

LESSONS LEARNT FROM THE TAILINGS DAM FAILURES AT BAIA MARE AND BAIA BORSA, ROMANIA, IN 2000

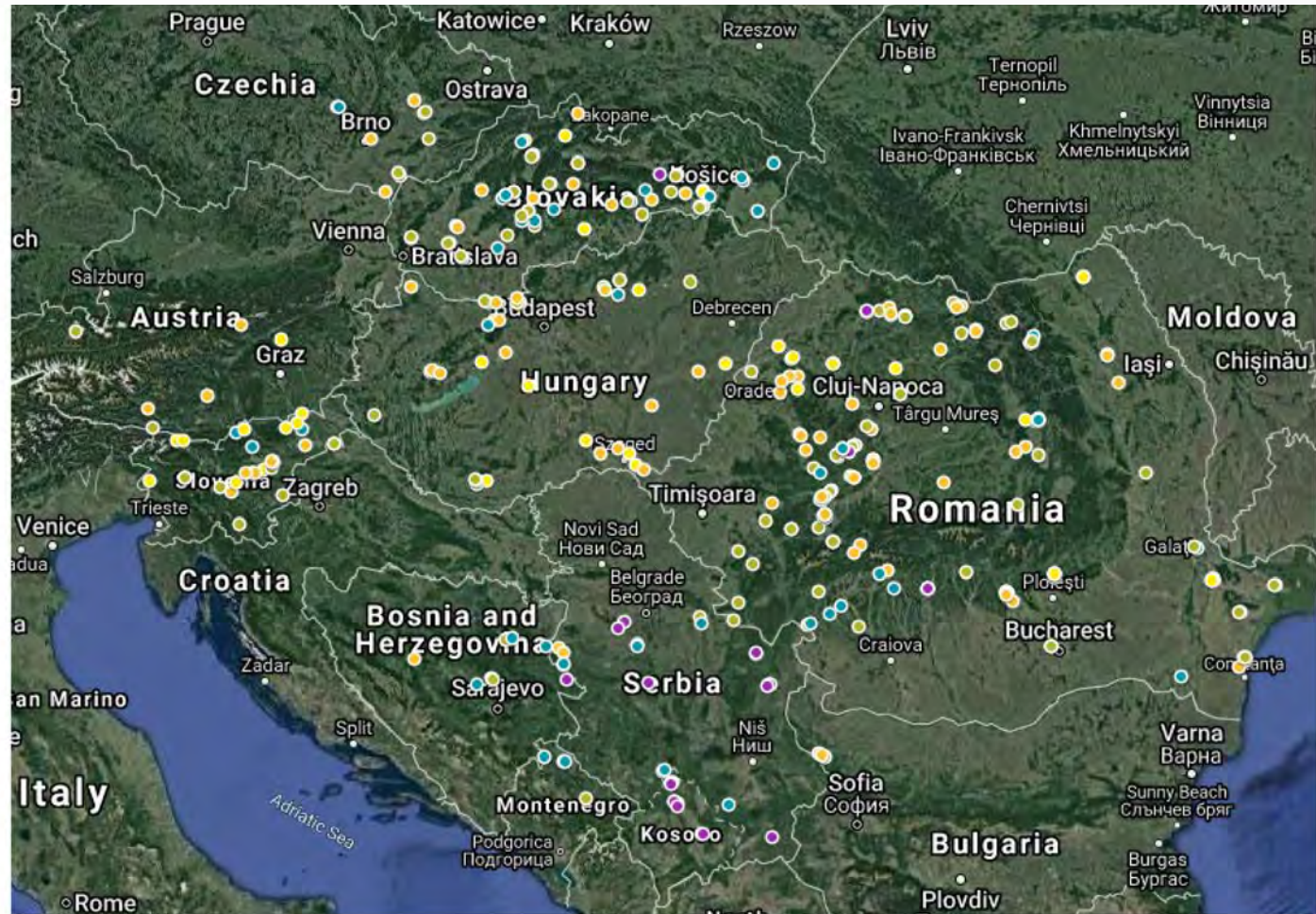
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THE SITUATION OF TAILINGS MANAGEMENT FACILITIES IN THE DANUBE RIVER BASIN

- TMFS CLASSIFIED BY TAILINGS HAZARD INDEX (THI) IN DRB COUNTRIES
- A PRODUCT OF THE **DANUBE TMF PROJECT**



Color scheme: lilac – very high hazard ($THI > 14$), blue – high hazard ($12 < THI \leq 14$), green – medium hazard ($10 < THI \leq 12$), orange – low hazard ($8 < THI \leq 10$), yellow – very low hazard ($THI \leq 8$), © Google

Figure 1. Google map with TMF location and THI classification.

BAIA MARE AND BAIA BORSA TMFS



Figure 2. Source: UNEP/OCHA, 2000.

THE BAIIA MARE CYANIDE SPILL, 30 JANUARY 2000



Figure 3. Aurul and Bozanta Mare TMFs

Figure 4. AURUL TMF in 2019

CAUSES OF THE ACCIDENT

- **NATURAL:**
- HEAVY RAINFALL: APROX. 36 L/M² FOR 24 HOURS
- MELTING OF SNOW: APROX. 43 CM ON THE TMF SURFACE
- **MAN MADE:**
- BAD DESIGN - CLOSED WATER CIRCUIT;
- AUTHORITIES WERE NOT CONTACTED BEFORE THE ACCIDENT ABOUT THE SITUATION OF THE DAM.

THE EVENT

- DAM FAILURE OF AURUL TMF ON THE S-E SIDE
- 22,3 M LENGTH AND 2,5 M DEPTH BREACH AND THE SPILL OF 100.000 M³ TOXIC WATER AND SLUDGE CONTAINING CYANIDE AND HEAVY METALS (COPPER, LEAD, ZINC, IRON, MAGNESIUM)
- ATTEMPTS TO BLOCK THE BREACH USING POLYETHYLENE BAGS FILLED WITH STERILE MATERIAL FROM MEDA TMF



Figure 5. Workers trying to block the breach with sandbags (source: Ecomagazin.ro)

CONSEQUENCES

- TRANS-BOUNDARY EFFECTS: EXTENSIVE CONTAMINATION OF A MAJOR RIVER SYSTEM, FROM THE SZAMOS STREAMS AND THE TISZA RIVER, TO THE DANUBE RIVER
- CONTAMINATION AND INTERRUPTION OF THE DRINKING WATER IN 24 TOWNS AND OF 2.5 MILLION PEOPLE;
- MASSIVE FISH-KILL AND DESTRUCTION OF AQUATIC SPECIES IN THE RIVER SYSTEMS.



Figure 6. Dead fish in the Tisza river after Baia Mare disaster



Figure 7. Event timeline and measurements in Szamos and Tisza Rivers, Hungary

POST-ACCIDENT MEASURES

- **SHORT TERM MEASURES:**
- POPULATION WAS ALERTED FAST BY THE ICPDR AND DANUBE INTERNATIONAL ALARMING CENTER (AEWS – ACCIDENT EMERGENCY WARNING SYSTEM).
- THE SYSTEM EFFECTIVELY ENABLED THE TIMELY ACTIVATION OF MEASURES THAT PREVENTED MORE EXTENSIVE DAMAGE TO PEOPLE AND ECOSYSTEMS DOWNSTREAM ALONG THE TISA RIVER.
- POPULATION WAS NOT AFFECTED DIRECTLY BY THE POLLUTION DUE TO THE FAST INFORMATION FLUX.

MEDIUM-TERM MEASURES

- COMPLIANCE WITH SAFETY REQUIREMENTS FROM ORIGINAL DESIGN (BEACH SIZE, GUARD DITCH, SLOPE OF THE DOWNSTREAM FACE) USING NORMAL DEPOSITION TECHNOLOGY OR MECHANICAL DEPOSITION WHERE NECESSARY
- STRINGENT MONITORING OF TMF: WATER LEVEL, BEACH SIZE, METEOROLOGICAL CONDITIONS AND WATER BALANCE.

LONG-TERM MEASURES

- **NEW LEGISLATION: AT NATIONAL LEVEL**
- STRENGTHENING THE LEGAL FRAMEWORK FOR HYDROTECHNICAL CONSTRUCTIONS WITH POTENTIAL RISK FOR POPULATION AND ENVIRONMENT (NTLH 021, 022, 031-036) (MINISTRY OF ENVIRONMENT AND MINISTRY OF PUBLIC WORKS AND LAND-USE PLANNING):
 - METHODOLOGY FOR ESTABLISHING THE IMPORTANCE CATEGORIES OF DAMS
 - METHODOLOGY FOR ASSESSMENT OF DAMS SAFETY
 - METHODOLOGY FOR ASSESSMENT OF TMFS SAFETY (NTLH, 2002A)
- **NEW LEGISLATION: AT EU LEVEL**
- SEVESO II DIRECTIVE AMENDED BY DIRECTIVE 105/2003/CE

LONG-TERM MEASURES

- **TECHNICAL MEASURES:**
- CONSTRUCTION OF AN EMERGENCY SPILLAGE POLDER WITH A CAPACITY OF 250.000 M³ (FIG. 8)
- INSTALLATION OF A HIGHLY RESISTANT POLYETHYLENE GEOMEMBRANE
- NEW WATER MANAGEMENT SYSTEM OF THE TMF WITH WATER PURIFICATION STATION (FIG. 9)



Figure 8.



Figure 9.

BAIA BORSA ACCIDENT, 10 MARCH 2000



Figure 10. The Baia Borsa spill

CAUSES OF THE ACCIDENT

- **NATURAL:**
- TORRENTIAL RAINS OF 37 L/M² AND MELTING SNOW (70 CM) FROM THE SLOPES SURROUNDING THE NOVAT TMF (VALLEY TYPE POND WITH 3 INDIVIDUAL DAMS)
- UNMANAGEABLE RISE IN THE RESERVOIR'S WATER LEVEL AND OVERTOPPING
- **MAN MADE:**
- DEFICIENCIES IN THE DESIGN OF THE SYSTEM
- DEFICIENCIES IN THE OPERATION OF THE PLANT RELATING TO PRECAUTIONS AGAINST OVERFLOWS AND SPILLS, AND IN TERMS OF EMERGENCY RESPONSE PLANS;
- WEAK AND INAPPROPRIATE PERMITTING OF THE FACILITY, AND INADEQUATE MONITORING AND INSPECTION.

CONSEQUENCES

- BREACH: 25 LONG, 15 DEEP
- APPROXIMATELY 40,000 TONS OF SOLID MINERAL WASTE AND 100.000 M³ OF WATER WERE DISCHARGED.
- 20.000 T SOLID FRACTION RETAINED AND APROX. 20.000 T FLUSHED INTO THE VISEU RIVER, VASER RIVER, TRIBUTARIES OF UPPER TISZA RIVER.
- POLLUTED WATERS REACHED UKRAINIAN TERRITORY DURING THE NIGHT OF 10TH MARCH.

LESSONS LEARNED FROM BOTH CASES

- OPERATION OF TMFS IN OPEN WATER CIRCUIT IS SAFER
- DANUBE INTERNATIONAL ALARMING CENTER WAS VERY EFFICIENT
- STRINGENT MONITORING OF TMFS IS NECESSARY
- NEW LEGISLATION FOR TMF SAFETY EVALUATION WAS NECESSARY
- SAFETY AND RISK EVALUATION TOOLS ARE VERY IMPORTANT AND USEFUL – CONCLUSION OF DANUBE TMF PROJECT TRAINING IN ROMANIA (2019)
- RISK ANALYSIS FOR TMFS TO BE USED IN LAND-USE PLANNING PROCESSES
- FURTHER ACTIONS AT NATIONAL, EU, UNECE LEVELS ARE NEEDED FOR THE IMPLEMENTATION OF SAFETY ASSESSMENT TOOLS AND BEST PRACTICES TO REACH MINIMUM SAFETY STANDARDS OF TMFS



**Thank you
for your
attention!**

Figure 11. Valea Sesei TMF – 3rd highest TRI in Romania