raising Knowledge among Students and Teachers on Tailings Safety and its Legislative Review in Ukraine” includes Annexes describing working packages completed within Project activities (Annexes 2-10), as well as developed Project documents (Annexes 11-19)

During the Project implementation under close cooperation with the national authorities LLC “Ecoplatform” has the opportunity to get and treat the state statistical data on Ukrainian TMFs from MENR. As a result, LLC “Ecoplatform” staff developed additional Project products to the ones planned in the original Project concept, namely:

- ▶ Updated Ukrainian TMF database (containing 344 objects)
- ▶ Ukrainian TMFs interactive map based on Google Maps
- ▶ Recommendations on Improving Tailings Safety Management System submitted to the Ministry of Ecology and Natural Resources of Ukraine

4.1 Dissemination of Project results

International meetings

To disseminate the preliminary results of the Project including the results of two trainings the Project director Prof. D. Rudakov took part in the Ninth meeting of the Conference of the Parties to the UNECE TEIA Convention held in Ljubljana (Slovenia) on 28–30 November, 2016. During the Side Event on Wednesday, 30 he made the presentation entitled “Preventing water pollution based on the UNECE Safety Guidelines and Good Practices for Tailings Management Facilities”, in which he outlined the Project background, Checklist development, and Project products that can be used in UNECE member countries solving the TMF-related issues. Apart from the Project result dissemination, this event provided the opportunity to establish and deepen the contacts with the Conference participants in order to widen TMF Methodology application in UNECE member countries.

Apart from the conference in Ljubljana, the Project results were presented at the 15th International Forum on Industrial Safety in St.-Petersburg (Russia) held from May 30 to June 2, 2017. During the UNECE Special Session on May 31 the Project director Prof. D. Rudakov made a presentation entitled “Application of the UNECE Safety Guidelines for Tailings Management Facilities in Ukraine”, in which the Project development milestones and developed products, including the education e-learning course “TMF Safety”, were highlighted. The questions and answers during the discussion raised the issues of TMF Checklist application to auditing hazardous mining facilities, including tailings dams. The prospects of the TMF Methodology and Checklist application in Russian Federation were dis-

cussed with the Head of the Forum Organising Committee and President of “City Center of Expertise” Alexander Moskalenko.

Implementation of the education modules on TMF safety in Ukrainian universities

According to the Law of Ukraine on Higher Education adopted in 2014, which proclaimed the autonomy of higher educational establishments, the development and introduction of educational programs is the right and responsibility of universities. The Ministry of Education and Science of Ukraine formally does not influence the introducing and modifying educational programs.

The participating universities have the options to implement the educational course “TMF Safety” either as a separate course or as a thematic education module(s), supplementing similar existing courses, which are currently taught in Ukraine. The universities had to account for the current trend in higher education of Ukraine that consists in shortening the number of educational courses caused by the curricula unification. Introducing a new course under such conditions becomes problematic. Thus, the most promising way of the course integration into teaching/learning process is to start from introducing individual modules to the existing courses on environmental and industrial safety taught by the tutors or their colleagues for the Bachelor’s students of the 4th year of study and/or 1st year of Master’s degree education within environmental curricula.

The materials of two trainings amalgamated by the Project team into the educational course “TMF safety” were used by the participating universities in the form of education modules on TMF safety to update the existing courses as follows.

The Ecology and Environment Protection Department of the National Mining University has updated the course “Technoecology” (duration 108 hours) taught for Master’s students of the curricula “Ecology” by introducing thematic module “Tailings safety”. The course focuses on the basic types of industrial wastes, including those generated by extractive industries, their impact on the environment, the methods of landscape restoration, implementation of environmentally friendly technologies. The introduced education module highlighted the TMF-related issues regarding tailings as hazardous objects, with outlining the TMF Methodology and TMF checklist and their application for environmental audit of hazardous sites.

The Department of Ecology, Heat Technics and Labour Safety of the National Metallurgical Academy of Ukraine has updated the education course “Management and processing of wastes” (duration: 120 hours) taught for Master’s students of “Ecology” curricula with the thematic module on tailings safety. The course provides the knowledge and skills required for justification of technologies of recycling and industrial wastes. The introduced education module highlighted the TMF-related issues including the legislative framework of TMF Checklist application, TMF Methodology, and THI.

The Department of Ecology and Environment Protection of Prydniprovaska State Academy of Construction and Architecture has updated the course “Environmental Management and Audit” (duration: 75 hours) taught for Master’s students of curricula “Ecology”. The course will provide knowledge of and skills in using advanced tools of environmental management and auditing hazardous sites, with the focus on the importance of the TMF problem, the structure of TMF as geotechnical systems, protective measures based on the Best Available Techniques (BAT) ensuring sustainable development of extractive industries.

The Ecology and Environment Protection Department of Dnipro State Agrarian and Economical University has updated the course “Environmental Inspection” (duration: 150 hours) taught for Master’s students of curricula “Ecology”. The course focuses on the knowledge and skills necessary for professionals in the field of environmental inspection. Particularly, the updated educational materials will include legislative basics of environmental inspection, the methods of environmental safety assessment of hazardous facilities including tailings, and the measures for improving their safety.

The updated courses will be taught on the annual basis in the participating universities starting from 2017/2018 academic year. The letters from the universities to UBA (Annex 20) confirm the integration of the course “TMF safety” into teaching/learning process.

Public relations

During Project implementation, the Project team actively disseminated the results through various media. Thus, the news about each Project event was published both on the NMU Project website and on the LLC “Ecoplatform” website – please refer to the links in table below.

Table 6: Web links to the news on Project events

No.	Project event	Links to the Project website (in English)	Links to the NMU web-site (only in Ukrainian)
1.	Starting workshop	Start of the Project "Raising Knowledge among Students and Teachers on Tailings Safety and Its Legislative Review in Ukraine"	NMU has started the Project on TMF safety (in Ukrainian)
2.	First training	First training on TMF safety	First training of international Project (in Ukrainian)
3.	Second training	Second training on TMF safety Second training is in progress	The Second training of international Project (in Ukrainian)
4.	Round table	Round table "Implementation ways of Directive 2006/21/EC on the management of waste from the extractive industries" Round table summary	Round table "Implementation ways of Directive 2006/21/EC on the management of waste from the extractive industries"
5.	Final workshop	Final Workshop in Dnipro Final Workshop at the NMU	Environmental protection – the main task of future specialists (in Ukrainian)

During the field-trip to the thermal power plant under the First training the local TV-channel interviewed the Project representatives and released a news video on TMF safety. The video can be viewed [at this link](#) (in Ukrainian).

Press briefing

The agenda of the Round table “Implementation ways of Directive 2006/21/EC on the management of waste from the extractive industries” (held in February 2017 in Kyiv) included Press briefing “Tailings Management Facilities Safety in Ukraine; European standards for industrial waste management” attended by

- ▶ Mr. Ostap Semerak, Minister of Ecology and Natural Resources of Ukraine
- ▶ Mr. Gerhard Winkelmann-Oei, German Environment Agency (UBA)
- ▶ Ms. Claudia Kamke, United Nations Economic Commission for Europe
- ▶ Ms. Iryna Nikolaieva, Project Manager, Ecoplatform

About 30 Ukrainian journalists from various media accredited by the Ministry of Ecology and Natural Resources of Ukraine participated in the press briefing – for details see table below.

Table 7: Media accredited by the Ministry and presented at a press briefing

No.	Mass media title	Type of mass media
1.	24 channel	TV channel
2.	Business portal "UA prom"	Online newspaper
3.	Espresso	TV channel
4.	Greenpeace Ukraine	Informational portal
5.	Glavkom	Information Agency
6.	Golos UA	Information Agency
7.	HUBS	News online resource
8.	ICTV	TV channel
9.	Pershyy dilovyi	TV channel
10.	RBC Ukraine	Informational portal
11.	Ukraina moloda	Daily Ukrainian information and political newspaper
12.	Ukrainian National News	Information Agency
13.	Ukrinform	Information Agency
14.	UNIAN	Ukrainian Independent Information Agency
15.	Uriadovyi kurier	Newspaper of Ukrainian central authorities
16.	ZIK	Information Agency

The Ministry of Ecology and Natural Resources of Ukraine raised the issue of TMF safety for public discussion for the first time. He presented the map of 344 TMFs located in Ukraine. UBA and the UNECE TEIA Convention representatives acquainted journalists with the Project objective and European standards. The Project Manager reported on the joint activities with the Ministry of Ecology and Natural resources of Ukraine under the legislative Project component.

After the press briefing, media representatives made publications on TMF safety issues in Ukraine. For example, the news was published on the websites of the [Ministry of Ecology and Natural Resources of Ukraine](#), [Information agency "ZIK"](#), ["Glavkom"](#) and others. To watch a full video of the press briefing, please click [here](#), photo can be found [here](#).

4.2 Evaluation of the Project by the beneficiaries

The Project beneficiaries are the Ministry of Ecology and Natural Resources of Ukraine and the Ministry of Education and Science of Ukraine (see letters of support in Annex 1).

Additionally, the Project team closely cooperated with representatives of the Ministry of Energy and Coal Industry of Ukraine, the State ecological inspection of Ukraine, the State Emergency Service of Ukraine and other authorities that are responsible for tailings safety issues in analysing the Ukrainian legislation compliance with EU requirements and considering the TMF Methodology as a practical tool for assessing the TMFs safety. For the results of cooperation with above mentioned institutions please refer to section 3.2 of this report.

4.2.1 Ministry of Ecology and Natural Resources of Ukraine

The Project team coordinated by LLC "Ecoplatform" in cooperation with experts from the Ministry of Ecology and Natural Resources of Ukraine:

- ▶ identified the implementation ways of EU requirements on TMF safety into Ukrainian legislation - the Report on the implementation of EU Directives and UNECE Guidelines in the field of TMF safety management was developed
- ▶ updated the Ukrainian TMF database and interactive map
- ▶ contributed to the National Strategy on Waste Management
- ▶ held a Round table on TMF safety
- ▶ adapted the TMF Methodology for inspection bodies of Ukraine
- ▶ developed the Recommendations on Improving Tailings Safety Management System for the Ministry of Ecology and Natural Resources of Ukraine.

LLC “Ecoplatform”, authorized by German Environment Agency (UBA), submitted “Recommendations on Improving Tailings Safety Management System” to the Ministry of Ecology and Natural Resources of Ukraine and received the positive feedback with gratitude to the Project. The Project results are highly appreciated by the Ministry that is stated in Letter No. 5/3-7/3724-17 dated May 12, 2017 (refer to Annex 21). The Ministry points out that submitted Project materials meet the Ukrainian political course in European integration and will be further helpful in the work of the Ministry.

4.2.2 Ministry of Education and Science of Ukraine

The National Mining University performed its activities in education in coordination with the Ministry of Education and Science of Ukraine. The Ministry was regularly informed about the Project progress, including all the events and e-learning course development, via the responsible collaborator appointed by the Deputy Minister.

By the end of the Project completion, the NMU has submitted the Project resume to the Ministry, having summarized the activity outcomes, developed products and the possibility of using the e-learning course in education of students of environmental curricula. The NMU requested the Ministry to share the gained experience of the Project, particularly, in education, by informing the universities on the availability of the new e-learning course “Safety of tailings management facilities” and opportunities of its integration into teaching/learning process.

Under the conditions of Ukrainian university autonomy introduced by the Law of Ukraine on Higher Education in 2014, the Ministry does not influence formally on the content of educational programmes. Therefore, the Ministry has recommended to the NMU to directly inform Ukrainian universities of the new e-learning course on tailings safety. The NMU has sent relevant information on the course and opportunities to use it in teaching/learning process to 36 universities from 17 regions of the country that educate Bachelor’s and Master’s students of environmental curricula related to waste management, industrial and environmental safety, audit and other relevant issues; these universities are the most likely course users. The letters from NMU to the Ministry of Education and Science and Ukrainian universities and the letter of the Ministry of Education and Science are attached to Annex 22.

This will facilitate further implementation of the e-learning course and checklist approach for hazardous site management. The Ministry highlighted the importance of the Project and developed e-learning course in the context of Ukraine’s integration into the European educational system.

The letters of the NMU to the Ministry and the letter of Ministry informing the universities are attached to Annex 22.

4.3 Estimation of the potential impacts of the Project

Educational Project component

- ▶ After the Project accomplished, the university teachers trained under the training course on TMF Methodology will continue to use the education module on tailings safety in their educational activities in universities
- ▶ The e-learning course “Safety of tailings management facilities” elaborated and tested in the Project can be used in any countries with TMFs as follows:
 - an original form of the course for teaching under- and postgraduate students of universities in related curricula that address the issues of environmental safety in the industry,
 - an extended form of the course adapted to the experienced users for advanced trainings aimed at the state environmental inspectors and responsible staff of TMFs;
- ▶ The further dissemination of the education module on tailings safety including TMF Methodology among its potential users, who are undergraduate students and postgraduates in environmental sciences and industrial safety, is believed to be the next right step towards the enhancement of mining and industrial site safety. In this way, the dissemination of the TMF Methodology will get a wider scope, stronger impact, and will cover a diverse audience of participants that will eventually enable future potential users applying this methodological toolkit in various fields of environmental protection.

Legislative Project component

- ▶ The evaluation of competent authorities’ strategy on TMF issues ensures a sustainable solution of the TMF problem on the legislative level
- ▶ TMF Methodology can be easily applied by the state authorities and by TMF operators to meet their future obligations under Directive 2006/21/EC, as the methodology for TMF inventory, facility prioritization and establishment of action plans to reduce the risks posed by TMFs
- ▶ Proposals and recommendations provided in the “Analysis of Ukrainian legislation compliance with the requirements of Directive 2006/21/EC on the management of waste from the extractive industries and the Roadmap of its implementation in the context of improving TMFs safety” can be used for initiating amendments on updating the Implementation Plan of Directive 2006/21/EC and during further this Directive implementation
- ▶ TMF methodology can be applied in carrying out measures of the state supervision (control) of the TMF sites operation
- ▶ THI method used in the updated Ukrainian TMFs database allows to rank a large number of such facilities by their hazard level and identify top dangerous objects among country/region for decision-making purposes and the state monitoring
- ▶ In general, the TMF Methodology will give the opportunities for the potential users to apply progressive management tools to TMFs of any type in a preventive manner in accordance with the modern international standards and, consequently, minimize the risk of incidents and accidents at hazardous objects in the future.

5 Conclusions and recommendations

The National Mining University and LLC “Ecoplatform” implemented the Project “Raising Knowledge among Students and Teachers on Tailings Safety and its Legislative Review in Ukraine” from June 2016 till May 2017. It was funded and coordinated by German Environment Agency with the assistance of UNECE Convention on the Transboundary Effects of Industrial Accidents. The Project was supported by the Ministry of Ecology and Natural Resources of Ukraine and the Ministry of Education and Science of Ukraine. The results reached under the educational and legislative Project components demonstrate the successful achievement of originally set Project objectives as described below.

Educational Project component

The Project team from Ukraine have educated the Ukrainian university students and teachers and raised their knowledge in TMF safety issues by applying the TMF Methodology within two trainings held at the National Mining University. The educational results of two trainings on TMF safety can be summarized as follows:

- ▶ The students have deeply learnt the TMF Methodology as an advanced toolkit in improvement of hazardous site safety; they familiarized themselves with the UNECE documents on tailings safety, global importance of the TMF problem, BAT Reference documents for mining industry, relevant legislative framework in Ukraine.
- ▶ The students gained necessary knowledge and skills to apply practically the TMF Checklist for evaluation of TMF safety level and to get the first-hand experience of filling in the Checklist for the real TMF, directly communicating with the TMF personnel and the leading Ukrainian experts.
- ▶ The tutors gained deep understanding of the TMF Methodology, which enabled revision of their educational materials on environmental safety and integrating it in the education modules in the universities; that ultimately contributed to better TMF Methodology sustainability.
- ▶ All education modules of the course have been tested; their clarity and completeness have been evaluated by the students that allowed to reveal the deficiencies in educational materials while creating the educational course. The e-questionnaires for knowledge consolidation test of trainees and the evaluation of training quality by the trainees have been developed and examined in the practice.

The education modules on TMF safety has been integrated in curricula of the participating universities that provides the opportunities for future students to study progressive technologies and gain practical knowledge in environmental safety and sustainable mining.

After testing the educational materials and collecting feedback from the participants, the Project team have developed e-learning course “Safety of tailings management facilities” and hosted it on Moodle Platform of the NMU website. It provides an opportunity to get full and consecutive information on the importance, scopes, operation problems of the TMFs as high-risk facilities, and application of the TMF Methodology in practice. Such modern education tool is considered to be an advanced European approach to improvement safety of hazardous mining sites.

The e-learning course developed and tested within the Project further can be offered to train the state inspectors, TMF operators and other stakeholders responsible for hazardous site management. In addition, it can be offered to students of other countries that may require re-training of staff responsible for the management of hazardous industrial facilities.

Legislative Project component

The big part of the Project activities was concerned with legislative issues on improving TMF safety in Ukraine. The Project team made the research on competent authorities’ engagement in the regulation

of TMFs, their responsibilities, the existing national regulations and the ways of implementation of European legislation into Ukrainian one. The ways for implementing the UNECE TMF Guidelines and TMF Methodology in Ukraine were considered under this analysis. While performing the legislative review, the Project team closely cooperated with the Ministry of Ecology and Natural Resources of Ukraine and took into account the comments and recommendations received from the concerned national authorities.

The legislative Project component resulted in:

- ▶ “Analysis of Ukrainian legislation compliance with the requirements of Directive 2006/21/EC on the management of waste from the extractive industries and Roadmap of its implementation in the context of improving TMFs safety” that can be used for initiating amendments on updating the Implementation Plan of Directive 2006/21/EC and during the further implementation of this Directive;
- ▶ the updated Ukrainian TMF database, including the interactive map on Google-maps. THI method used in this database allows to make ranking of a large number of such facilities by their hazard level and to identify the top dangerous objects among country or region for decision-making purposes and the state monitoring;
- ▶ the adapted version of TMF Methodology for Ukrainian inspection bodies that can be applied in carrying out the measures of the state supervision (control) of TMF sites operation.

All the mentioned Project developments formed the “Recommendations on Improving Tailings Safety Management System” that were submitted to the Ministry of Ecology and Natural Resources of Ukraine by LLC “Ecoplatform” as a document summing-up the results of the legislative Project component.

These Recommendations determine the CA’s strategy and assist to establish the tailings management system in accordance with European standards, complying with the Ukraine’s political course towards European integration.

Importance of the Project results

- ▶ E-learning course “Safety of tailings management facilities” raises the qualifications and skills of inspectors, operators, university students and teachers in management of industrial waste storages
- ▶ Analysis of the Ukrainian legislation has initiated the harmonization of the Ukrainian legislation with EU law in the field of mining industry waste management
- ▶ Methodology for improving TMF safety provides
 - the unified requirements for the TMF safety and TMF assessment procedures in “inspector – TMF operator” cooperation
 - TMF database maintenance and priority identification, evaluation of the TMF safety level
 - the possibility in carrying out the identification and inventory of TMFs applying TMF Checklist and THI method.

The Project “Raising Knowledge among Students and Teachers on Tailings Safety and its Legislative Review in Ukraine” was the only international Project in Ukraine during 2016-2017 that had highlighted the importance of TMF safety issues, raised the awareness of this problem, attracted public interest and created the real practical tools to move forward in increasing safety and reducing the risks posed by TMFs in Ukraine. The Project’s experience, results and developments ensure the sustainable solution of the TMF problem in Ukraine. It can further be taken as an example and adopted by other countries which aspire to join European Union or face the same TMF issues.

6 Proposals on Project follow up activities

The Project “Raising Knowledge among Students and Teachers on Tailings Safety and its Legislative Review in Ukraine” had a pilot character. Its concept and results demonstrate the best practices in training university students and trainers known as ‘train-the-trainer’ that can find its further implications in TMFs safety trainings in other countries of the former USSR and ECE region where tailing management quality is low or similar to that of Ukraine.

Achievement of the Project objective in raising the knowledge of student trainees by familiarizing them with the modern international rules and requirements for safe operation of tailings have a sustainable character that is significant/crucial for socio-ecologic and economic development of Ukraine and its neighbouring countries.

6.1 Proposals on follow up activities in Ukraine

As a follow up of the current Project, the pilot Project for inspection bodies could be proposed. It may consist of the following components:

- ▶ Development of the relevant software (IT-tools):
 - ▶ to develop the software for TMFs safety based on THI and Checklist methods in order to change the Excel format of the TMF Methodology;
 - ▶ to create a TMF online map based on software for THI method as an additional section on the existing Ukrainian ecomap to ensure public access to it;
 - ▶ to perform the online course on applying TMF safety software to training the inspectors,
- ▶ TMF identification and inventory through the developed software:
 - ▶ to organize taking and completing the online course by inspectors on applying TMF safety software;
 - ▶ to identify abandoned/orphaned TMFs of the country;
 - ▶ to perform the detailed inventory: of the most hazard TMFs in 5 industrial regions by basin principle.

Besides, the Ukrainian experts from the State Scientific and Technical Center for Nuclear and Radiation Safety and Ukrainian Hydrometeorological Institute of State Emergency Service of Ukraine and the National Academy of Sciences of Ukraine expressed the need for developing complex evaluation methods for uranium mining tailings and tailings in processing industry to be based on TMF Methodology, as the government control and operators’ management of such objects are conducted at a low level.

6.2 Recommendations for the UNECE Joint Expert Group on Industrial Accidents

- ▶ Further applications of the TMF Methodology, which is updated in 2017 as the modern organisational and managerial toolkit to improve tailings safety and developed based on the TMF Guidelines instrumentality, will contribute to the implementation of sustainable mining in the UNECE member countries.
- ▶ Promote the extensive use of the developed educational e-learning course “Safety of tailings management facilities” which includes both the comprehensive theoretical knowledge package and guidelines for practical trainings on TMF Checklist application. The e-learning course should be considered as a methodological core of the international and national trainings to be conducted for TMF personnel and representatives of the competent authorities responsible for TMF issues that will contribute to TMF Methodology sustainability.
- ▶ Promote the further improvement of the educational course on tailings safety through its adaptation to more experienced audience and upgrade it with modern software on the platform of the Environmental Emergencies Centre of UNECE in the synergy with the existing online courses. This will widen further dissemination of the advanced approaches to hazardous site treatment in the

countries of Central and Eastern Europe, the Caucasus and Central Asia and other countries neighbouring the European Union.

- ▶ Recommend the creation and permanent/regular update of the national and international databases on tailings management facilities and similar sites in order to rank their relative hazards and prioritize safety measure application, using the THI method as the integral part of the TMF methodology, taking into proper account the Ukrainian experience in creation and design of the tailings database and TMF Checklist applications.
- ▶ Consider the Roadmap with the Action plan to implement Directive 2006/21/EC through the UNECE TMF Guidelines instrumentality developed for Ukraine as the instructive example for other countries that aspire to join the European Union through the Action Plan adaptation regarding the existing national regulatory frameworks. Thus, the Action plan will be valuable for the countries solving similar environmental problems caused by mining activities.
- ▶ Consider the opportunity to organize a Project focusing on tailings safety in Kazakhstan involving Kazakh technical universities and competent authorities. The specifics of this activity can be engagement of the best trainees in the educational Project in Ukraine who would act as trainers for Kazakh tutors/trainees. This way of the TMF Methodology use and European experience in safety of tailings can be disseminated in Kazakhstan, which is one of the leaders in the world mining industry, facing nowadays the environmental problems caused by TMFs.

7 List of Annexes

The annexes are divided in three blocks: official letters, the Project activities and the Project documents. They include the documents and activities in details that can be used by readers depending of their interest. Annexes are numbered in the order mentioned in the Report.

The public version of Final report includes the Annexes 12-14 (Project products).

The number of pages is indicated in brackets for each Annex (print versions). The internal version of the Final report includes 1302 pages with all annexes; the public version with only Annexes 12, 13 and 14 includes 408 pages.

Official letters (*not for public version of this report*)

- ▶ Annex 1. Letters from Project beneficiaries (6 pages)

Project activities (*not for public version of this report*)

- ▶ Annex 2. Program of DTEK participation in conducting the training course (in Russian, containing English-language summary; 78 pages)
- ▶ Annex 3. Minutes of the Starting workshop (17 pages)
- ▶ Annex 4. Minutes of the First training (25 pages)
- ▶ Annex 5. Minutes of the Second training (41 pages)
- ▶ Annex 6. Minutes of the Round table (12 pages)
- ▶ Annex 7. Resolution of the Round table (2 pages)
- ▶ Annex 8. TMF safety level evaluation performed by university students at trainings (72 pages)
- ▶ Annex 9. Minutes of the Final workshop (20 pages)
- ▶ Annex 10. Photos from all Project events (17 pages)

Project documents

- ▶ Annex 11. Brief summary of Prydniprovskia Thermal Power Plant (in Russian, containing English-language summary; 95 pages). *It contains confidential information and not intended for public version of this report.*
- ▶ Annex 12. The lectures of education course “Safety of tailings management facilities” (76 pages).
- ▶ Annex 13. Analysis of Ukrainian legislation compliance with the requirements of Directive 2006/21/EC on the management of waste from the extractive industries and Roadmap of its implementation in the context of improving TMFs safety (167 pages)
- ▶ Annex 14. Methodology for Comprehensive Evaluation of Tailings Management Facilities Safety – updated version 2017 (128 pages)
- ▶ Annex 15. Template for calculation TMF safety level, TMF Checklist method (MS Excel file “Template TMF Checklist.xls”, 101 pages in PDF) – *It is not intended for public version of this report.*
- ▶ Annex 16. Template for calculation Tailings Hazard Index, THI method (MS Excel file “Template_THI_Method.xls”, 13 pages in PDF) – *It is not intended for public version of this report.*
- ▶ Annex 17. Letters-responses regarding TMF Methodology review received from Competent authorities (in Ukrainian; 8 pages) – *It is not intended for public version of this report.*
- ▶ Annex 18. Updated Ukrainian TMFs database (as of April 2017; MS Excel file “Ukrainian TMF Database.xls”, 28 pages in PDF) – *It is not intended for public version of this report.*
- ▶ Annex 19. Recommendations on Improving Tailings Safety Management System (in Ukrainian, containing English-language summary; 317 pages) – *It is not intended for public version of this report.*

Official letters (*not for public version of this report*)

- ▶ Annex 20. Integration of the education course “TMF safety” in participating universities into teaching/learning process (*22 pages*)
- ▶ Annex 21. Letter from the Ministry of Ecology and Natural Resources of Ukraine regarding consideration of international Project’s developments (*4 pages*)
- ▶ Annex 22. Letters of the NMU and the Ministry of Education and Science of Ukraine on informing the universities on the education course (*26 pages*).

8 References

1. United Nations Economic Commission for Europe (2014): Safety guidelines and good practices for tailings management facilities. Geneva.
2. John Vijgen, Irina Nikolaieva, on behalf of the German Environment Agency (2016): Improving the safety of industrial tailings management facilities based on the example of Ukrainian facilities. Final report. Annex 2 Methodology for improving TMF safety. Dessau-Roßlau.
3. European Union (2014): Association agreement between the European Union and its Member States, of the one part, and Ukraine, of the other part. Official Journal of the European Union, L 161.
4. European Parliament, Council of the European Union (2006): Directive 2006/21/EC of the European Parliament and of the Council of 15 March 2006 on the management of waste from extractive industries and amending Directive 2004/35/EC - Statement by the European Parliament, the Council and the Commission. Official Journal of the European Union, L 102, p. 15-33.
5. Cabinet of Ministers of Ukraine (2015): Annex to the Resolution of the Cabinet of Ministers of Ukraine No. 346-p of 8 April 2015. Implementation Plan for Directive 2006/21/EC of the European Parliament and of the Council of 15 March 2006 on the management of waste from extractive industries and amending Directive 2004/35/EC. Kyiv.
6. European Parliament, Council of the European Union (2012): Directive 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC (SEVESO-III). Official Journal of the European Union L 197, p. 1–37.
7. Ecoplatform LLC (2016): Report on research work “Development of TMF summary of Thermal Power Plant”. Development of presentations for Training course on TMFs safety in Ukraine”. Kyiv.
8. Ecoplatform LLC (2017): Report on research work “The analysis of Ukrainian legislation compliance with the requirements of Directive 2006/21/EC on the management of waste from the extractive industries and Roadmap of its implementation in the context of improving TMFs safety”. Kyiv.
9. Ecoplatform LLC (2017): Report on research work “The results of the scientific workshop holding a round table “Implementation ways of Directive 2006/21/EC on the management of waste from the extractive industries”. Kyiv.
10. Ecoplatform LLC (2017): Report on research work “The development of Ukrainian TMFs database and interactive TMFs’ map”. Kyiv.
11. Ecoplatform LLC (2017): Report on research work “The development of the e-learning course “Safety of tailings management facilities”; TMF Methodology improvement; development of Final report on the results of the international Project “Raising Knowledge among Students and Teachers on Tailings Safety and its Legislative Review in Ukraine” for the period June 2016 - May 2017”. Kyiv.
12. Ecoplatform LLC (2017): Report on research work “Translation the materials of the Project “Raising Knowledge among Students and Teachers on Tailings Safety and its Legislative Review in Ukraine” from Ukrainian into English”. Kyiv.