

## Advisory Mission to Ukraine *Solotvyno salt mine area*

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### **Executive Summary of the RISK ASSESSMENT REPORT**



Crater Mine No. 7 Solotvyno, *photo credit: EUCPT*

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## Executive summary

### Introduction

This Risk Assessment Report focuses on the technical aspects of the European Union Civil Protection Team (EUCPT) advisory mission to Ukraine. It discusses in detail the following mission objectives:

- *Conduct a comprehensive risk assessment at the Soltvyno salt mines area.*
- *Advise on the development of a monitoring system with local, state and international stakeholders in order to determine milestones for next steps.*
- *Make short, medium and long term recommendations, including potential mitigation and engineering solutions.*
- *Make follow-up observations on immediate measures to be taken by the Ukrainian authorities on recommendations provided by the EUCPT during the scoping mission.*
- *Identify next steps to be taken by the competent authorities and appropriate stakeholders for hand-over of the findings, recommendations and suggestions for further work.*

### Mission context

On 12 January 2016, Hungarian and Ukrainian civil protection authorities addressed a letter to Commissioner Stylianides regarding a cross-border environmental pollution concern at the Soltvyno salt mine complex in Ukraine.

The Union Civil Protection Mechanism (UCPM) was activated on 17 June 2016 and deployed a scoping mission between 2 to 9 July to support the national authorities. The scoping mission produced a technical report shared with Participating States (PS) and Ukrainian authorities (UA) and draft a “*Terms of Reference*” (ToR) for an advisory mission.

Based on the findings of the scoping mission, it was decided to deploy an advisory mission in order to conduct a “*comprehensive risk assessment at the Soltvyno salt mines area*”. The deployment took place from 14 September to 7 October 2016.

The EUCPT are particularly grateful for the exceptionally high level of cooperation of the Ukrainian technical experts from the National Academy of Science (NAS) of Ukraine: Professor D. Khrushchov and Dr Y. Yakovlev, Head Scientific Researcher and corresponding member of NAS of Ukraine, Dr S. Shekhunova. Their professional and open approach to information sharing with a clear focus on the main objective of producing a “*Risk Assessment*” of the Soltvyno mine area was evident at all times.

### Methodology

The advisory mission applied the following methodology and processes to complete the risk assessment report:

In order to structure the work and tasks, the team followed a practical workflow process, which consisted of the following phases *measurements, assessments* (including interviews and fieldwork) *processing of information* (data analysis) and reporting. This was done following a risk assessment model, as per the Commission Staff

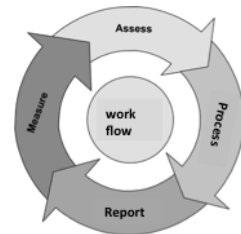


Figure 1: Workflow Process

Working Paper on “Risk Assessment and Mapping Guidelines for Disaster Management”.

Following this methodology, the following activities were conducted:

- Pre mission desk research.
- Pre mission technical workshop in Brussels.
- Outputs and review of scoping mission reports and information products.
- Field assessments and investigations.
- Interviews with stakeholders at State, Regional, District and Local level, including members of the public from Solotvyno and surrounding areas.
- Water sampling and on-site measurements
- Chemical analyses were carried out on and off site. Isotope determinations were carried out in a laboratory in Germany as they needed particular requirements.
- Development and use of a risk assessment model
- Development of a dedicated GIS data base to support the mission and inform future actions and programmes.
- Detailed review and research of mining records, mapping, plans, and other historical data products.
- Detailed data and information analysis.
- Daily technical workshops and de-briefings in close cooperation with Ukrainian technical experts.
- Meteorological observations during the mission from the on-site weather station.

The seriousness of the emergency situation at the Solotvyno mine and surrounding areas quickly became apparent to the EUCPT technical experts. The team was able to produce the “*Risk Assessment*” and other mission objectives within the mission timeframe. However, due to the time constraints, it is not exhaustive.

A general determination to address this state of emergency was shown by the different stakeholders which is central in the follow-up of the scoping and advisory missions. A high level of cooperation was demonstrated between the EUCPT, Ministry of Agrarian Policy and Food of Ukraine, Transcarpathian Regional Government, Solotvyno Council Executive Committee (Mayor and Deputy Mayor), Tyachiv district authorities, Solotvyno Mine authorities, and Ukraine State Rescue Service (Mountain Rescue).

The following conclusions were reached after extensive research and investigations within the 24-day deployment-

### Main Conclusions

1. Man-made activities in combination with natural processes have resulted in an overall decay of the mine and surrounding area. This is still ongoing without it being actively managed
2. The overall area is extremely complex in terms of hydrogeological systems and the geological structure, including terrain elevation, karstification and (sub)surface water flows. Therefore more investigations and assessments are required to get a more credible understanding.
3. The consequences of outdated mining technologies and practises along with uncontrolled and unmanaged mining processes taking place over a number of years have resulted in the general situation and state of emergency. However, the possibility of an effective and environmentally sustainable use of salt resources may be viable.

4. Poorly managed development and land use is contributing to the complexity of the issues and overall situation.
5. Through the risk assessment process, key areas of uncertainty and vulnerabilities were identified and the EUCPT was able to provide a number of recommendations to reduce and address the uncertainties and put in place the next steps and potential further actions/programmes.
6. The requirement for a suitable and viable monitoring system was acknowledged and the recommendations are contained under the coordination of the *pillar* “protecting the environment” of the EU Strategy for the Danube Region (EUSDR).
7. Although the EUCPT has not identified a significant level of salt contribution from the assessed area into the Tisza River, since the ending of mining operations in 2010, further investigation and regular monitoring is required.
8. The tipping of domestic and industrial waste is evident within the mine and surrounding areas (a notable increase has been observed since the scoping mission) and is considered a potential risk for health and environment.
9. The EUCPT was unable to make any conclusive observations on the follow up of the immediate recommendations from the scoping mission. However, Ukrainian Stakeholders (at all levels) expressed a positive encouragement and anticipation for the final advisory mission “Risk Assessment” report to act as a platform to move and address the immediate recommendations and potential future actions to address the situation at the Solotvyno mine and surrounding areas.
10. The EUCPT has developed and captured both a digital archive of legacy data and activated both the Emergency and Risk/Recovery modes of Copernicus Satellite mapping capability, including radar data.

The overall conclusion is that the vulnerability of the population in the hazardous area is high. There are significant uncertainties arising from the mining area, in terms of collapses (craters), sinkholes and potential landslides, which could either, have a direct impact on human life or an impact on buildings, houses and other constructions (infrastructure), as well as consequential effects on society and the economy. An additional finding is that the wide spread propagation of domestic and industrial waste is a potential hazard to health and the environment.

### Recommendations

The recommendations hereafter are clustered, where appropriate, in order to provide granularity. The EUCPT advises to use the momentum of the cooperation that has been developed at all levels (State, Regional, District, Local and Scientific), to discuss the implementation of the recommendations and the follow up in terms of specific actions and projects.

The following recommendations are considered in the short, medium and long-term context, broadly approximating to 0-2, 2-5 and 5-10 -year time scales

#### **1. Implement a long-term monitoring system including:**

- Monitoring to establish a “benchmark” for the monitoring parameters;
- Ground movement and ground levels, including landslides delivered to a common platform;
- Groundwater quality parameters and groundwater levels;
- Whilst monitoring data is already available, there is a requirement for continuous monitoring of the Tisza River water quality parameters and discharge rates, as well as water levels up and downstream of Solotvyno;
- Salt and freshwater lake water quality parameters and levels;

- Establishment of a flood plain monitoring network, connected to the alluvium quality and elevation (some use of existing wells);
  - A network of monitoring wells and springs between Solotvyno and the Magura Mountain;
  - A programme for drinking water quality monitoring (public- and private- wells and springs);
  - The sewage drainage system is important for the hydrology in the mining area, and the health of the population, but the system is damaged. Therefore, monitoring and further actions are needed (please see recommendation 8).
  - Consideration of monitoring vulnerable critical infrastructure and housing
- 2. Undertake proactive, coordinated, short and medium term mitigation planning in conjunction with the monitoring and vulnerability programmes.**
- 3. Work in proactive collaboration with the EUSDR (short to long term) by:**
- Establish a regular exchange of data and information;
  - Exploration of funding opportunities for the recommended monitoring system;
- 4. Conduct a detailed geological, hydrogeological, lithological and geomechanical model, including: (short term and ongoing)**
- Further hazard footprint mapping;
  - The further developing of hydrogeological understanding, including seasonality and karst processes
  - Further investigation of the linkage between Black Moor and the mining area and establishment of a monitoring network, including water level and quality, such as catchment vs precipitation
  - Implementation of a programme to develop the expertise for using ground radar interferometry to monitor ground motion
  - Modelling dissolution rates and time to collapse
  - Further assessment of data archived at the Mining Museum
  - Establish the degree of connectivity between the gas field and the mining area
  - Use the model to contribute to the delivery of recommendations 1, 2, 5, 6, 7 & 8.
- 5. Revise the land use plan as a land use management plan (medium to long term), to include:**
- A robust application of building codes and the implementation of the construction laws
  - Survey on mitigation by civil engineering programmes
  - Contingency planning for restoring critical infrastructure and business continuity planning
  - Demolish old and unsafe mining infrastructure above surface and capping of old boreholes and shafts (risk assessment).
  - Retaining wall systems
  - Relocation of the inhabitants near Black Moor (hazard zone).
  - Structural database
  - Exclusion zones
- 6. Consider an environmentally sustainable Economic Development Plan (medium to long term), including;**
- The exploration of the Solotvyno mine and surrounding area

- The leisure (lake) area
- The effective use of salt resources (brine and rocksalt) for health purposes (hospital: speleotherapy)
- Consider industrial heritage to conserve old mining industrial archaeology

**7. *Community safety (short term action, but ongoing)***

- Improve public awareness campaign on the hazards and risks in the mining area and surroundings
- Involve local population in further risk assessments, related to the decision making process
- Continue educational programmes
- Detailed structural vulnerability survey

**8. *Develop, implement and maintain a robust Waste Management Plan (medium to long term), including:***

- Domestic and commercial waste
- Sewage system
- Hydrocarbon underground storage (former soviet military base)

**More information**

For more detailed information, please see the complete Risk Assessment Report which goes into depth regarding technical information, conclusions and recommendations.