On the use of an ALARA Tool to Countering Nuclear or Radiological Terrorism

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Outline of this talk

- Introduction
- The TMT project
- The ALARA tool used in TMT
- Case scenarios
- Results
- Conclusions

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Introduction

- European national emergency response plans have long been focused on accidents at nuclear power plants.
- The evolution of nuclear emergency planning has led to the refinement of response plans away from fixed nuclear sites, such as the accidents involving the transport of radioactive material.

Cont'd

- More recently, the possible threats by disaffected groups have shifted the focus to being prepared for malevolent use of ionizing radiation that are aimed at creating disruption and panic in the society.

Cont'd

- In order to provide practical guidance for responders in the event of the malevolent use of ionizing radiation, a program of work developed the Triage, Monitoring and Treatment Handbook (TMT Handbook)

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Cont'd

- In a new application, this work reports on – without entering into details – the usage of an ALARA tool, such as Visiplan

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Cont'd

- The ALARA tool developed to estimate dose to workers has been, in this case, used to estimate the possible consequences of an act of terrorism involving ionizing radiation, such a radiation exposure device, both in terms of received dose and number of affected people.

TMT Handbook

- TMT Handbook was a special targeted research project of the 6th Euratom Framework Program of the European Commission, that had as a primary objective the development of practical guidelines on the Triage, Monitoring and Treatment of the public exposed to the malevolent use of radiation.

- The “malicious” event is one that is relatively new to our consciousness and therefore there is relatively little established guidance available specific to this situation. Whilst there are numerous overlaps with accidental situations in terms of the public protection a number of specific issues need to be considered,

- How do you ensure the effective triage of members of the public exposed to radiation or radioactive materials?
- What are the best means of monitoring members of the public, what strategies are adopted at a national level and what resources are available?
- Which treatment options are available and offer the most effective response?

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- One of the first tasks in the development of the handbook was to analyze a number of potential scenarios which would result in a number of people being exposed to ionizing radiation.

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- One of these scenarios was analyzed both qualitatively and quantitatively using the software package Visiplan

Visiplan

- Visiplan is a planning tool used to estimate the dose to workers in the nuclear industry.
- It was developed at the SCK•CEN during the decommissioning of the BR3 reactor.

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Cont'd

Within the ALARA philosophy optimization is very important, taking account of the following factors that will determine the dose:

- The given geometry
- The source distribution and strength
- The shielding if any
- The working conditions

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All this makes of VISIPLAN the ideal tool for the purposes of the TMT Handbook project

The RED Scenario

The radiation exposure device scenario consisted of a hidden radioactive source is left in a public place with the purpose of irradiating as many people as possible. In this case, we have chosen a subway as a public place and the source is supposedly to be ^{60}Co. Here, ^{60}Co is a gamma emitter with a main energy of 1173 and 1332 keV.

RED Cont'd

We analyzed two cases:

a) the source is left inside the car;

b) the source is left on the platform at a given station

Two RED possibilities

The source is hidden inside the subway car

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The source is left hidden on the platform at the station

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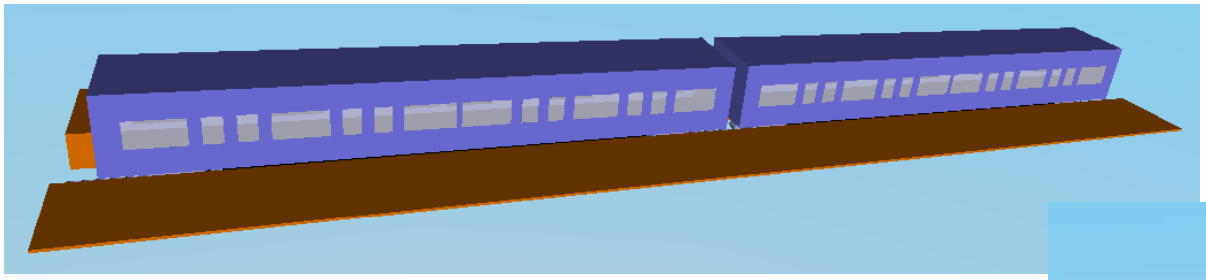
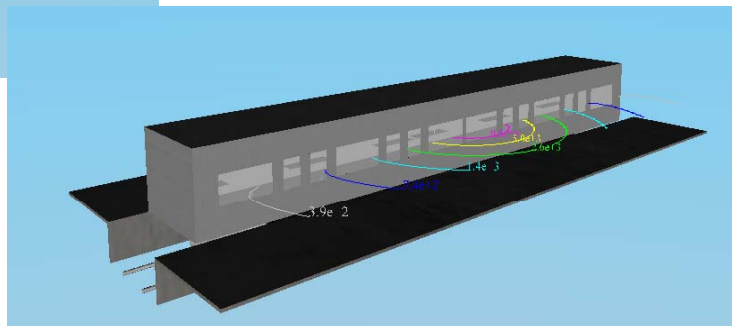
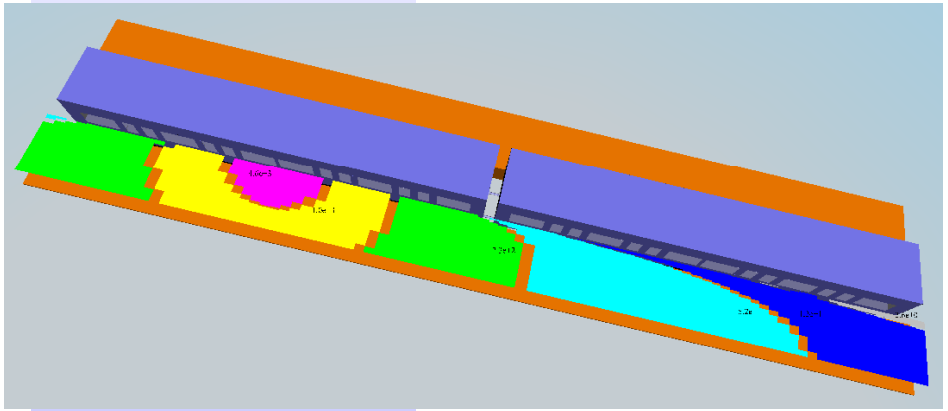
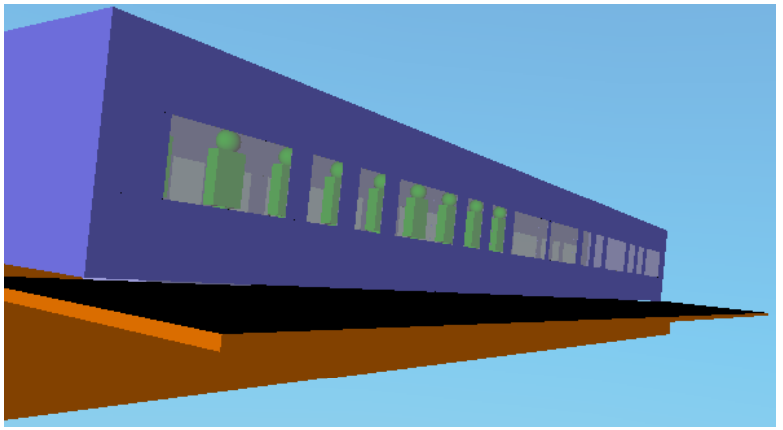
Modelisation



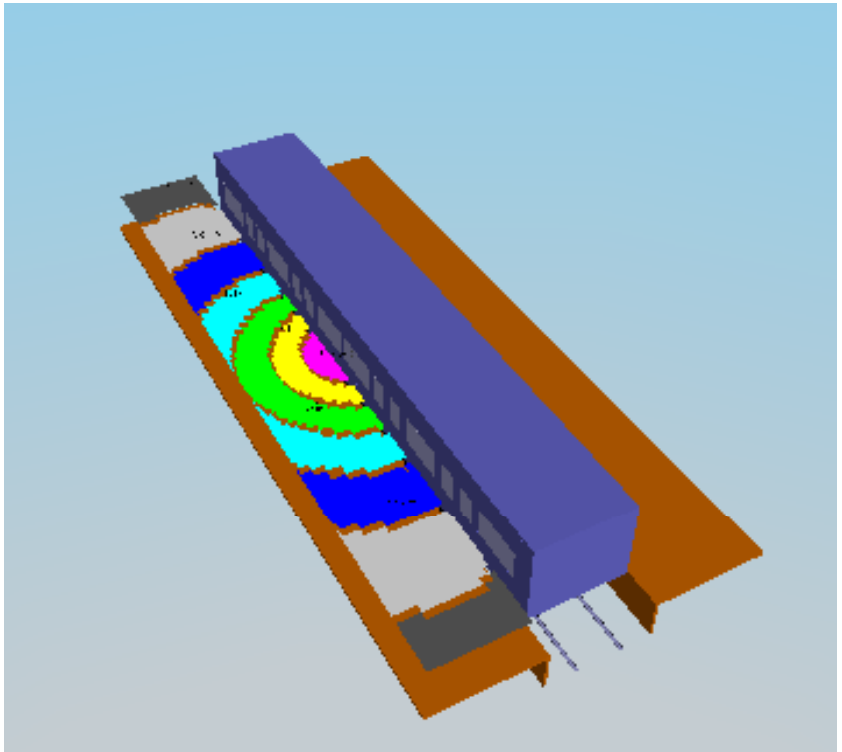




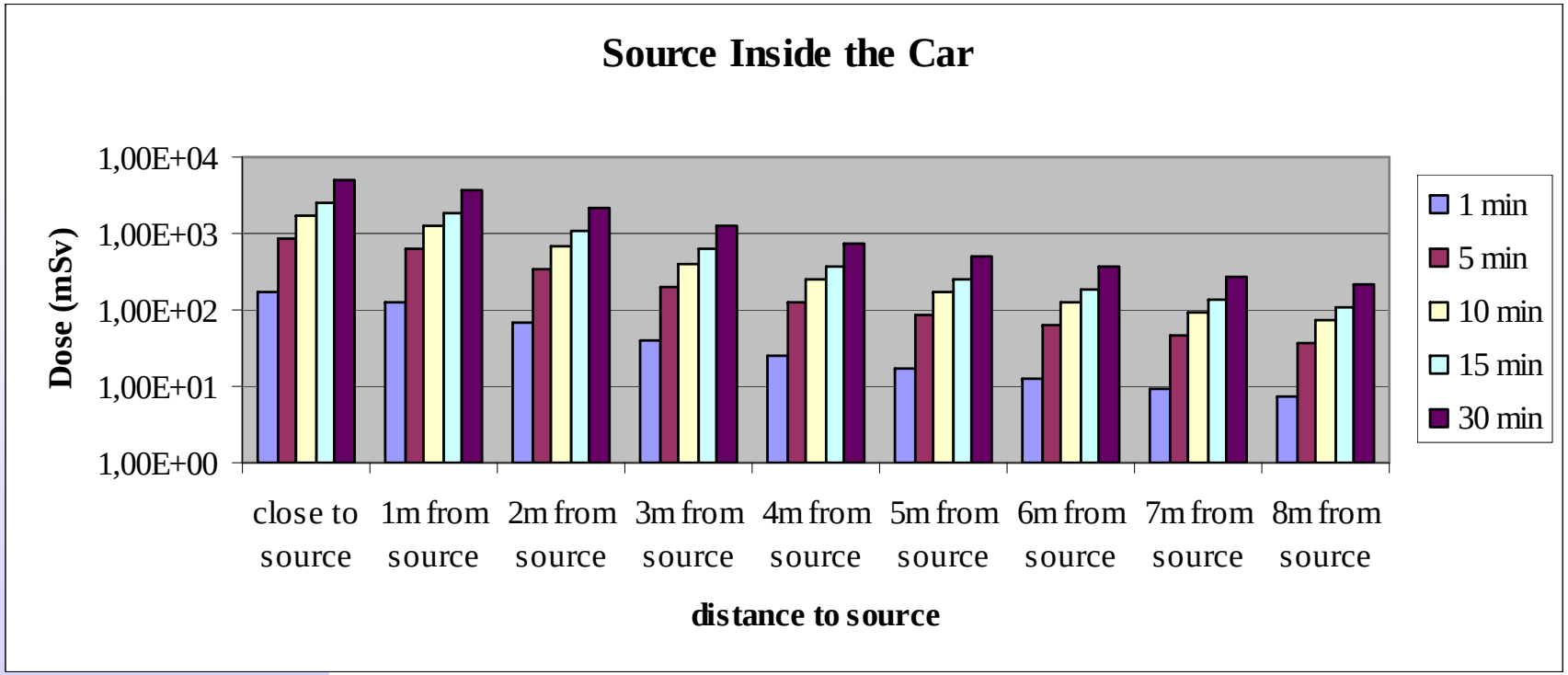


Results

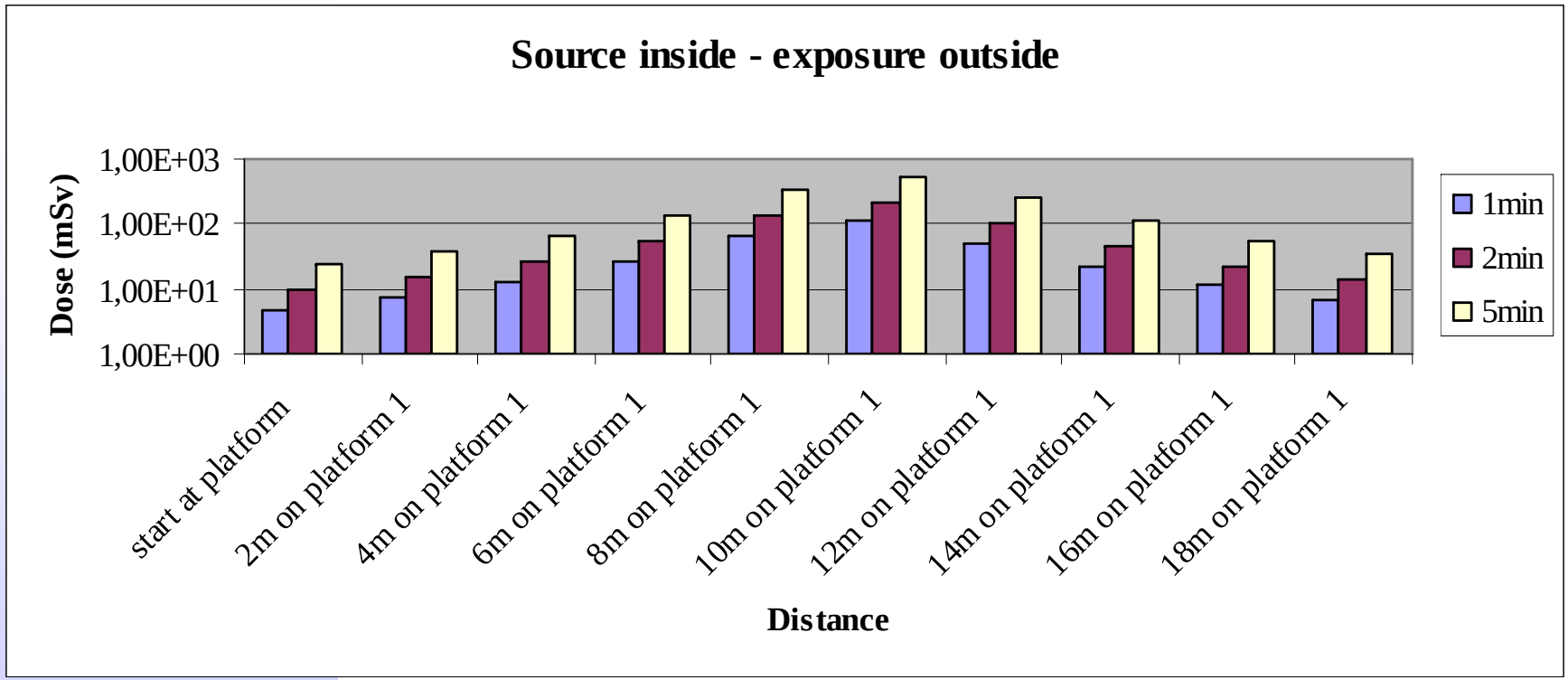
- Gamma radiation pattern observed at a height of 1.2 m on the platform when the source is placed on the train



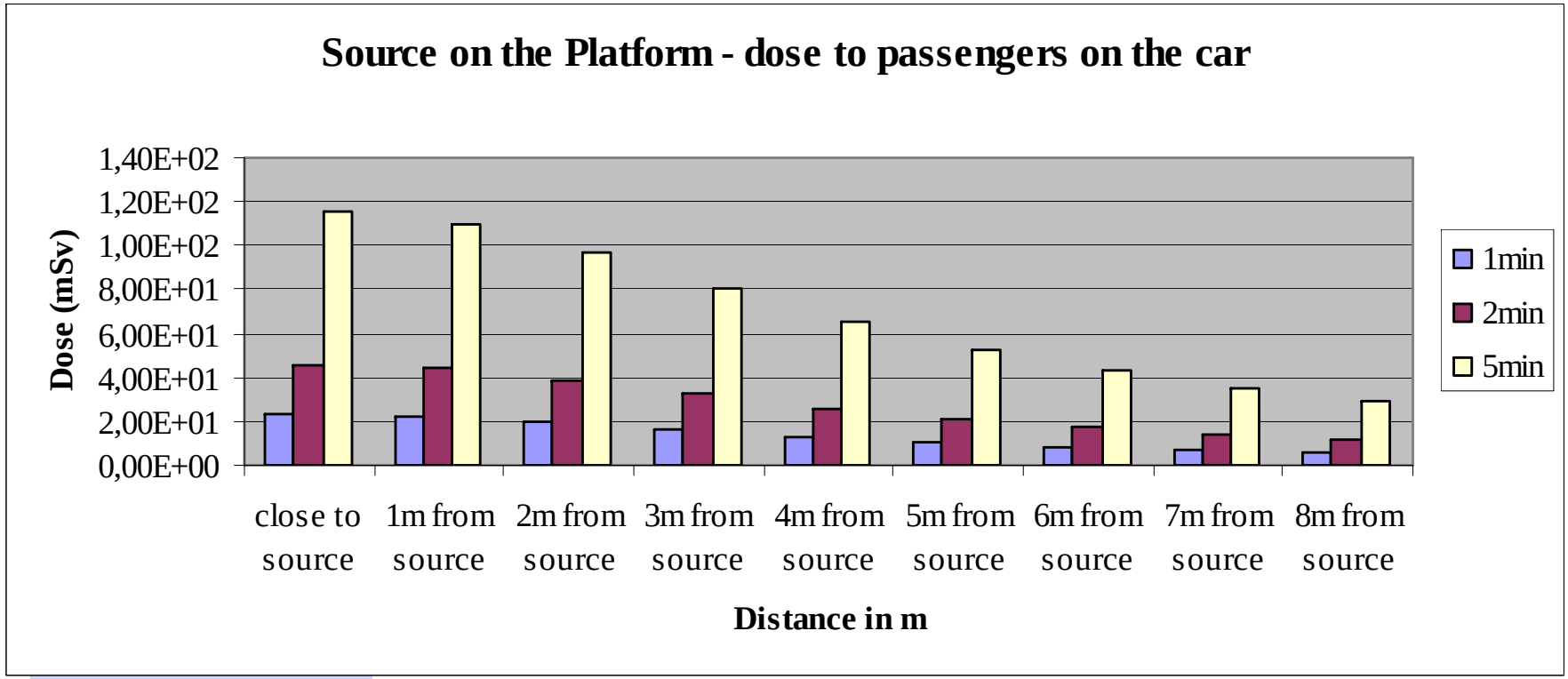
Dose to people on the train as function of distance and exposure time



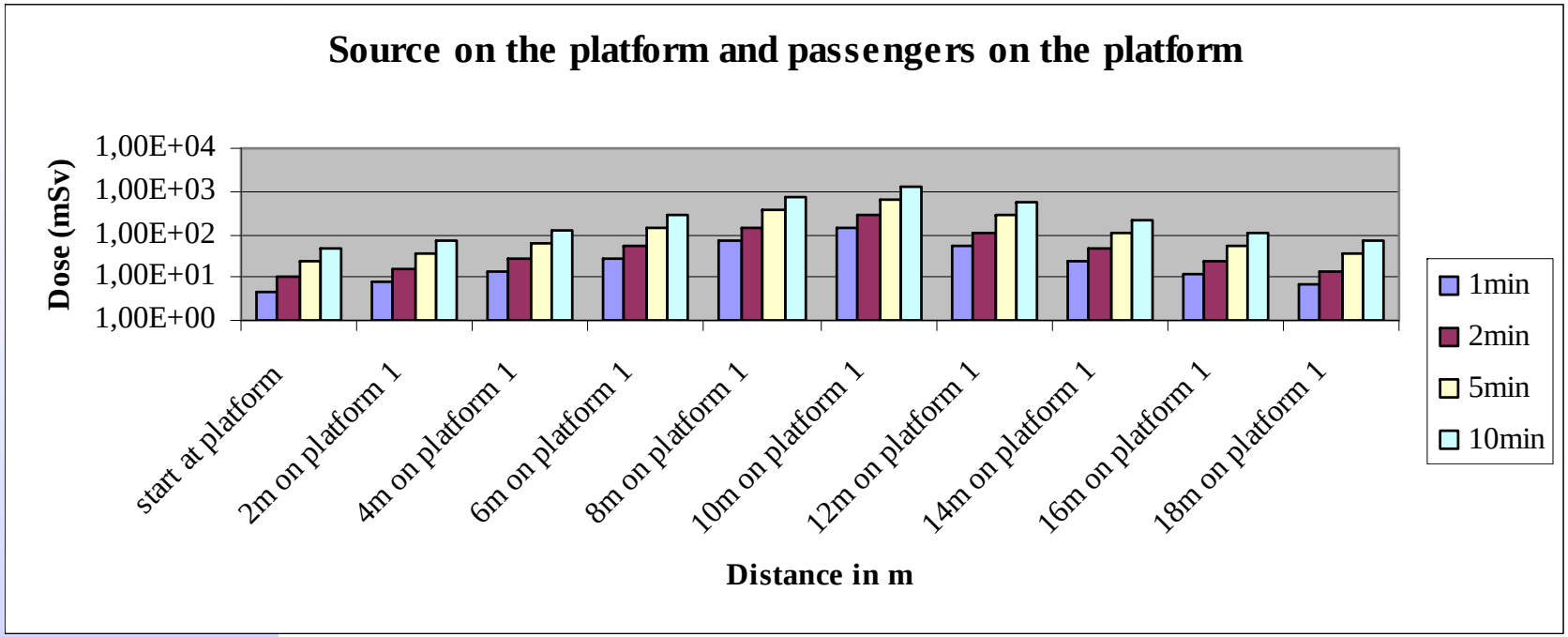
Dose to people on the platform, when source is on the train as a function of distance and exposure time



Dose to people on the train when source is hidden on the platform



Here both source and passengers are on the platform



Concluding remarks

Results of these VISIPLAN calculations were not only used for a consequence analysis of the RED scenario, but have also been used to establish a table-top exercise based on realistic assumptions and consequences, both with respect to the radiological and medical emergency response.

Cont'd

- Visiplan has proven to be a valuable and straightforward tool for estimating the possible consequences of a radiation exposure device in a scenario whereby the malevolent use of radiation will cause mass casualties and will also require trained personnel to treat and follow up the victims.

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- The results of this research provided the TMT Handbook project with valuable information on the potential number of casualties exhibiting acute radiation syndrome, signs of overexposure to ionizing radiation and on the type of treatment they would require.

Acknowledgements

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