

Innovations and industrial safety: Satellite monitoring technologies, including InSAR, for tailings safety



**A special session at the Thirteenth meeting of the
Conference of the Parties to the Convention on the
Transboundary Effects of Industrial Accidents**

*Geneva, 29 November 2024, 11:30 a.m. – 01:00 p.m.
with interpretation in English, French and Russian*



– Concept note and draft programme –

1. Background

Mining is an important industry for economic and social development. However, mining operations pose serious risks to people and the environment, and failures at tailings management facilities (TMFs) can lead to devastating catastrophes, as demonstrated by the tragic accidents in Brumadinho, Brazil (2019), Ridder, Kazakhstan (2015), Baia Mare, Romania (2000) and others. The increasing demand for minerals and metals needed to develop technology for the green energy transition is leading to more mining activities and subsequently more tailings risks for countries to manage. Also, the increasingly extreme and frequent impacts of climate change are increasing the risks of natural hazard-triggered technological disasters (Natech risks) at TMFs. Given these circumstances, it is likely that the number of tailings failures and their disastrous consequences will also significantly grow.

Under the United Nations Economic Commission for Europe (UNECE) Industrial Accidents Convention, a strong and comprehensive workstream has been established over many years to support Parties and other member States in strengthening mine tailings safety. Among other activities, this has entailed developing Safety Guidelines and Good Practices for TMFs, a TMF Methodology for practically implementing the Guidelines and organizing trainings, seminars and capacity-building workshops. The work has culminated in the endorsement of the 2030 Roadmap for action to strengthen mine tailings safety within and beyond the UNECE region and in the adoption of Decision 2020/1 on Strengthening mine tailings safety. Through both the Decision and Roadmap Parties agreed to take a number of specific actions to strengthen the safe governance of tailings management facilities and protect people, economies and the environment from the disastrous effects of tailings failures, notably by preventing such in the first place.

Satellite monitoring technologies, including Interferometric Synthetic Aperture Radar (InSAR), can be helpful in advancing the implementation of the Convention, along the areas of the 2030 Road map for Action to strengthen mine tailings safety within and beyond the UNECE region, by assessing and informing potential risks:

- **TMF monitoring:** The causes of many past accidents from tailings dam failures can be attributed to a lack of management continuity and inadequate resources for management. With the possibility of remote-sensing, InSAR can be used to monitor the surrounding ground movements and deformation. Moreover, satellite-based monitoring could be helpful in monitoring a wider area around TMFs.
- **Timely response:** It can provide surface motion/changes in near real-time, despite several days of intervals in collecting data, providing continuous monitoring and facilitates timely response in case accident happens.
- **Early warning of potential hazards:** The adverse impacts of climate change, such as extreme weather events, flooding, fires and permafrost thawing, and natural hazards are expected to increase, posing higher Natech risks. InSAR can be used to detect, measure and monitor landscape changes and be useful by providing early warning of potential natural hazards.

Leveraging InSAR technology will also enhance transboundary cooperation, particularly in promoting scientific and technological collaboration. Article 14 (Research and development) of the Industrial Accidents Convention states that the 'Parties shall encourage and actively promote scientific and technological cooperation, including research into less hazardous processes aimed at limiting accident hazards and preventing and limiting the consequences of industrial accidents. Likewise, Article 16

(Exchange of Technology) emphasizes that the need of utilization of technology to facilitate appropriate cooperation among organizations including the private sector, to enhance mutual assistance, research and developments, preparedness, as well as preparedness and mitigation of consequences.

As many TMF failures have led to accidental water pollution within the UNECE region and beyond, InSAR can also contribute to the implementation of the Protocol on Civil Liability and Compensation for Damage Caused by the Transboundary Effects of Industrial Accidents on Transboundary Water in the following perspectives:

- Accident monitoring and assessment for compensation: As InSAR provides continuous monitoring of the area, it can rapidly assess the extent of the deformation and provide data for determining the accident's scope, accountability and transboundary effects.
- Supporting liability determination: Data collected by InSAR can be used as evidence in determining liability and claims for compensation.
- Additionally, InSAR can also be used in the insurance industry. Satellite-based monitoring assists insurers in detecting and quantifying property claim risks. For instance, it can be used to identify ground deformation almost in real-time, helping to determine whether it is affecting a particular house property or not.

Monitoring the stability of tailings dams using satellites is one way of detecting deformation of property and infrastructures, including TMFs, that can capitalize on technology advancements and provide scalable solutions. The special session provides an opportunity to discuss the potential application of satellite monitoring for tailings safety – by looking more closely into the Interferometric Synthetic Aperture Radar (InSAR) solution, providing an overview of the actors using this technology and discussing linkages with the Industrial Accidents Convention.

2. Special session overview

2.1 Scope

The special session will provide information on satellite monitoring technologies, including InSAR, for tailings safety and facilitate a discussion on the potential use of satellite monitoring technologies under the framework of the Industrial Accidents Convention.

2.2 Objective

The main objective of the special session is to exchange information about benefits and limitations of the application of satellite monitoring technologies, including InSAR, for monitoring tailings safety, and to explore their potential use, including as a failure prediction tool, to strengthen tailings safety under the Industrial Accidents Convention.

2.3 Target audience

The target audience of the special session are public authorities that oversee aspects of the tailings safety, including policy and technical experts, TMF operators, civil society organizations and academia.

3. Draft programme

Duration of the special session: 90 minutes

Moderator: Bojan Srdić, Co-chair of the Joint Expert Group on Water and Industrial Accidents, Ministry of Environmental Protection of Serbia

Session 1 – Satellite monitoring technologies and industrial safety (11:30-12:00)	
> Welcome and setting the scene	<i>Moderator</i>
> Overview of satellite monitoring technologies, trends and their use for industrial safety and natural hazards	<i>Samir Belabbes, United Nations Satellite Centre (UNOSAT)</i>
> Overview of Copernicus and opportunities for hazards prevention, preparedness and response	<i>Michel Rixen, Directorate-General Defence Industry and Space (DG DEFIS), European Commission</i>
> Q&A	<i>Questions from the audience</i>
Session 2 – Benefits and limitations of satellite monitoring technologies for monitoring tailings safety and preventing tailings failures (12:00-12:55)	
> Practical application of satellite-based technologies for monitoring TMFs and early-warning	<i>Aaron Chapple, Geotechnical Specialist at Glencore, Member Company of the International Council on Mining and Metals</i>
> Using InSAR for risk assessments and as a prediction failure tool for TMFs	<i>Reijo Pold, Founder of Value.Space</i>
> InSAR applicability for TMF failure modes: lessons learned from case studies	<i>Nahyan Rana, Engineering Geologist at Klohn Crippen Berger, Member of the ICOLD Committee L (Tailings Dams)</i>
> Q&A and discussion	<i>Questions from the audience</i>
Session 3 – Conclusions and recommendations (12:55-13:00)	
> Conclusions	<i>Moderator</i>