Decision making during the transition phase: establishment and optimisation of remediation strategies - urban/inhabited area

Scenario-based workshop

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This project has received funding from the Euratom research and training programme 2014-2018 under grant agreement No 662287

Topics and objectives

Topics:

- Evacuation/relocation of population
- Urban area recovery

Objectives:

- To determine which criteria are important for which stakeholder groups
- How certain criteria impact the return of evacuated/relocated population or opposite – impact further extended evacuation/relocation
- How these criteria and their uncertainties could be taken into account in post accident decision making on decontamination and recovery management

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Topics for discussion

- What do we understand by “the transition phase”
- Main concerns during the transition phase
- Issues to be addressed during the transition phase:
  - Relocation of people and restoration of living conditions
  - Application of countermeasures
  - Decontamination
  - Radiological characterization of the contaminated areas
  - Radioactivity surveillance/monitoring programs
  - Waste management
  - Information and risk communication to the population
  - Public acceptance
  - Public trust in experts and authorities
- Objectives and criteria of the restoration plan
- Alternative restoration actions
- Stakeholders engagement

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Scenario

- Scenario is situated during the transition phase after a fictitious accident in the Bohunice NPP with external release of radioactivity to environment.
- The release has ceased, and the control over the source has been taken.
- The radioactive contamination has spread in the surroundings of the damaged NPP and transported and dispersed through the borders of the country affecting the neighboring regions.
- The contamination level, range of contamination and affected areas have been identified.
- Early emergency actions have been taken to avoid the exposure to population, including evacuation, access restrictions and food restrictions.
- It has to be decided how to proceed in such a situation and prepare recovery of contaminated areas.

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Municipality Piestany

- **Spa** town
- Region/Canton: Trnava
- District: Piestany
- **Population**: 27 666 + 6 000 spa guests
- **Area of municipality**: 44.2 km² with 24% of build-up area ~ 10.7 km2 including buildings with different walls and roofs, interiors, streets and pavements, areas of grass, trees, plants, soil, playing grounds, sport fields, water areas and others.
- **Geography**:
  - on the right bank of the river Vah
  - south of the town is the Sĺňava water reservoir created by a dam on the Vah river

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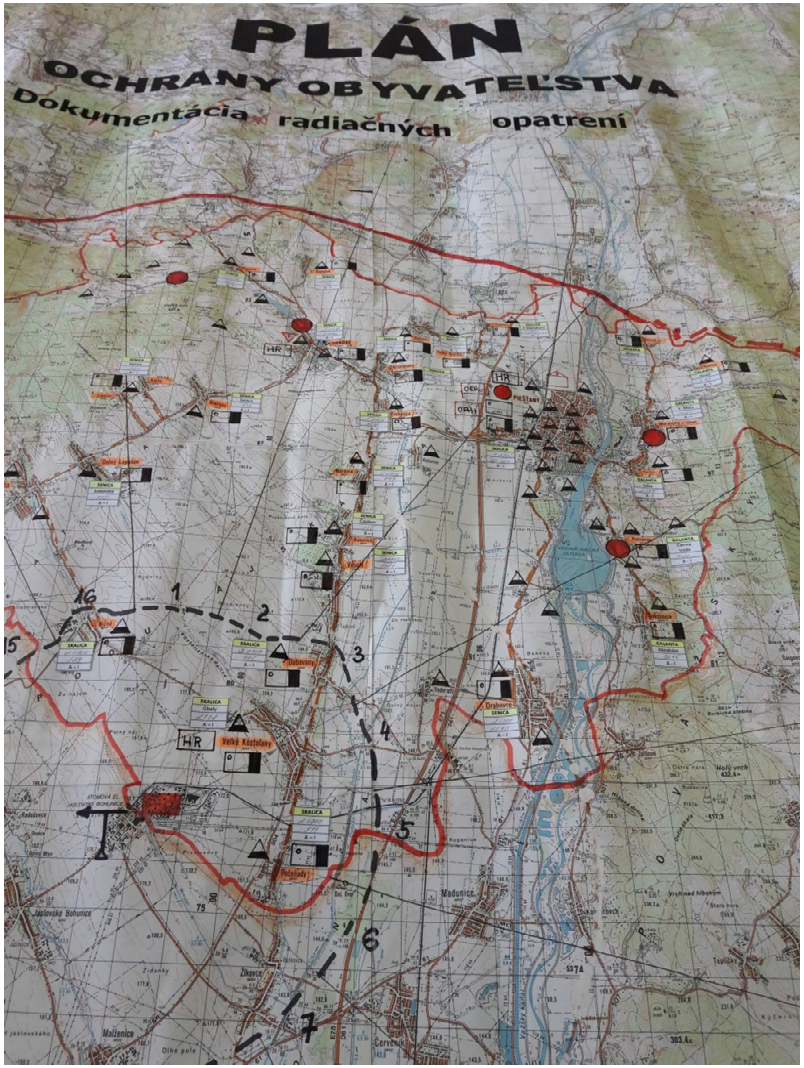
Region Trnava



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Traditional events in Piestany during summer: period in 3 month after an accident

- 1.– 3.6.2018 Opening on the **spa season**
- 1.– 3.6.2018 **International Canoe Regatta** Piešťany - International event for the young canoeists
- 15.–16.6.2018 **Car at tuning party** – party motorisms, sport, music, dance, fashion and entertainment
- 6.–8.7.2018 **Motorcycle race with side rock concerts**, paragliding and other site events
- 10.–11.8.2018 **Grape Festival** is a summer music open-air festival
- 30.8.–1.9.2018 **Country Lodenica** – a festival dedicated to country and folk music
- 17.–23.9.2018 **Victoria Regia** is the major **florist event** in Slovakia – an international competition in flower arranging. The annual Slovak championship in flower arrangements and traditional flower promenade are enriched by Unusual Flowers Festival

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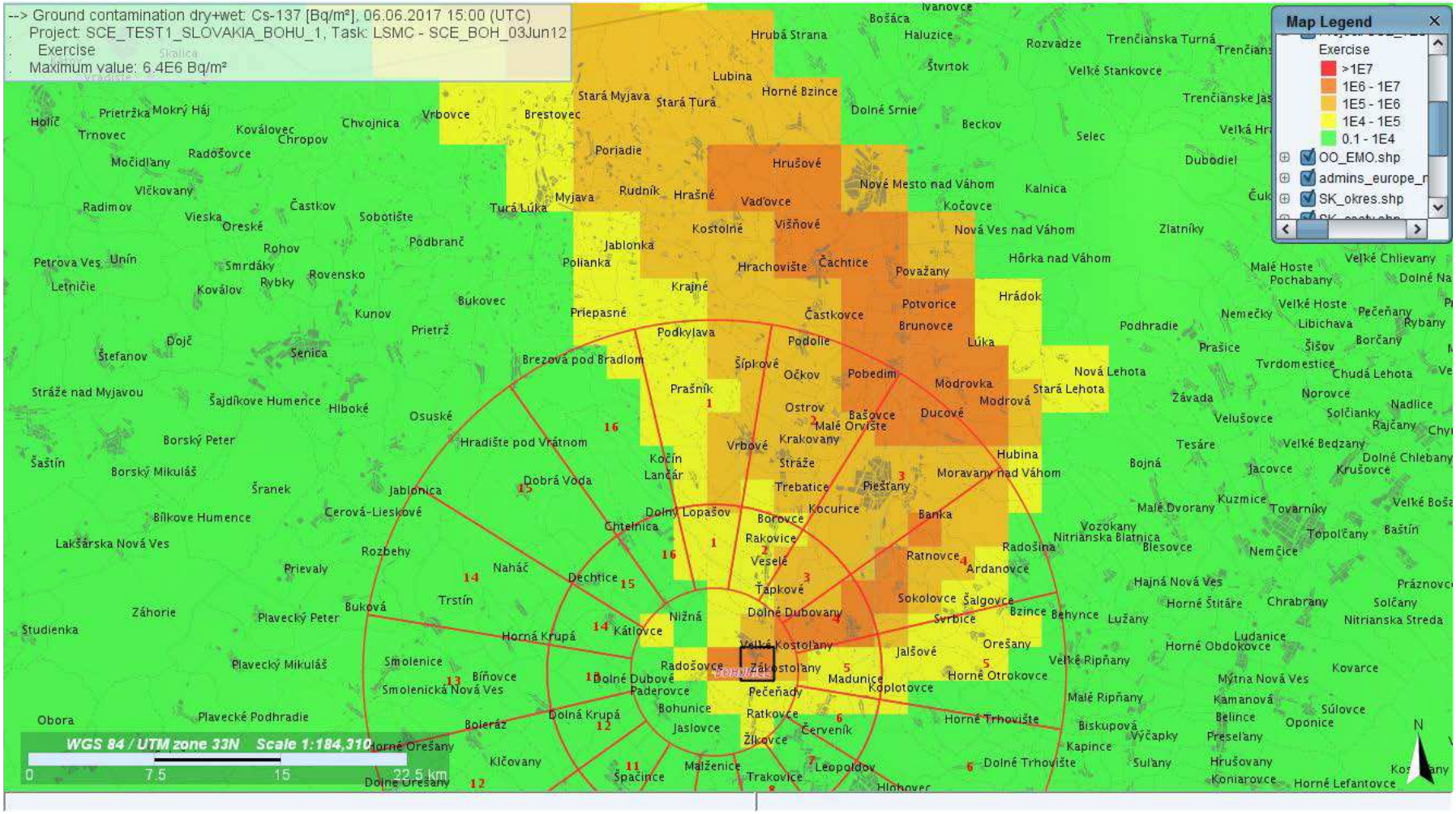
Scenario Bohunice (release: June 3 at 12:00)

ground contamination (dry+wet) for Cs137 at ~3 days after start of release



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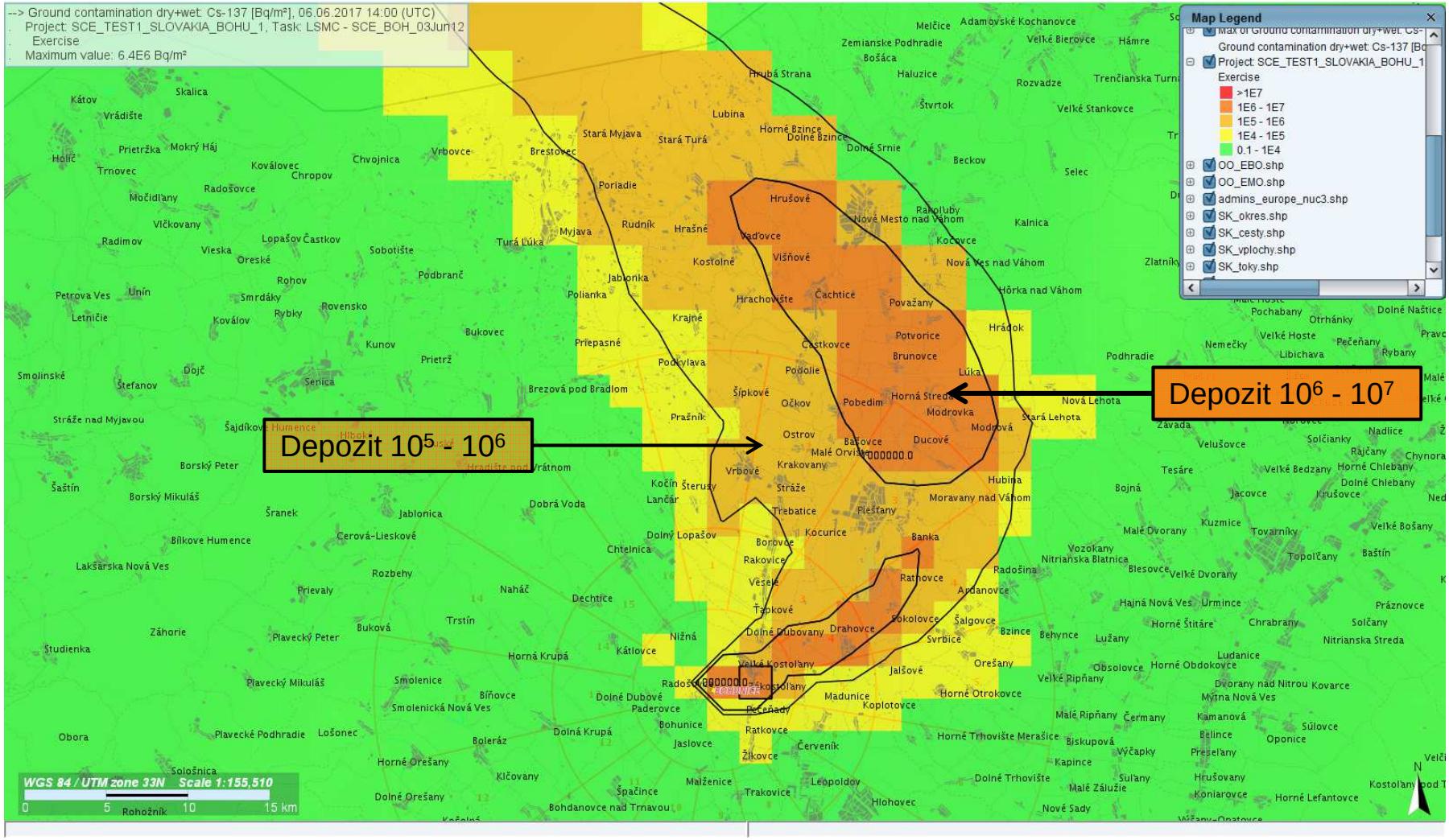

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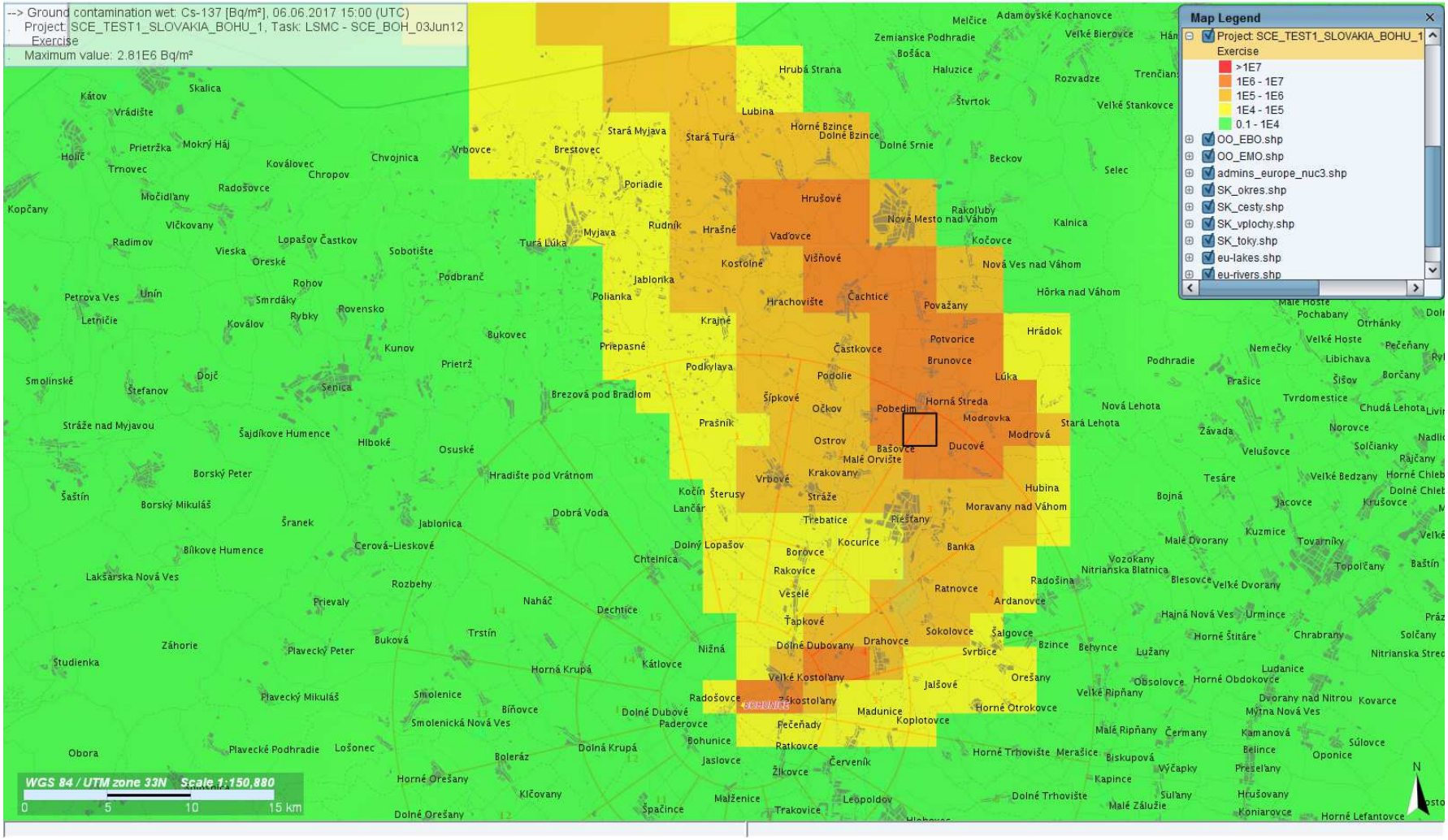

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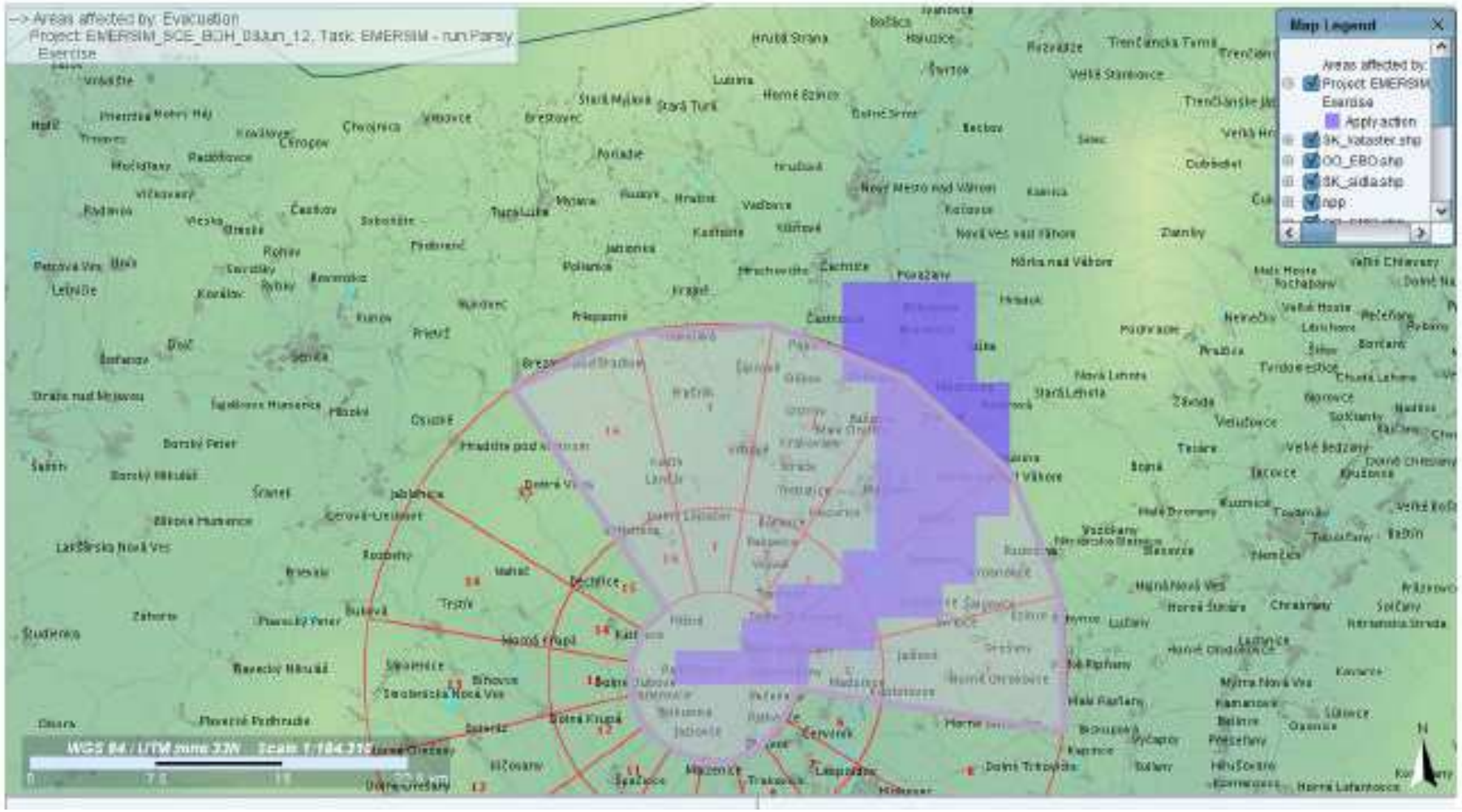
Scenario Bohunice (release: June 3 at 12:00)

Areas affected by evacuation (effective dose, integration time 7 days, 100 mSv)



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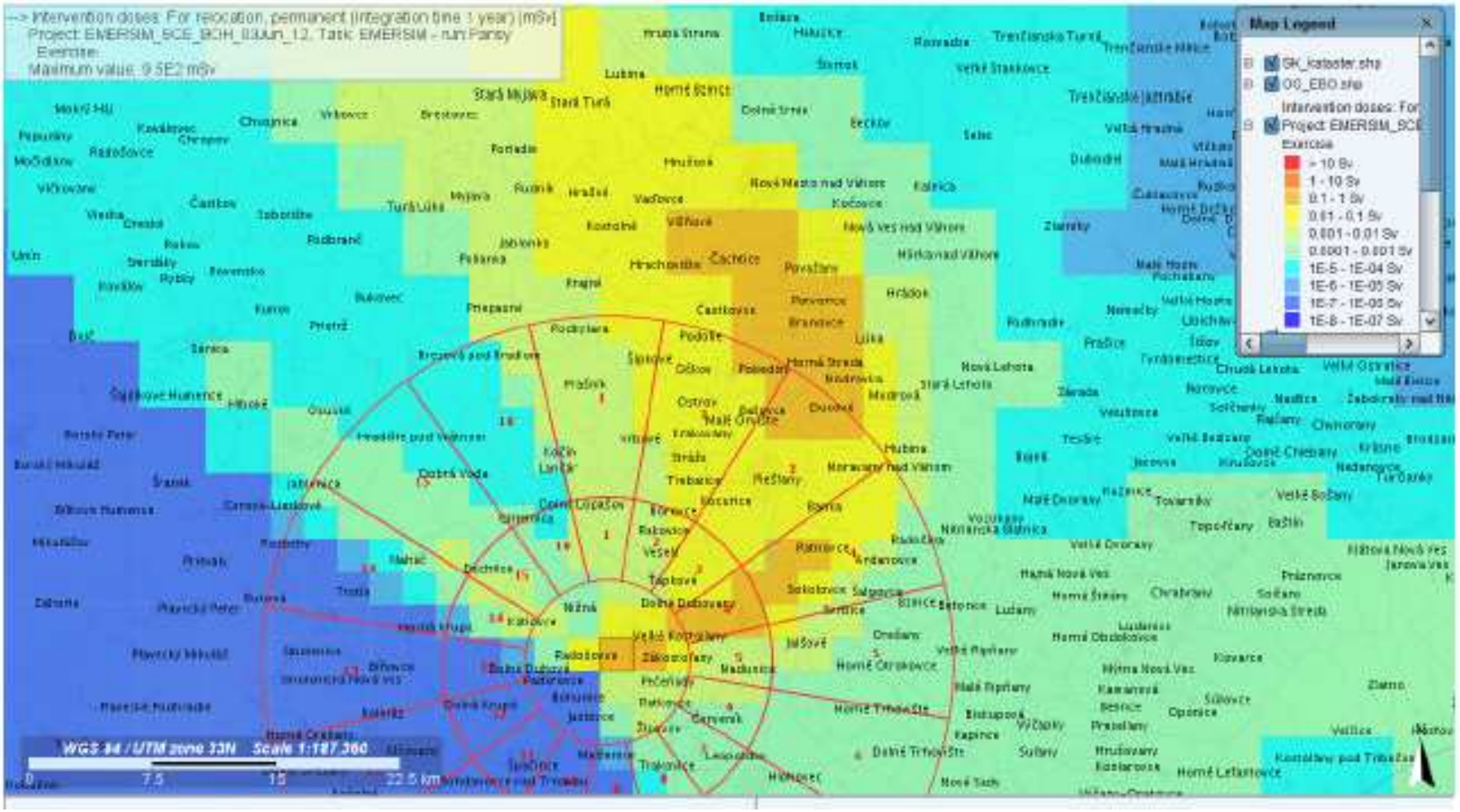
Scenario Bohunice (release: June 3 at 12:00)

Areas affected by temporary relocation (effective dose, integration time 1 year, 100 mSv - GSR Part 7)



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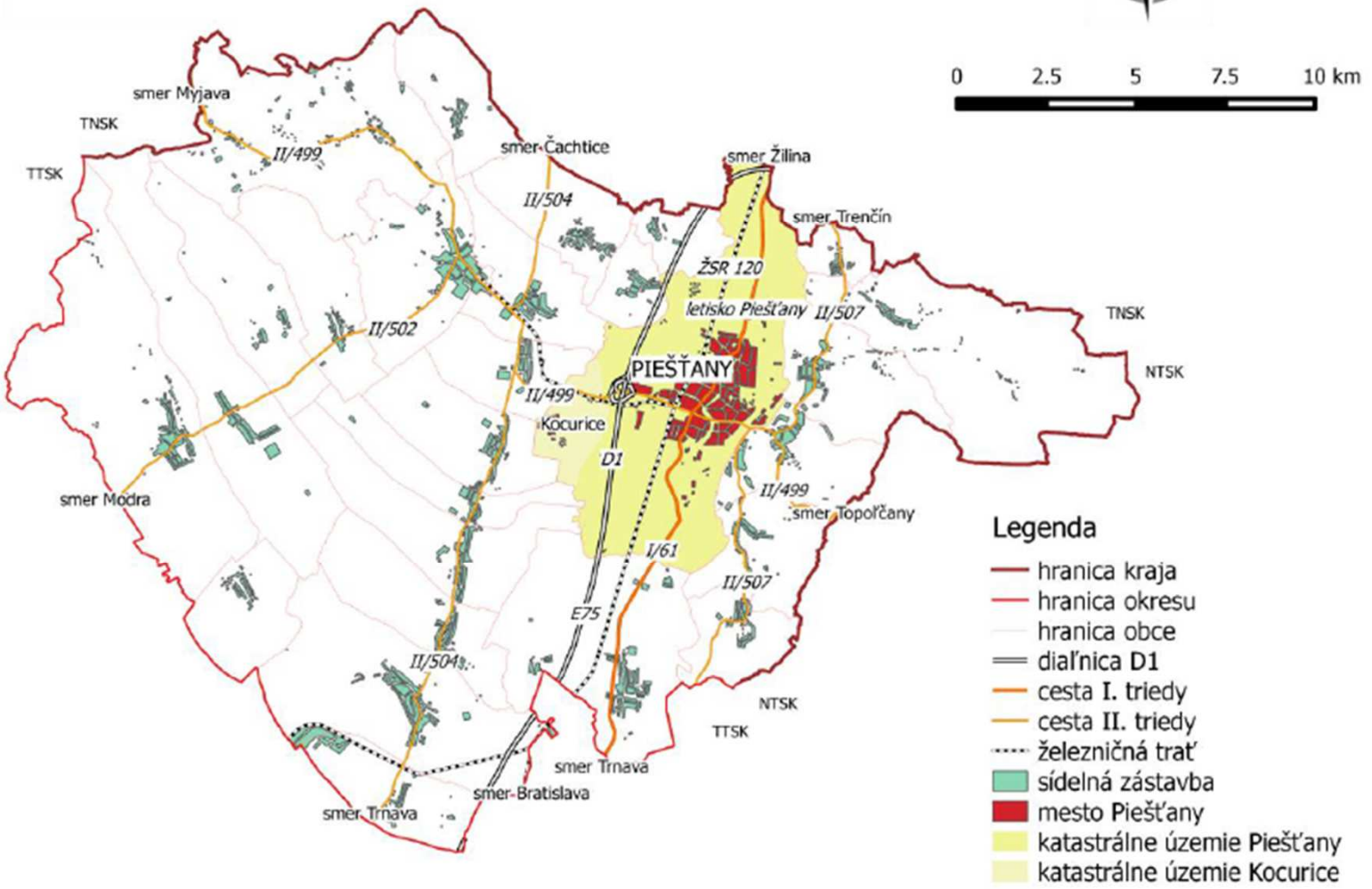

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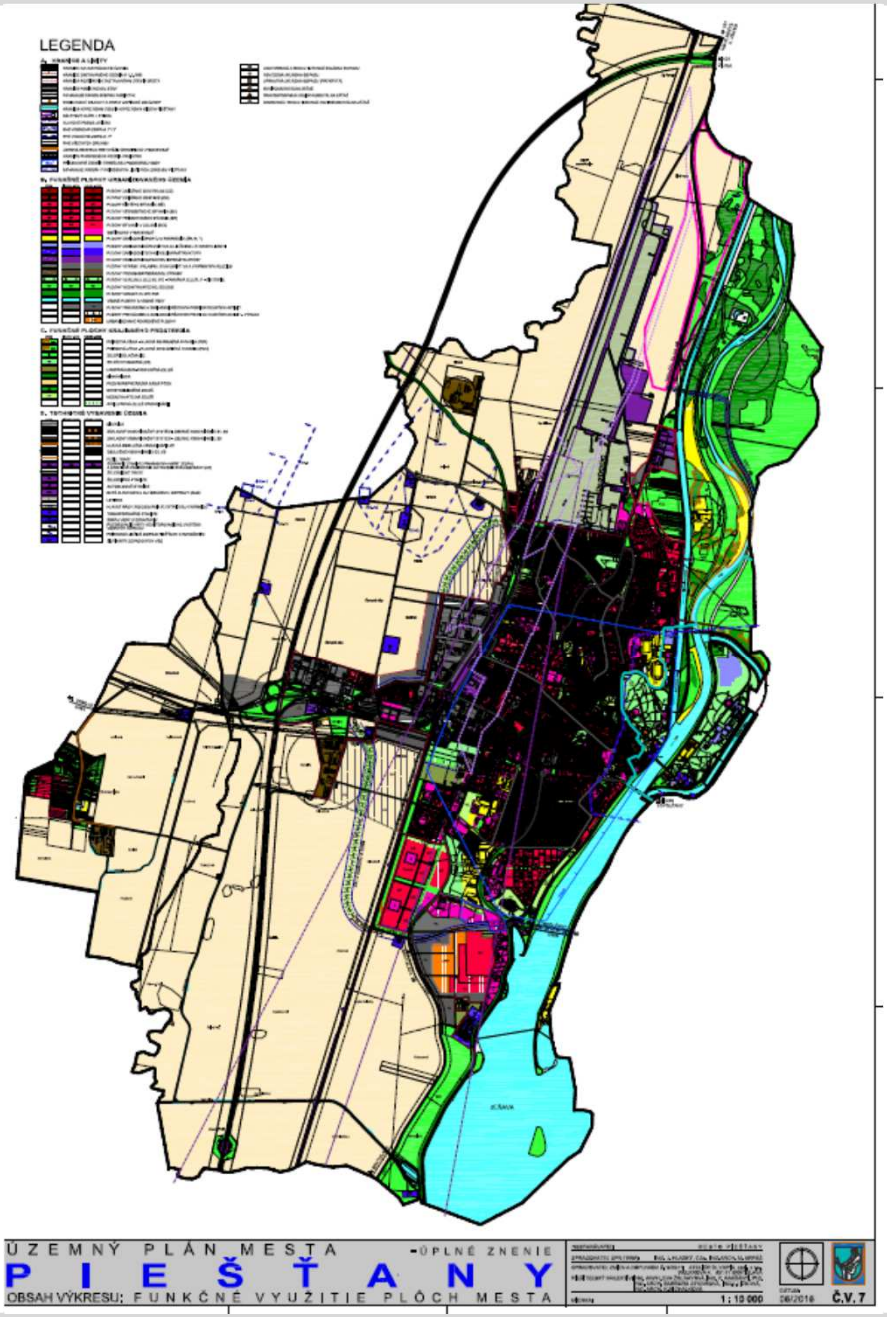
Municipality plan



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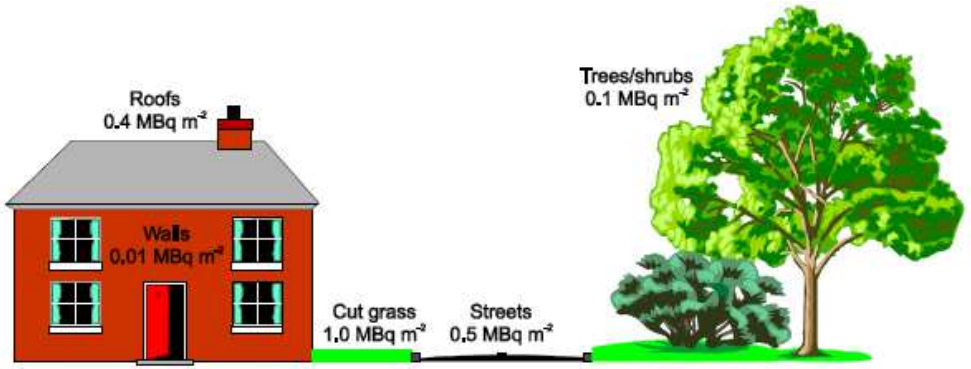
Consequences for Piestany

- Contaminated surfaces in urban areas
  - Roofs, walls
  - Streets, pavements
  - Areas of grass, garden(s)
  - Playing grounds
  - Sports fields
  - Interiors
  - …



- Under the scenario the situation in Piestany 3 days after an accident was supposed to be as follows:
  - contamination 3 - 4 MBq/m^2 ^{137}Cs
  - doses ≈ 20 mSv/year

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Recovery strategies

- 8 strategies have been defined based on the EU project HARMONE:
  - 5 strategies with different recovery options aimed at the cleanup of areas of grass, greens, gardens and plants, the interior and roofs,
  - 3 of the five cleanup strategies were combined with a three month relocation period.

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Recovery strategies

1. Do nothing (introducing of monitoring strategy)
2. Grass cutting, vacuum cleaning (roads)
3. Roof brushing (roofs), vacuum cleaning (internal building), tree/shrub removal (trees and shrubs), grass cutting (small and large areas of grass), plant and shrub removal (small area of plants) (*low waste 1*)
4. Roof brushing (roofs), vacuum cleaning (internal building), tree/shrub removal (trees and shrubs), grass cutting (small and large areas of grass), plant and shrub removal (small area of plants), rotovating carried out after plant, grass and shrub removal (*low waste 2*)
5. Roof replacement (roofs), vacuum cleaning (internal building), tree/shrub removal (trees and shrubs), grass cutting (small and large areas of grass), plant and shrub removal (small area of plants), topsoil removal carried out after plant, grass and shrub removal (*high waste*)
6. Strategy 3 + relocation for three months
7. Strategy 4 + relocation for three months
8. Strategy 5 + relocation for three months.

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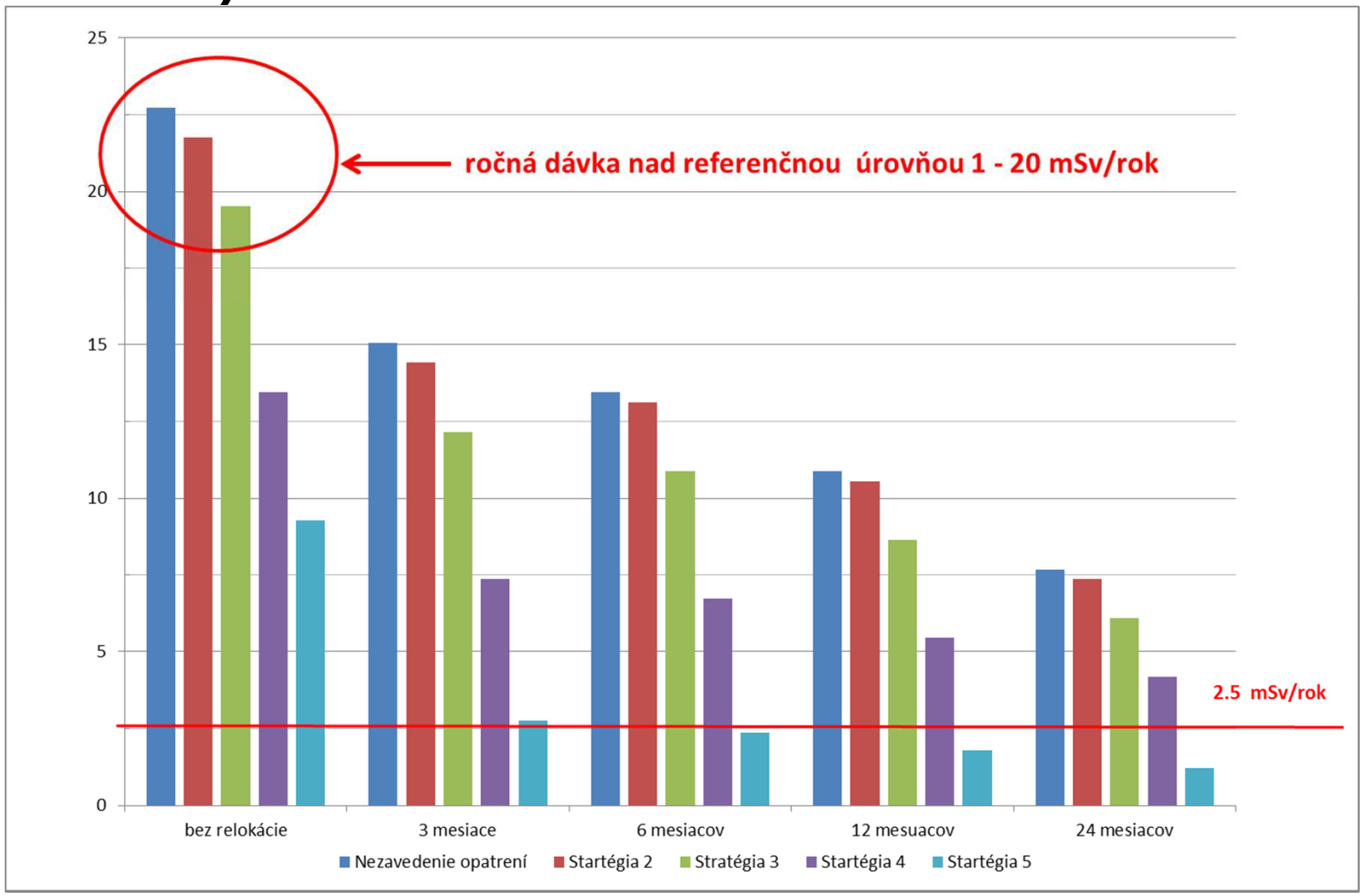
First year dose above EURATOM reference level: 1 – 20 mSv/year (compared to average dose in Slovakia) – results of ERMIN module of JRODOS



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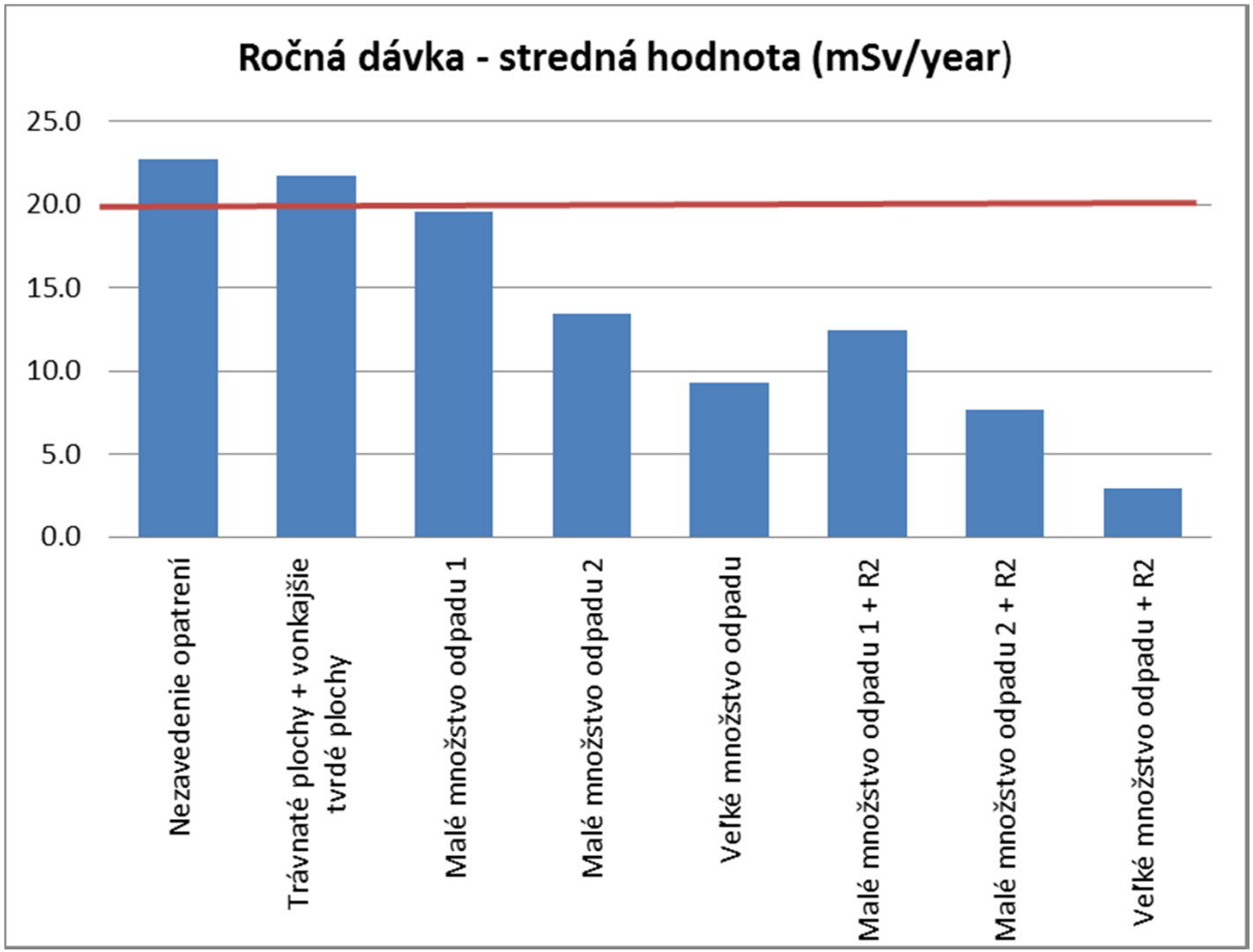
Annual dose, mean value, mSv/year



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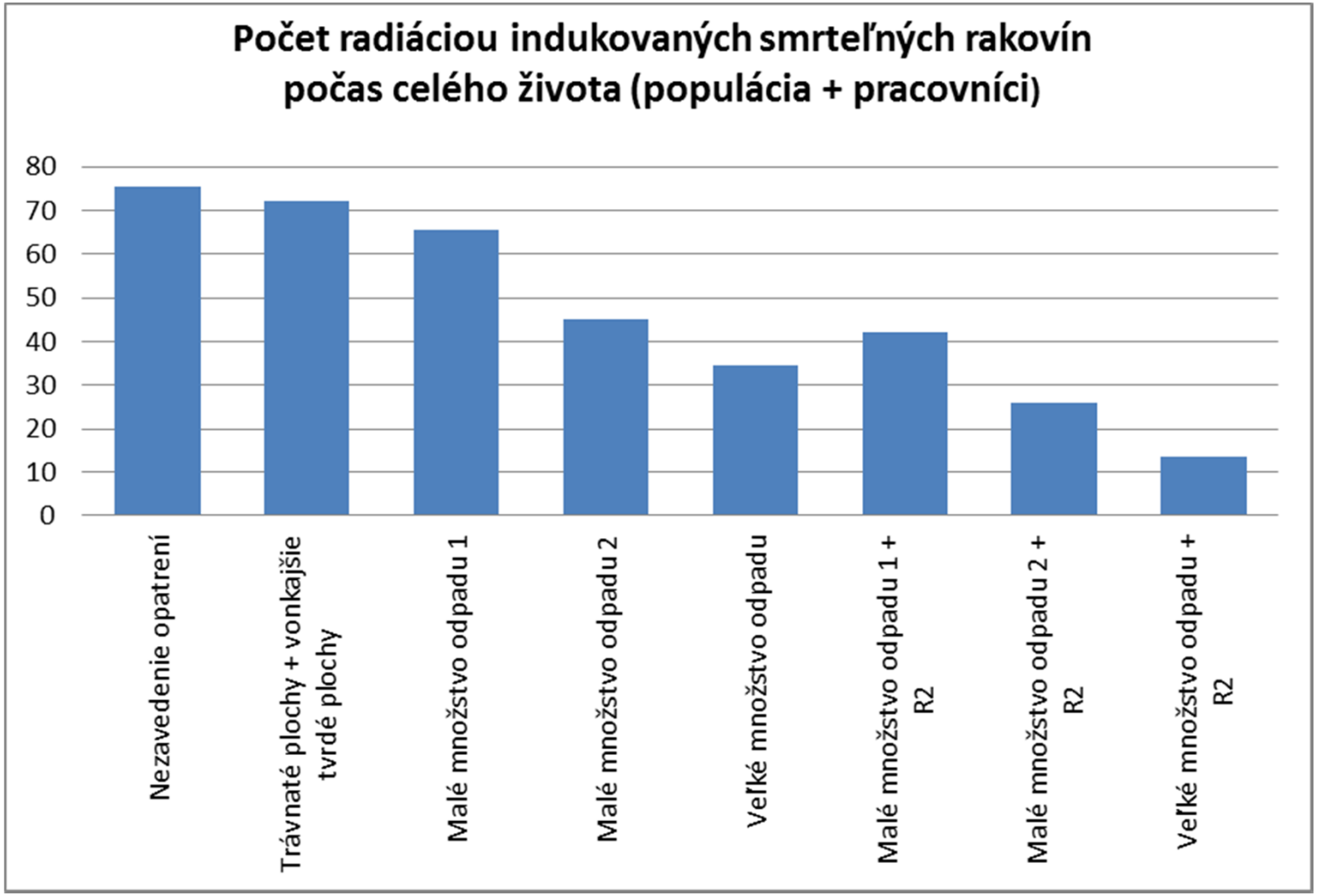
Number of cancer incidences during 50 years, attributed to the exposure (popul. and workers)



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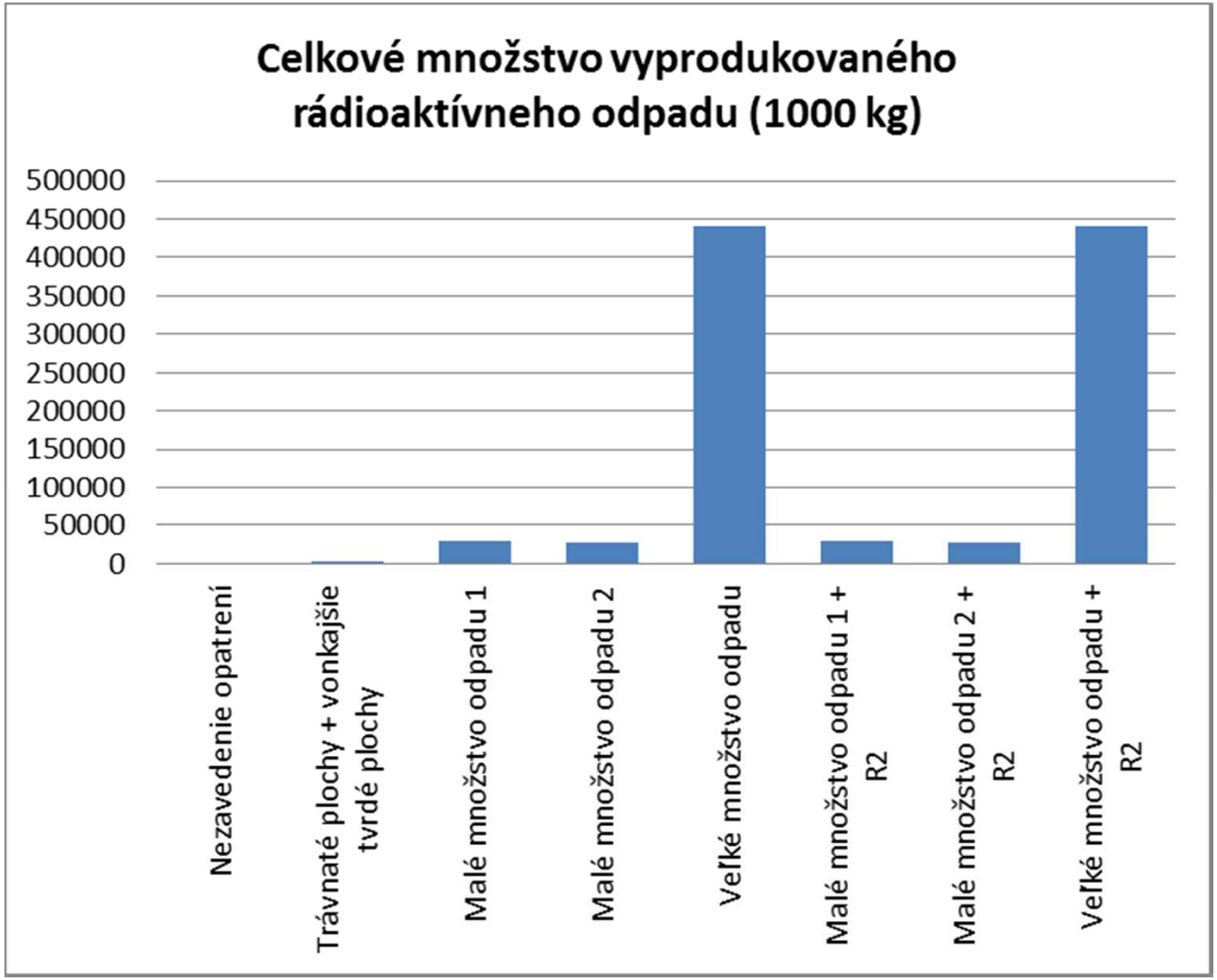
Radioactive waste amount, kg



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Costs

Costs of countermeasures taken into account during the discussions included following items:

- accommodation during relocation
- compensation of loss of productivity during relocation
- clean-up strategy implementation
- waste transport and storage and
- cancer treatments

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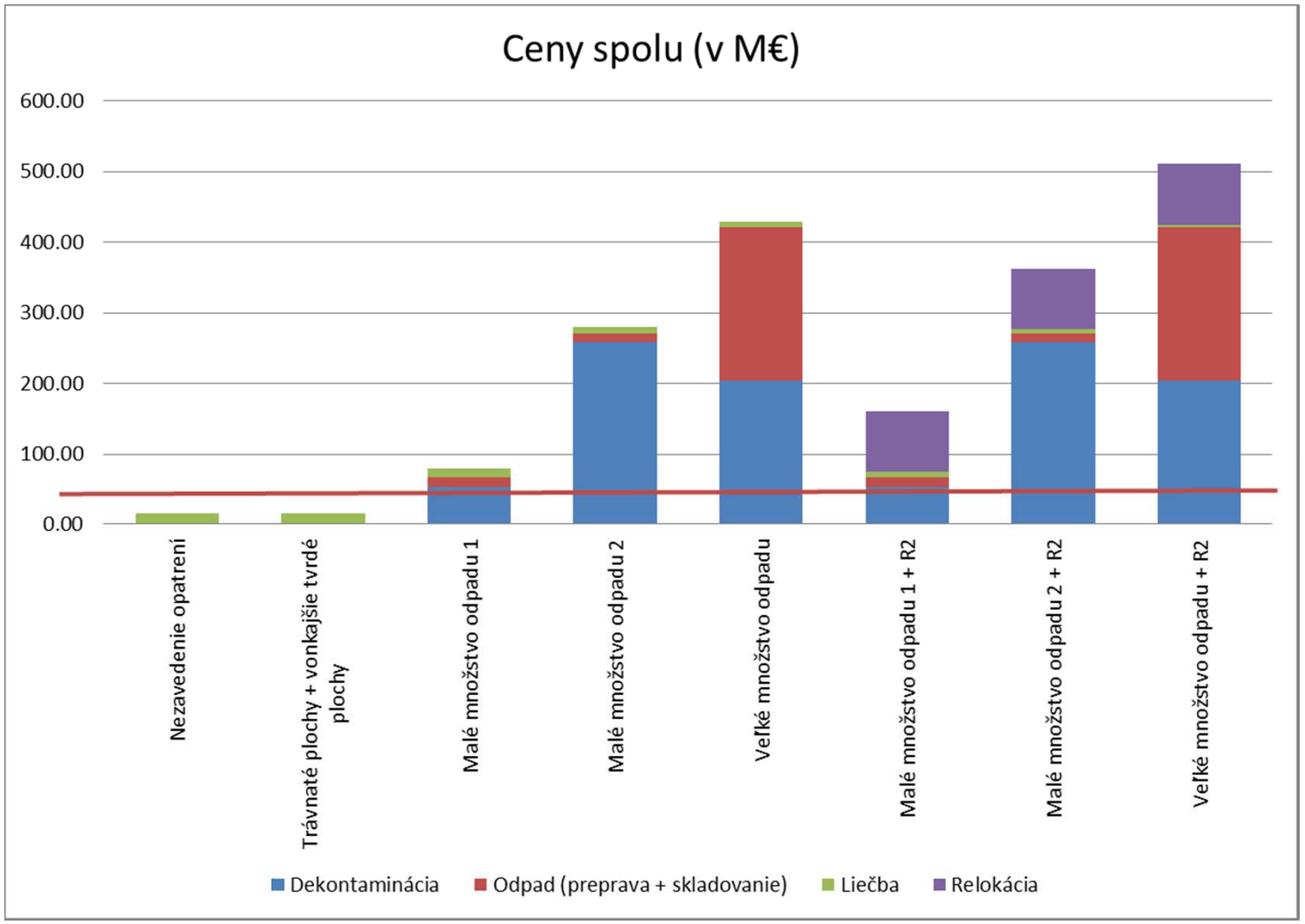
Overall costs for particular strategy



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Uncertainties included in generated ERMIN outputs

The following uncertainties have been included in generating the ERMIN outputs:

- occupancy variability,
- deposition amount and composition to reference surface variability,
- shielding/environment variability,
- soil migration variability and
- countermeasure uncertainty (simply treated; time of application and whether or not effective)

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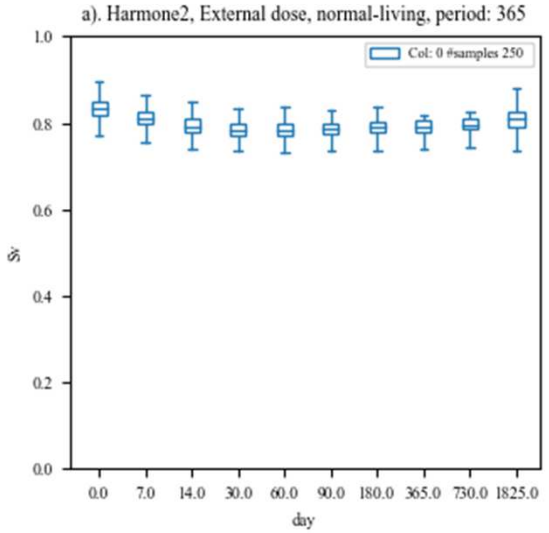
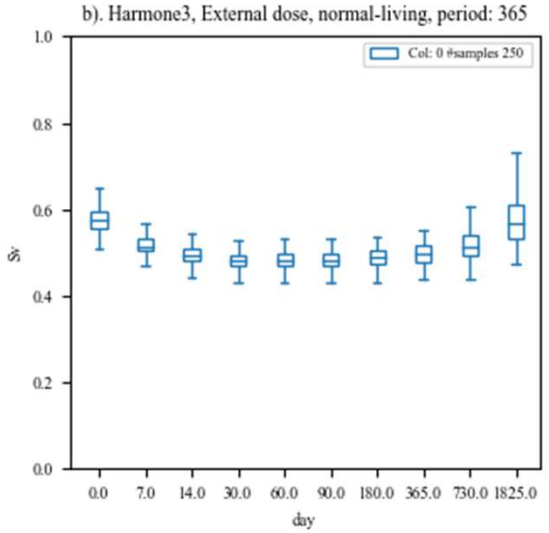
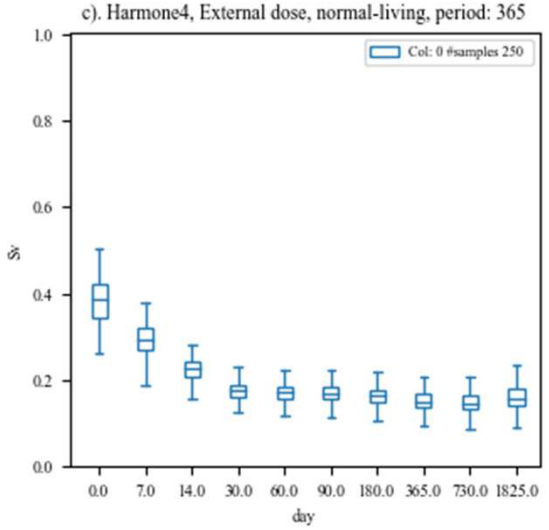
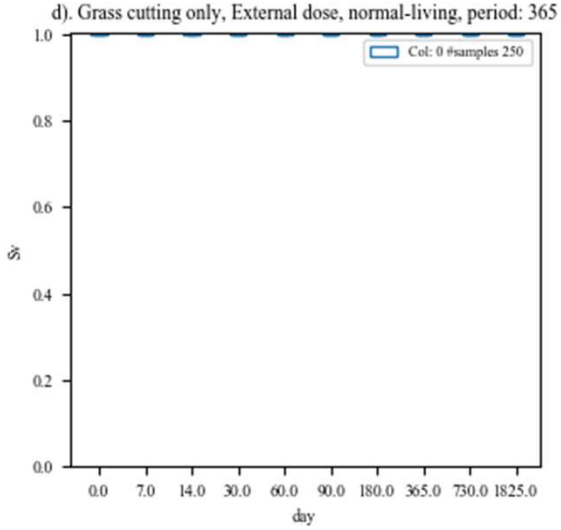
Dose reduction factors (Sv) for clean-up strategies (3, 4, 5, 2 - only grass cutting)









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Facilitated discussion questions

- Which criteria are important for which stakeholder groups
- How certain criteria impact the return of evacuated/relocated population or opposite – impact further extended evacuation/relocation
- How these criteria and their uncertainties could be taken into account in post accident decision making on decontamination and recovery management
- Objectives of the recovery/restoration plan: Which objective do we need to achieve?
- What are key criteria for selection of strategy?
- Choosing/prioritisation the strategy and taking into account the inherent uncertainties on:
  - the knowledge of the real consequences of an accident based on exercise scenario,
  - goal and criteria during the development of strategies on protective actions and their implementation
  - the strategies to be implemented, and
  - the potential socioeconomic impact on the affected population)

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