The Inception Workshop
of the Project to Strengthen the Safety
of Mining Operations, in particular
tailings management facilities (TMFs),
in Kazakhstan and beyond in Central Asia

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Tailing hazard index, its testing and application in Ukraine

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Tailing hazard index as a component part of the methodology to improve TMFs safety

Umwelt Bundesamt

UNECE

icpdr International Commission for the Protection of the Danube River iksd Internationale Kommission zum Schutz der Donau

The methodology, including

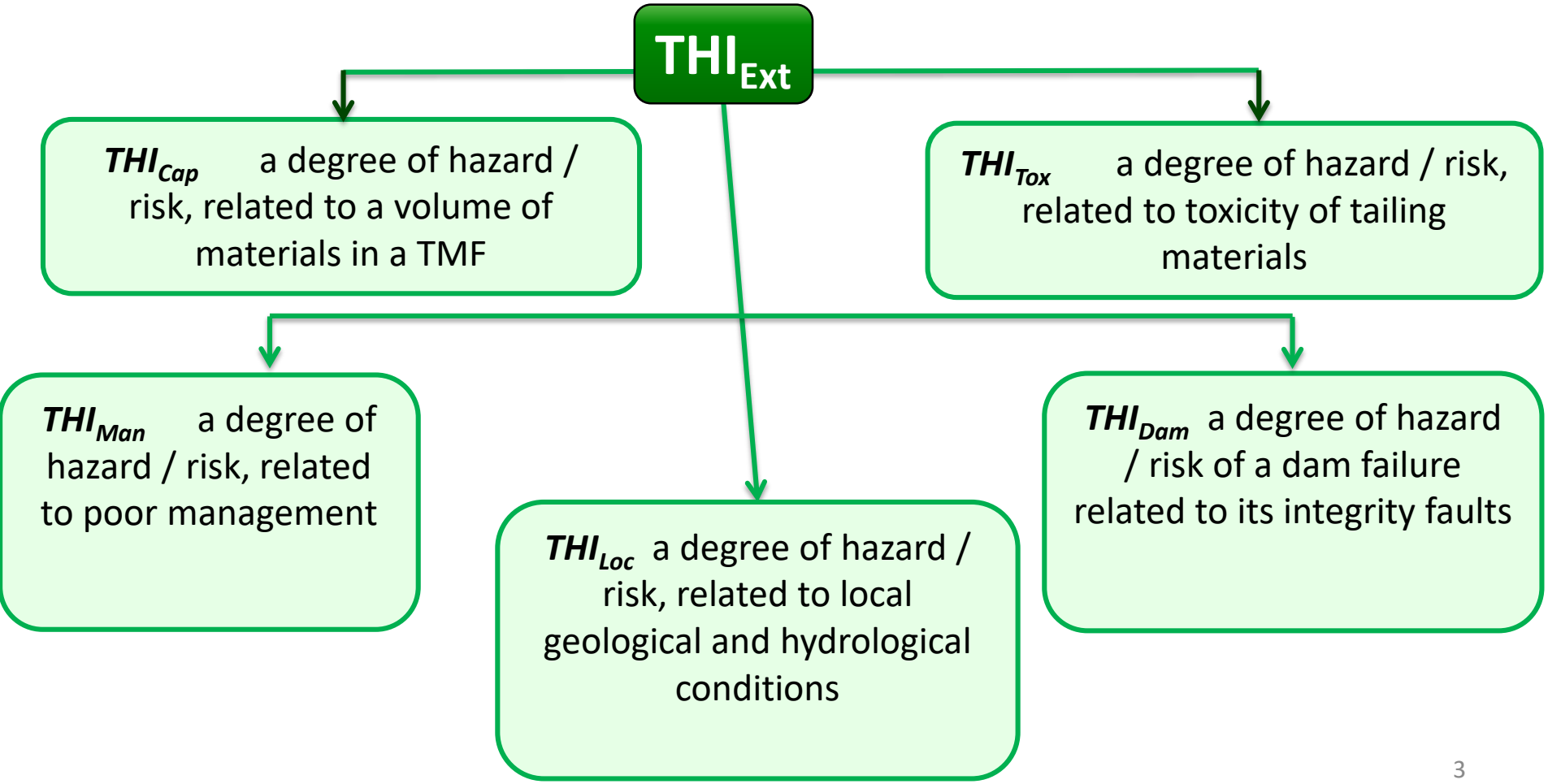
1) Tailing hazard index and 2) the Checklist,

has been developed by the Ukrainian project team in the framework of the German Federal Environment Agency project - **Improving Safety of Industrial Tailings Management Facilities Based on the Example of Ukrainian Facilities (2013-2015)** with participation of international experts

as a tool for practical implementation of UNECE Safety Guidelines and Good Practices for Tailings Management Facilities.

Tailings hazard index (THI)

$$THI_{Ext} = THI_{Cap} + TXI_{Tox} + THI_{Man} + THI_{Loc} + THI_{Dam}$$



Assessment of hazards related to volume of tailing materials

$$THI_{Cap} = Log_{10}[V_t]$$

here V_t - volume of tailing materials, m^3.

Examples.

For a major TMF with V_t= 10 million m^3

THI_{Cap}= **7**

For a small TMF with V_t= 0.01 million m^3

THI_{Cap} = **4**

Assessment of hazards related to toxicity of tailing materials

Minimal hazard

Maximal hazard

Classification		THI_{Tox} value
WHC (WGK)[1]	HC[2]	
0	4	0
1	3	1
2	2	2
3	1	3

[1] WHC = water hazard class; WGK = Wassergefährdungsklasse, classification of the German Federal Environment Agency

[2] HC = hazard class, classification of GOST 12.1.007-76 SSBT

Assessment of hazards related to TMF management

Data for THI_{Man} evaluation	THI_{Man} value
Closed or rehabilitated TMF	**0**
Operational or abandoned/derelict TMF	**1**

Assessment of geological hazards. Seismicity

$$THI_{Loc} = THI_{Seism} + THI_{Flood}$$

Data for THI_{Seism} evaluation Relative peak ground acceleration a_G with recurrence interval T_{ret}	THI_{Seism} value
≤0.1	0
>0.1	1

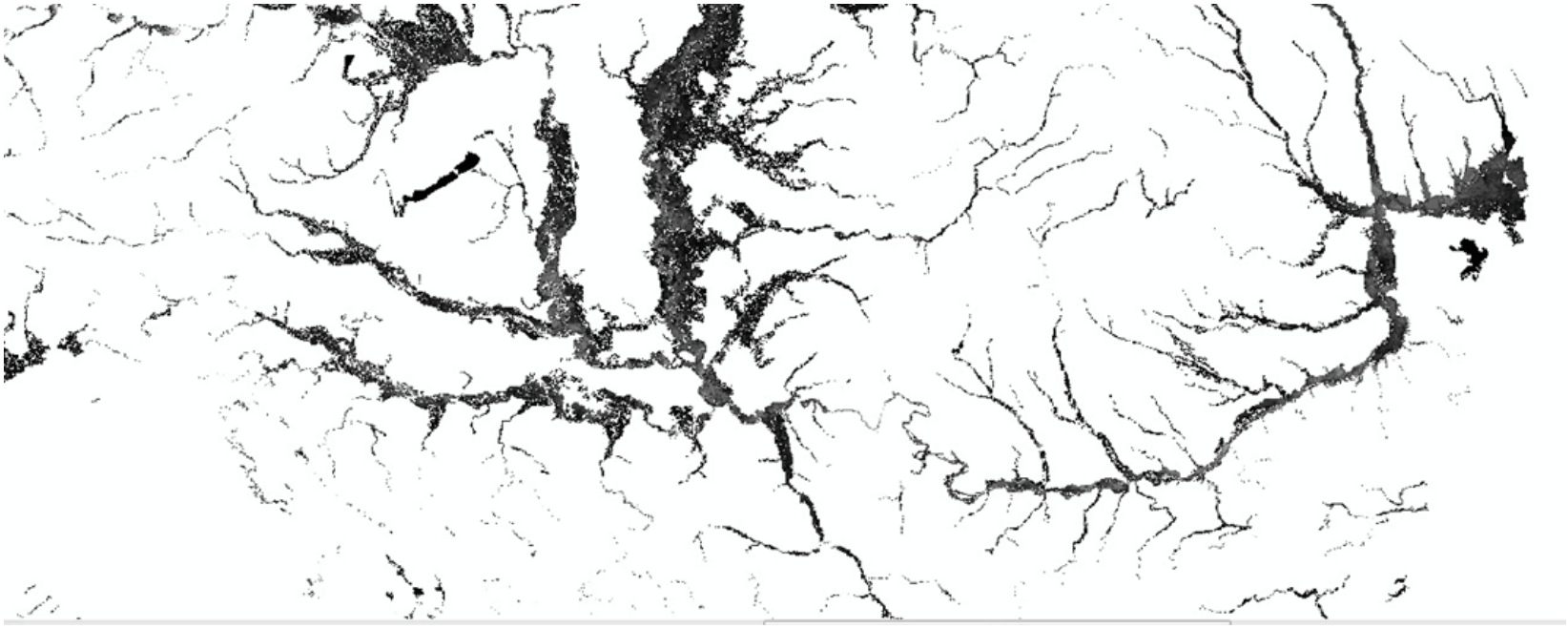
Assessment of flooding hazards

THI_{Flood} is defined by HQ_{500} parameter that provides qualitative frequency of floods with 500 years recurrence interval (floods with 1:500 probability).

Data for THI_{Flood} evaluation TMF location	THI_{Flood} value
Within HQ_{500} zone	1
Outside HQ_{500} zone	0

Assessment of flooding hazards. A sample map

A fragment of the map of zones with 1:500 flooding probability at the territory of Europe in the Danube river basin.
https://data.europa.eu/euodp/en/data/dataset/jrc-floods-floodmapeu_rp500y-tif



Assessment of hazards related to dam failures

Recommended calculation method

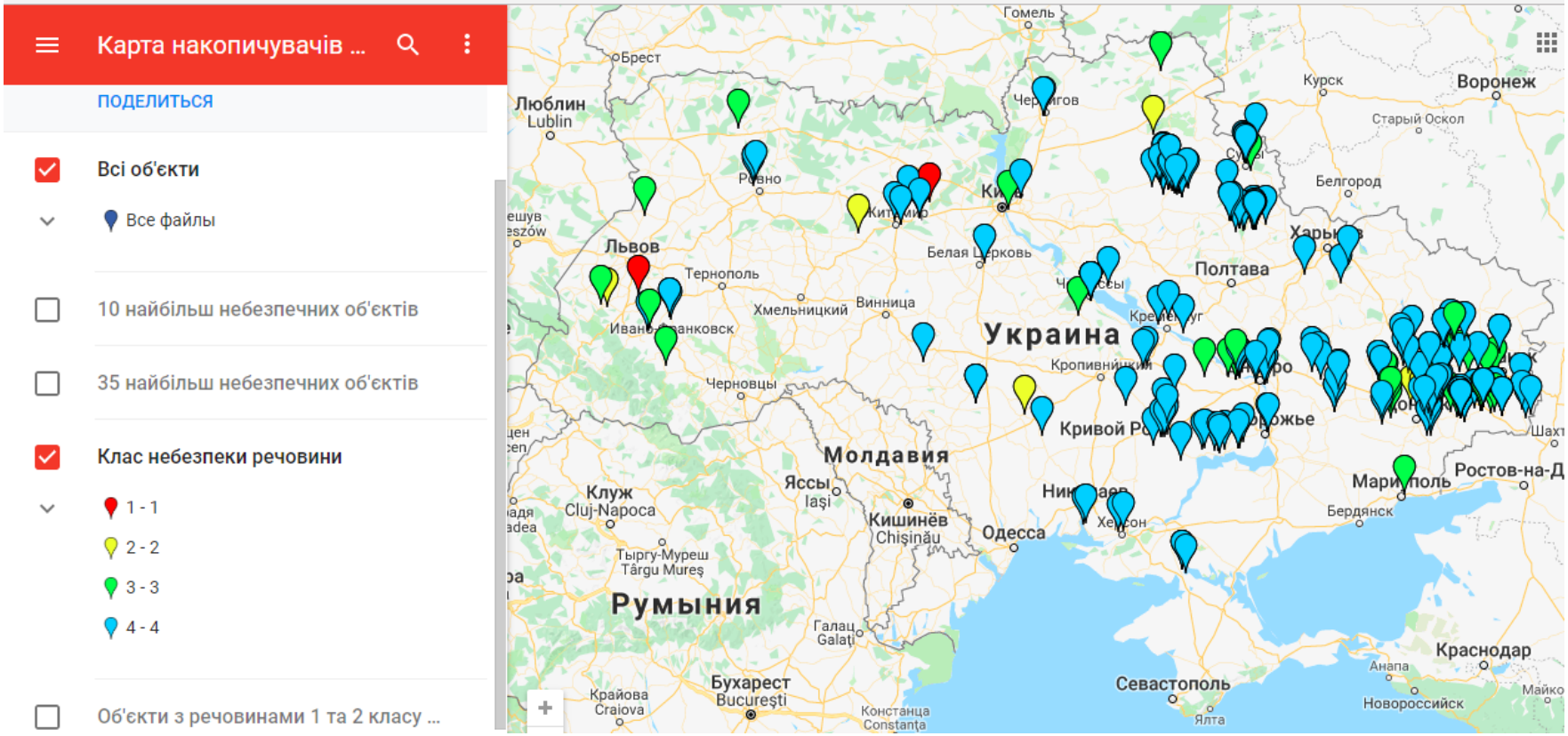
$$THI_{Dam} = THI_{SSF} + THI_{Age}$$

Slope stability factor ranges (SSF)	THI_{SSF} value
SSF > 1.5	0
1.2 < SSF < 1.5	1
SSF < 1.2	2

TMF operation age	THI_{Age} value
≤ 30 years	0
> 30 years	1

Application of tailing hazard indices in Ukraine

The map of 344 TMFs, ranked by THI_{Basic} (accounting for volumes of tailing materials and their toxicity) developed in the framework of UBA project - Raising Knowledge of Students and Lecturers on TMFs Safety and its Legislative Survey in Ukraine (2016-2017)



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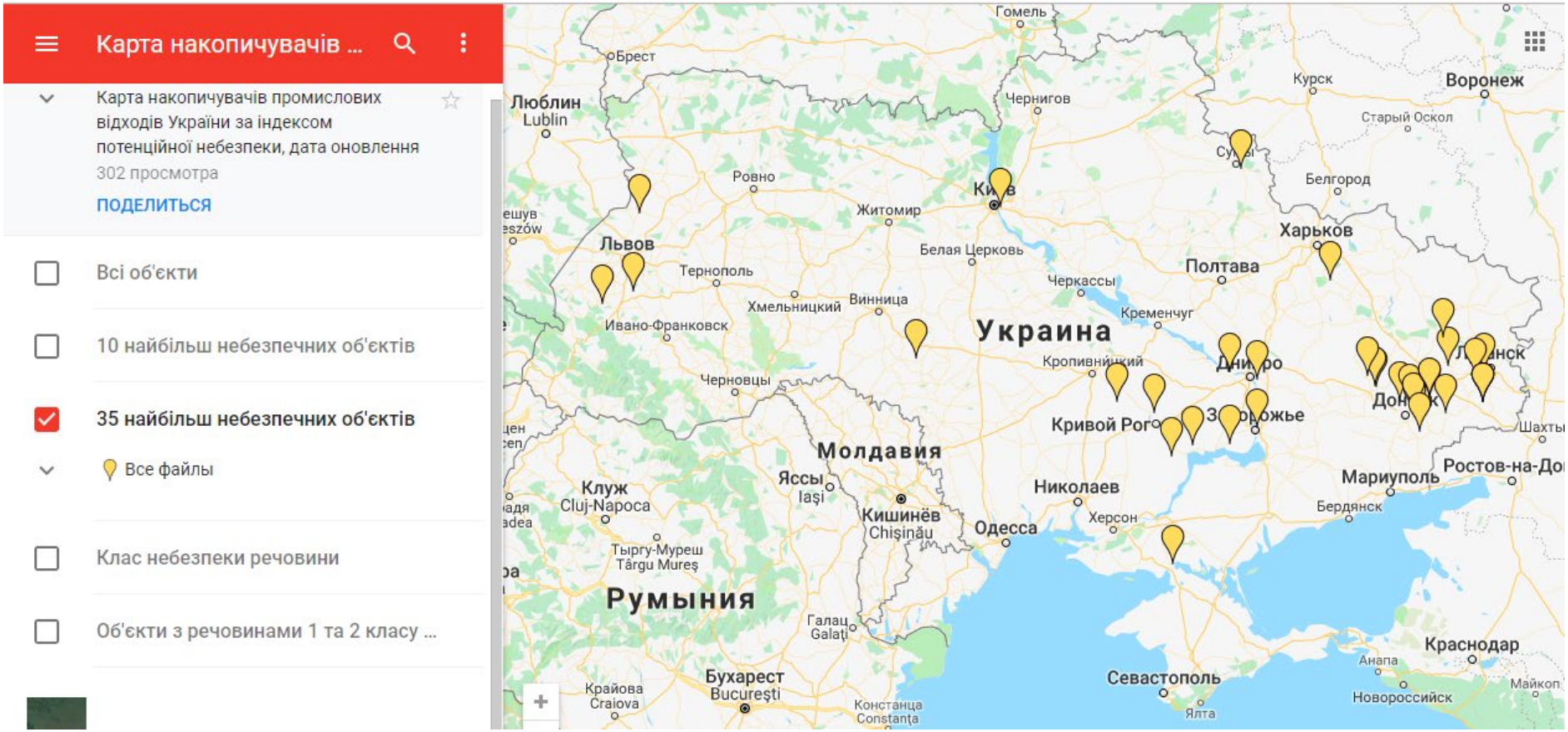
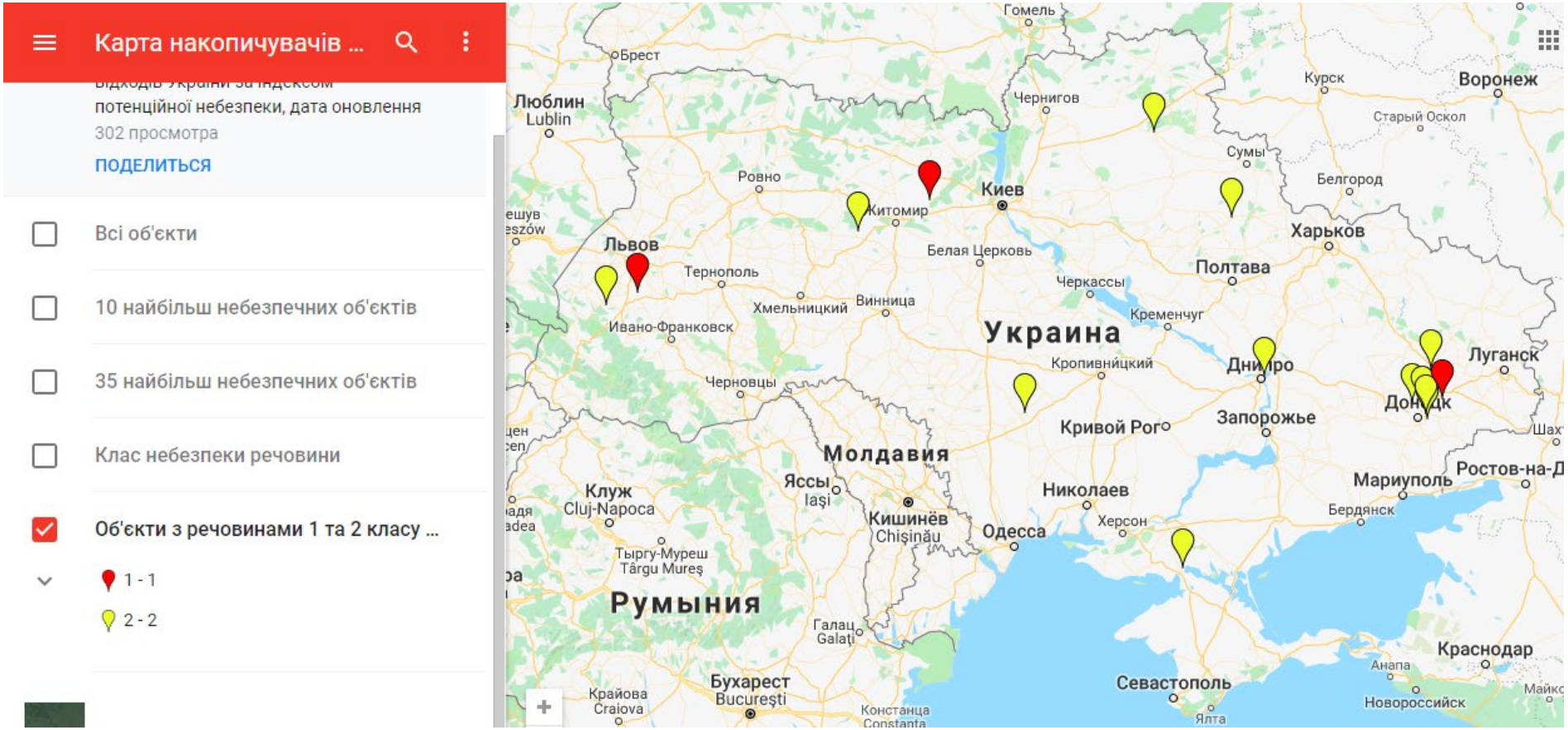
Application of tailing hazard indices in Ukraine

35 most hazardous TMFs



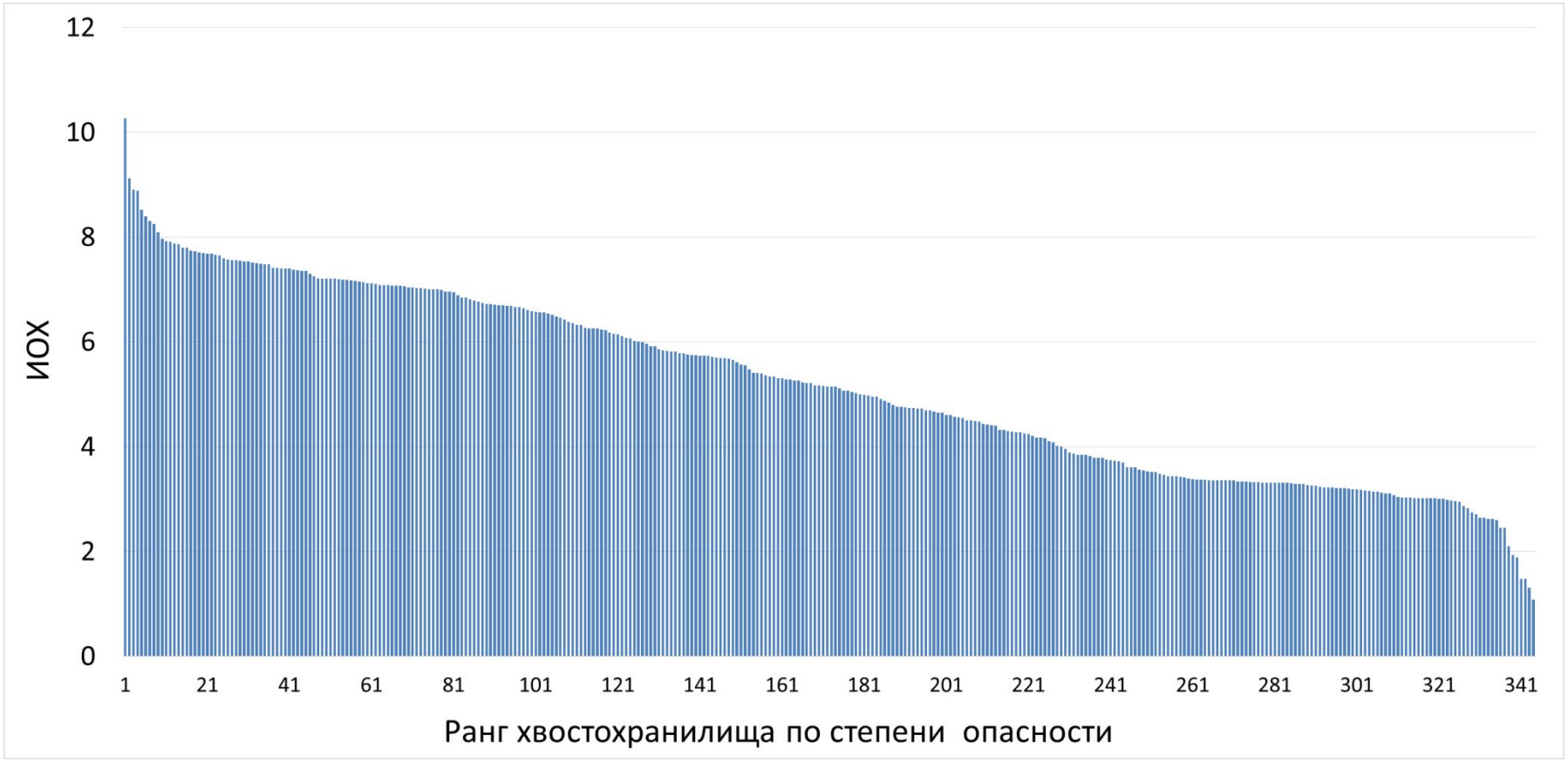
Application of tailing hazard indices in Ukraine

TMFs with substances of 1st and 2nd hazard classes



Ranking TMFs in Ukraine in terms of their hazards

The chart from the Ukrainian TMFs database



Conclusions

- A method was developed for ranking TMFs in terms of their hazards for a large group of sites at the national/regional level.
- The method allows to provide a preliminary hazard assessment, based on several most important parameters.
- In the framework of UBA projects in Ukraine, a database of TMFs was developed (344 sites) and hazards of the TMFs were assessed in terms of volumes and toxicity of tailing materials.

Thank you for your attention!