UNECE

Bundesministerium
für Umwelt, Naturschutz
und nukleare Sicherheit

BELÜGYMINISZTÉRIUM

Challenge 1:
Understanding and preventing accidental water pollution as a result of natural hazards (Natech): lessons learned

Joint Expert Group on Water and Industrial Accidents

Seminar on emerging risks in accidental water pollution: focus on natural hazard-triggered accidents

Budapest, Hungary and online, 5 October 2022

ROMANIA: LESSONS LEARNED FROM PAST NATECH ACCIDENTS TO BE READY FOR FUTURE CIRCUMSTANCES

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ROMANIA – LANDMARKS, MAIN NATURAL HAZARDS

The main natural and hazards and related risk identified in the national risk assessment (RoRisk Project – 2016):

Forest fires	Avalanches	Destructive geological phenomena		Dangerous hydrometeorological phenomena					
		Earthquakes	Land slides	Storm Sand blizzard	Floods	Heavy snow	Tornadoes	Drought	Extreme temperatures
1	2	3	4	5	6	7	8	9	10

Table 1. Main risk sectors identified for Romania – Country Report - Romania, 2016

ROMANIA – LANDMARKS, MAIN NATURAL HAZARDS

Seimic hazard:

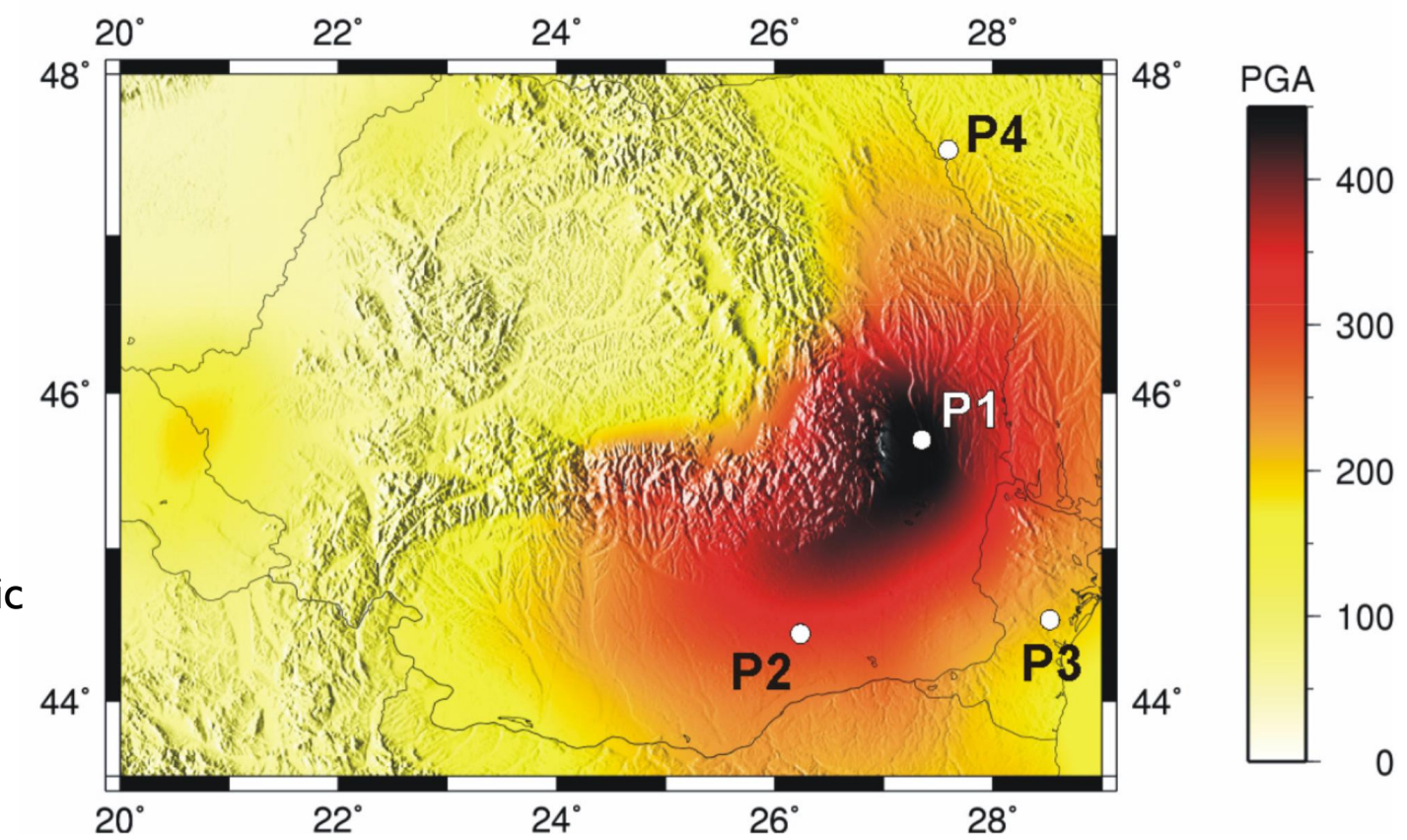

Figure 2. Probabilistic seismic hazard map of Romania - Return period of 475 years (Sokolov et. al, 2007)

ROMANIA – SEVESO SITES VS. SEISMIC HAZARD

Seveso sites in earthquake prone areas:

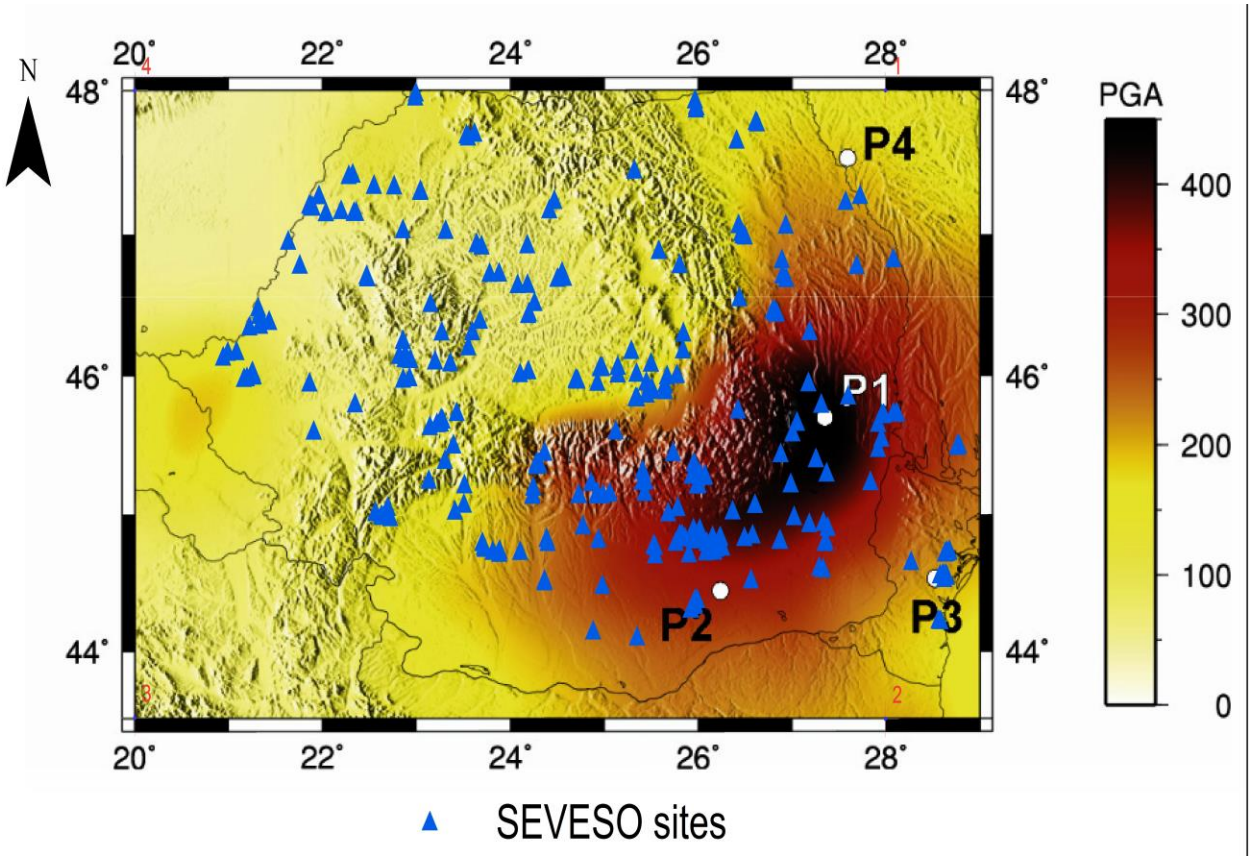

Figure 3. Seveso sites in earthquake prone area (map created by the author, based on the information from RoRisk project, 2016)

ROMANIA – LANDMARKS, MAIN NATURAL HAZARDS

Flood hazard:

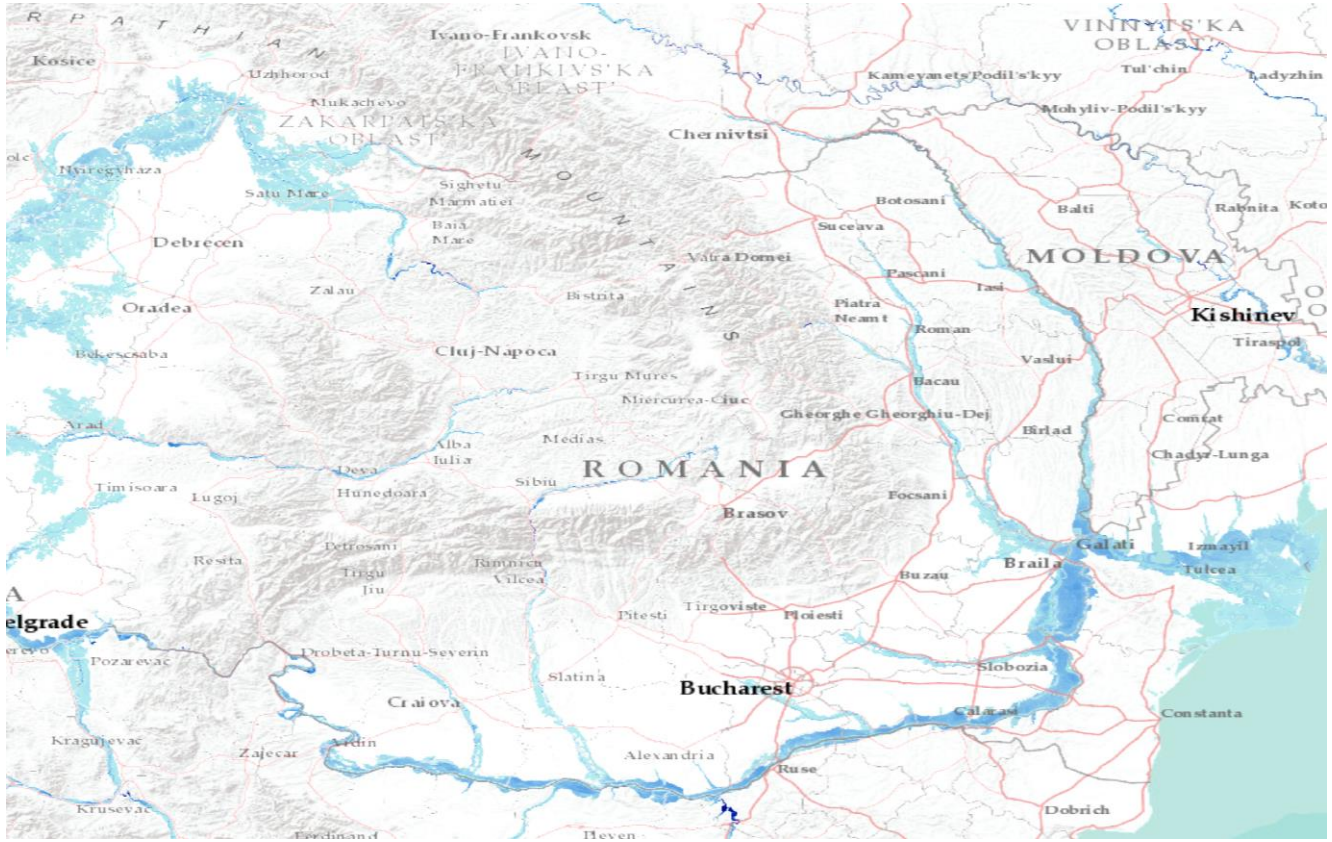

Figure 4. Flood hazard map of Romania - Return period of 500 years (Dottori et. al, 2016)

ROMANIA – INDUSTRIAL SITES VS. HAZARDS

Flood hazard:

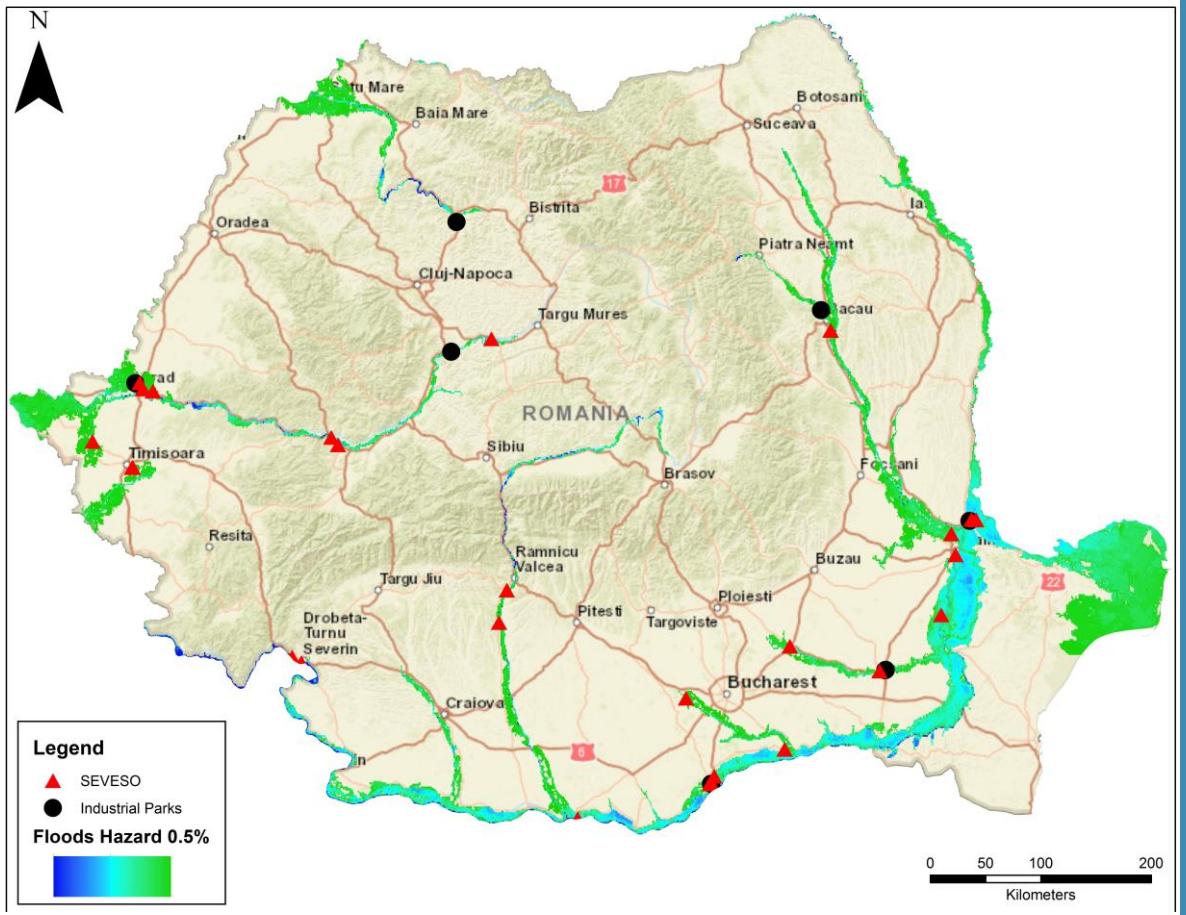

Figure 5. Industrial parks and Seveso sites in flood prone prone areas

ROMANIA – LANDMARKS, MAIN NATURAL HAZARDS

Landslide hazard:

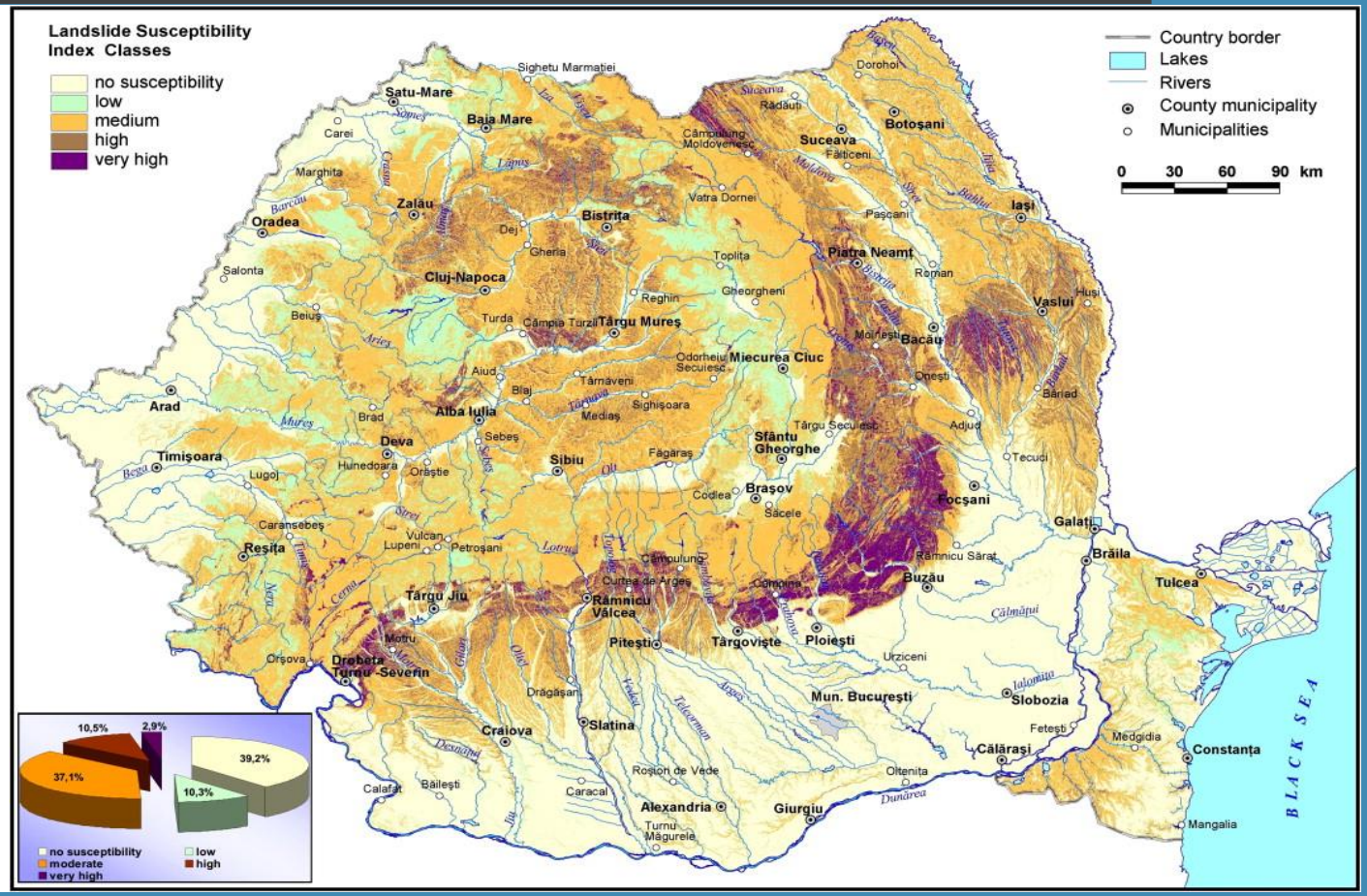

Figure 6. Landslide hazard map of Romania

PhD. Thesis: K. Alexandra, 2018

LESSONS LEARNED FROM PAST NATECH ACCIDENTS

BAIA MARE ACCIDENT (30 JANUARY 2000)

Causes:

- Natural - Heavy rainfall: aprox. 36 l/m2 for 24 hours
- Natural - Melting of snow: aprox. 43 cm on the TMF surface
- Design error - Closed circuit design
- Human - Authorities were not contacted before the accident about the situation of the dam

Figure 7. Aurul and Bozanta Mare TMFs

LESSONS LEARNED FROM PAST NATECH ACCIDENTS

BAIA MARE ACCIDENT (30 JANUARY 2000)

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 8. Dead fish in the Tisza river after Baia Mare disaster
http://www.source-international.org/wp-content/uploads/2012/11/baia-mare-cyanide-spill.jpg

LESSONS LEARNED FROM PAST NATECH ACCIDENTS

BAIA MARE ACCIDENT (30 JANUARY 2000)

Lessons learned:

- 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)

LESSONS LEARNED FROM PAST NATECH ACCIDENTS

TMFs in Romania - still a lot of work to do:

- Totally 152 TMFs in Romania
- 88 are located in the Carpathians
- 8 are active
- 80 are closed or rehabilitated

Figure 9. Valea Sesei TMF – 3rd highest TRI

LESSONS LEARNED FROM PAST NATECH ACCIDENTS

GAS PIPELINES AFFECTED BY LANDSLIDES

Causes:

- Natural – Landslides in areas where main gas pipelines are located

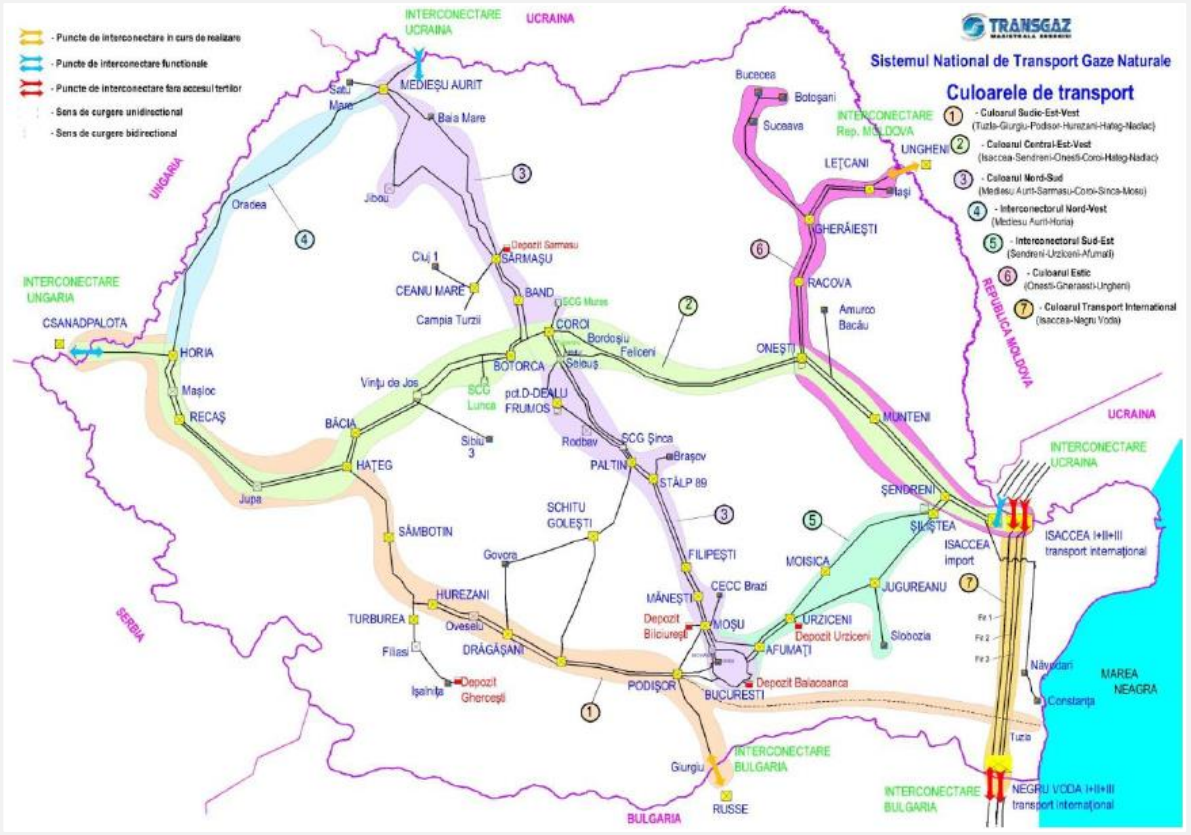

Figure 10. Map of main gas pipelines

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LESSONS LEARNED FROM PAST NATECH ACCIDENTS

GAS PIPELINES AFFECTED BY LANDSLIDES

Causes:

- Natural – Landslides in areas where main gas pipelines are located

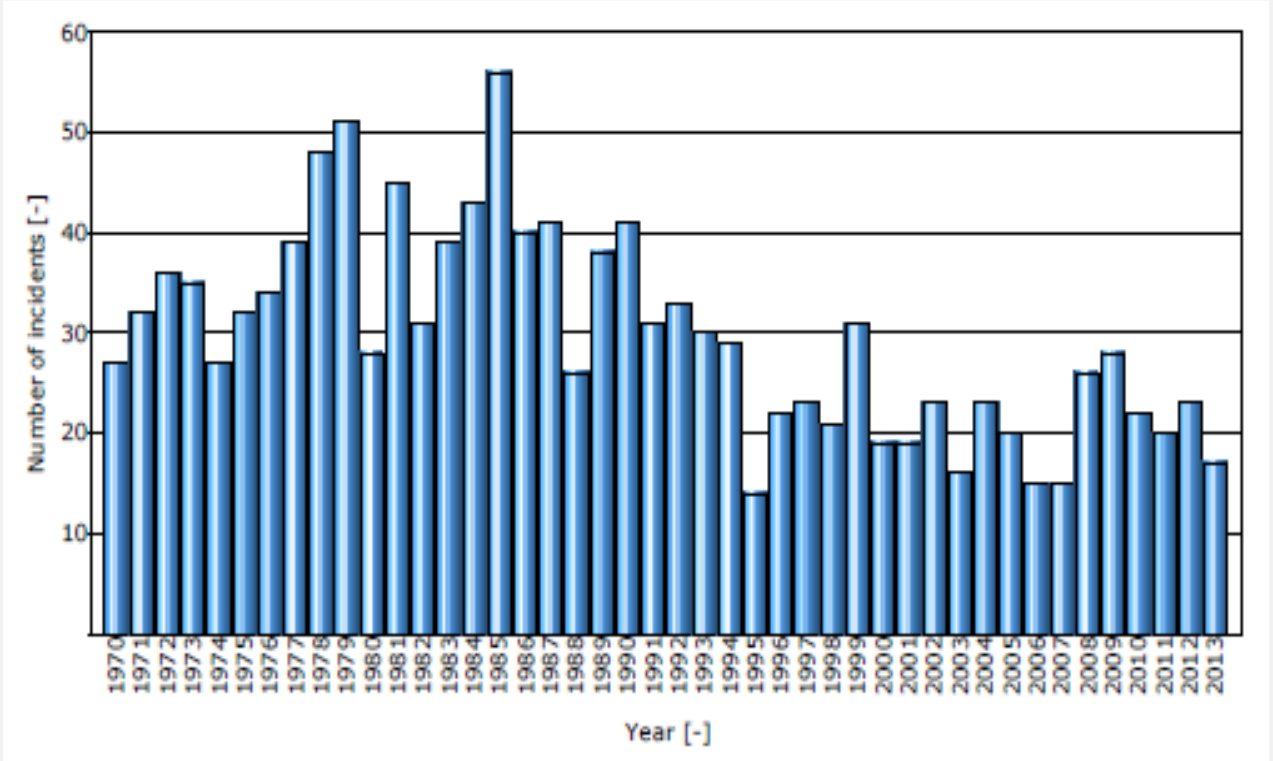

Figure 11. Annual no. of accidents involving natural gas transport pipelines 1970 – 2013 (EGIS, 2015)

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LESSONS LEARNED FROM PAST NATECH ACCIDENTS

GAS PIPELINES AFFECTED BY LANDSLIDES

Figure 12. Gas pipelines affected by landslides – area 1

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LESSONS LEARNED FROM PAST NATECH ACCIDENTS

GAS PIPELINES AFFECTED BY LANDSLIDES

Figure 13. Gas pipelines affected by landslides – area 2

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LESSONS LEARNED FROM PAST NATECH ACCIDENTS

GAS PIPELINES AFFECTED BY LANDSLIDES

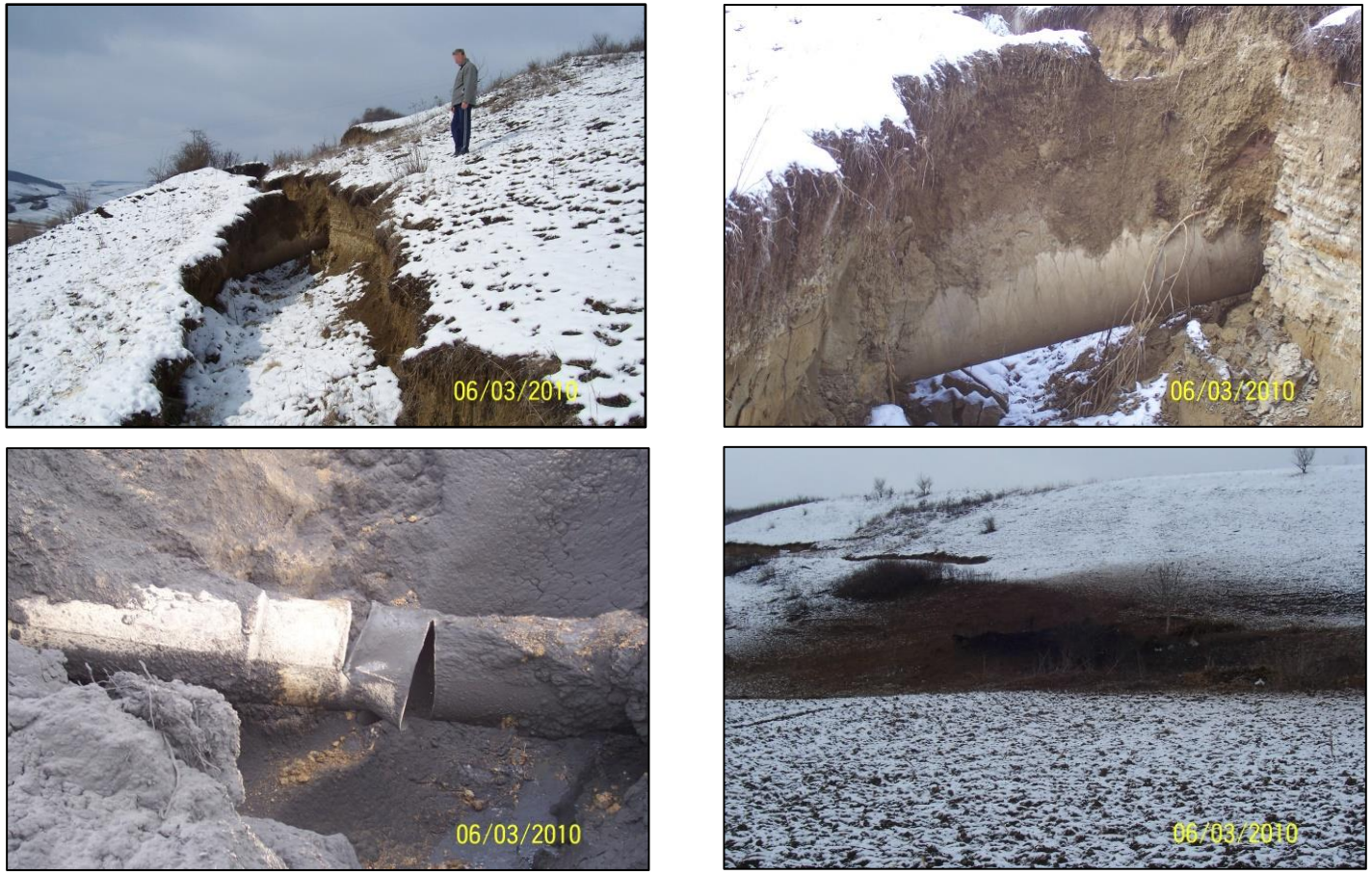

Figure 14. Gas pipelines affected by landslides – area 3

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LESSONS LEARNED FROM PAST NATECH ACCIDENTS

GAS PIPELINES AFFECTED BY LANDSLIDES

Natech risk analysis:
Fig. 15A – probabilistic landslide hazard map
Fig. 15B – Individual risk contours
Fig. 15C – Societal risk F-N curve
Fig. 15D – Natech risk map

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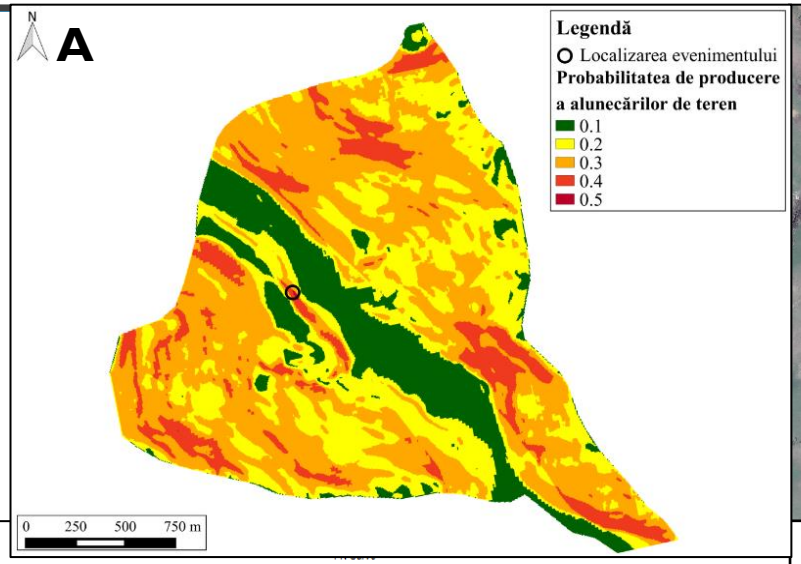
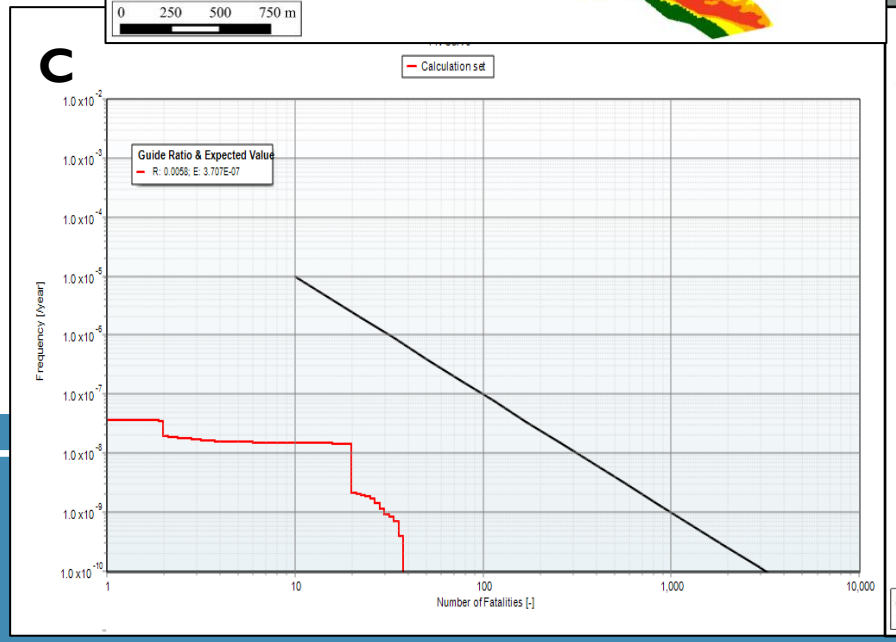
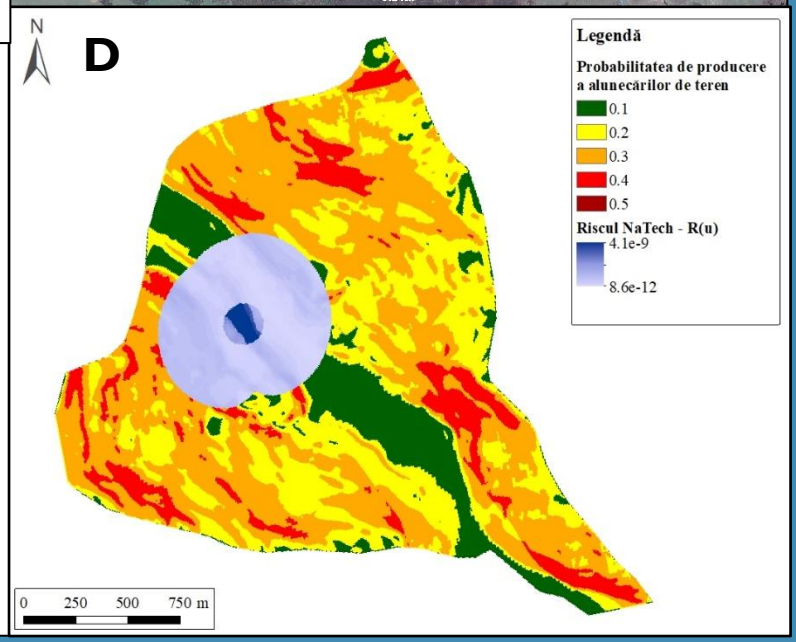






LESSONS LEARNED FROM PAST NATECH ACCIDENTS

Land-slide hazard – key findings:

- **Case studies:** IR and SR at acceptable level for population.
- **Overall:** High economic losses can be prevented by Natech risk assessments in case of landslides vs. gas pipelines
- Specific QRA methodologies should be used for individual cases

LESSONS LEARNED FROM PAST NATECH ACCIDENTS

REFINERIES AFFECTED BY EARTHQUAKES

Causes:

- Natural – Selected site located in one of the highest seismic risk area in Europe – Vrancea area in Romania
- Antrophic – land-use planning without risk studies

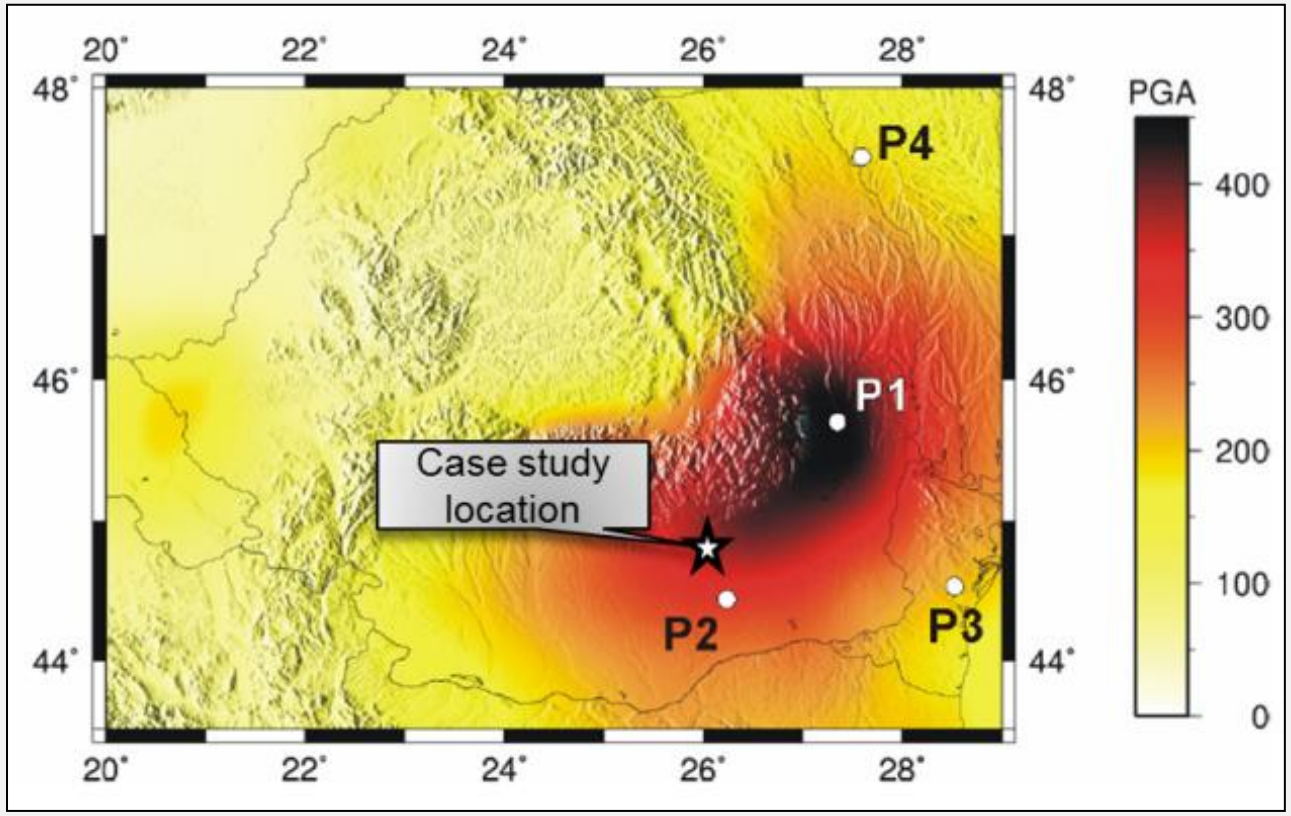


Figure 16. Probabilistic hazard map – 475 years recurrence period (Sokolov et al., 2007)

LESSONS LEARNED FROM PAST NATECH ACCIDENTS

REFINERIES AFFECTED BY EARTHQUAKES

Case study:

- Residential area in the proximity of refinery – less than 25 m from its boundaries

Figure 17. Selected tank farm for Natech risk analysis

Paper: Gheorghiu A.D[a]., Török Z.[a], Ozunu A.[a], Antonioni G.[b], Cozzani V.[b]

LESSONS LEARNED FROM PAST NATECH ACCIDENTS

REFINERIES AFFECTED BY EARTHQUAKES

Fig. 18A. IR considering only internal technological causes

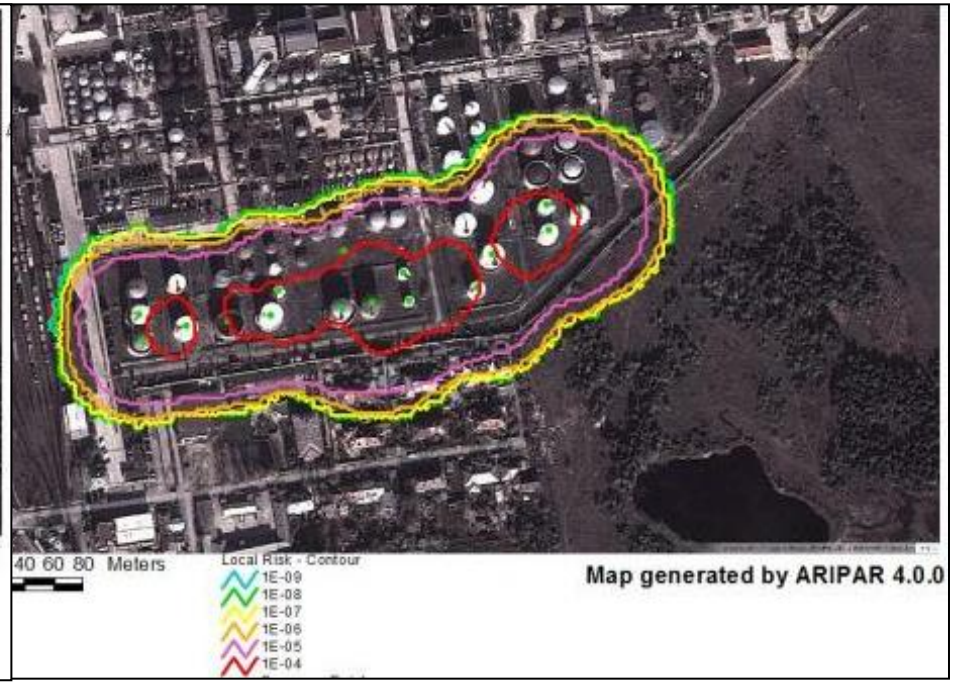


Fig. 18B. Total IR considering internal technological causes and NaTech event

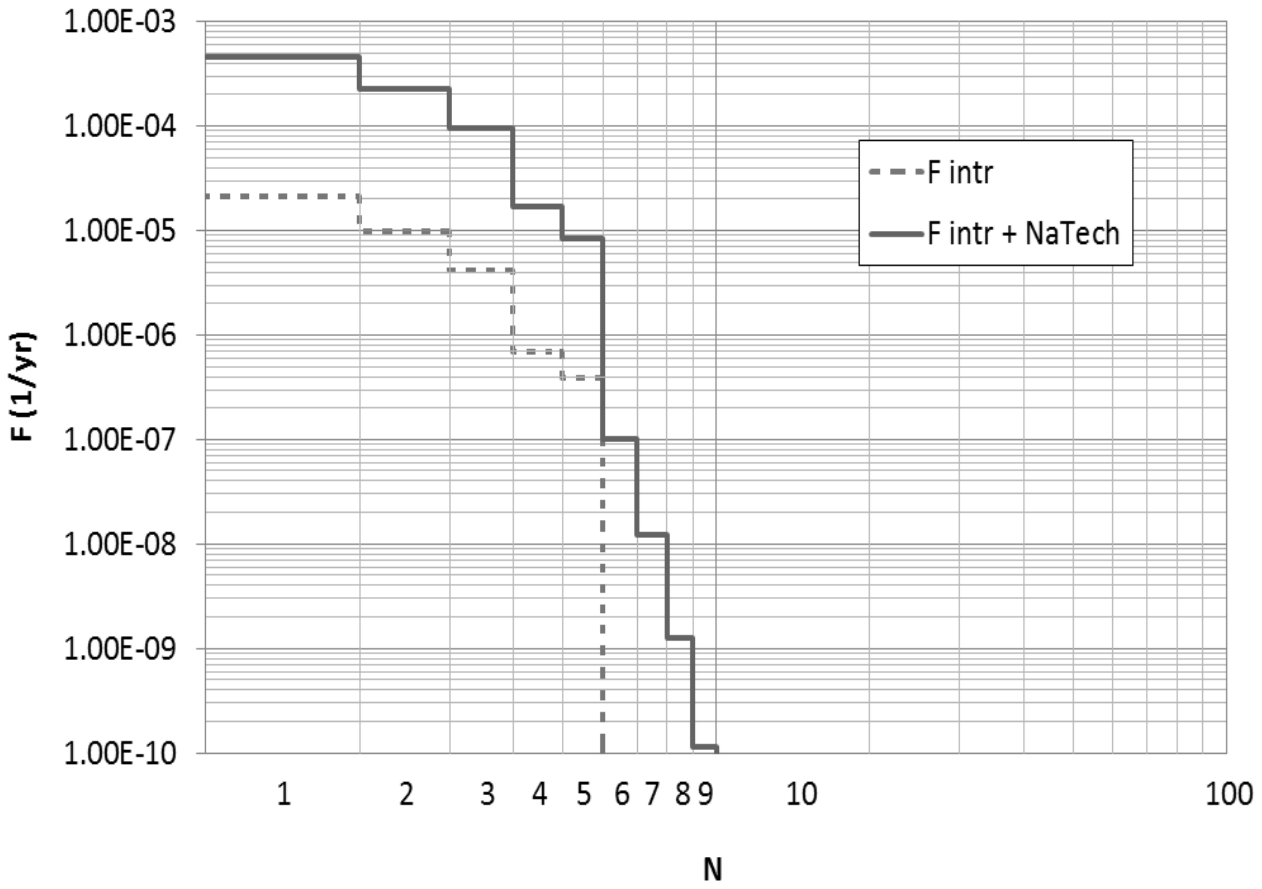
Paper: Gheorghiu A.D[a]., Török Z.[a], Ozunu A.[a], Antonioni G.[b], Cozzani V.[b]

LESSONS LEARNED FROM PAST NATECH ACCIDENTS

REFINERIES AFFECTED BY EARTHQUAKES

Figure19. Societal risk curves for technological and Natech risks

Paper: Gheorghiu A.D[a]., Török Z.[a], Ozunu A.[a], Antonioni G.[b], Cozzani V.[b]



LESSONS LEARNED FROM PAST NATECH ACCIDENTS

Earthquake Natech – key findings:

- IR and SR not acceptable, residential areas are at risk
- LUP is not considering risk results
- Natech scenarios (seismic-tech.) increase the risk with order of magnitude – also demonstrated in other case studies (Rorisk project)

Source: Observatorulph.ro

CONCLUSIONS

- Romania is prone to a series of natural hazards, some of them with **high Natech risk** potential and high risk of water pollution (especially in case of TMFs)
- **No risk assessment methodology** for SEVESO or TMFs implemented in the national legislation
- **No** explicit **requirement for Natech risk assessments** in Law 59/2016 (Seveso 3 transposed), but it is practiced in some specific cases
- Natech risk **must be considered** in land-use planning and contingency planning in the future!

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