

NERIS Research Priorities

**Antony Bexon (UKHSA)
on behalf of NERIS R&D Committee**

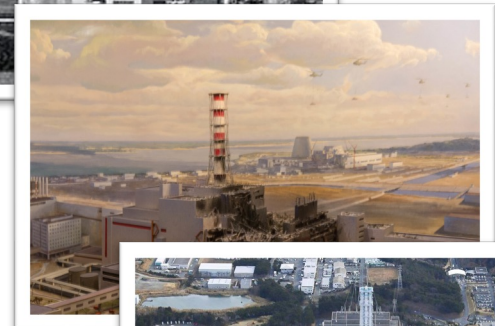
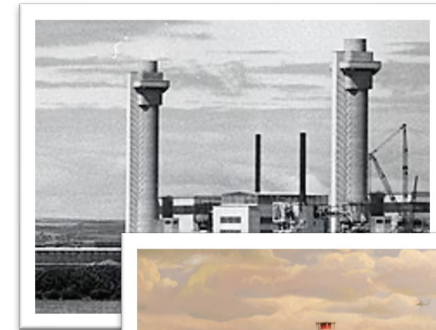
NERIS Workshop - 9th October 2023

Overview

- ▶ **Importance of research for EPR&R**
- ▶ **NERIS R&D Committee**
- ▶ **Strategic Research Agenda**
- ▶ **Roadmap development**
- ▶ **Research challenges**

Role of research in EPR&R

- ▶ **Emergency preparedness, response and recovery is a complex and evolving field:**
 - Learning from past events
 - Adapting to new technologies and threats
 - Requires involvement of many interested parties
- ▶ **NERIS helps to co-ordinate research across these areas**
- ▶ **Bringing together research, policy and practice across authorities, emergency centres, research organisations and academia among others**
- ▶ **Integral role of NERIS is identification of gaps and needs for further research and development in EPR&R**
- ▶ **Prioritisation of research challenges**
- ▶ **NERIS R&D Committee – 15 members, 12 organisations across 10 countries**

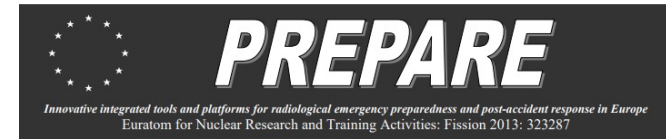


NERIS interests and involvement in research

▶ **NERIS-TP – 2011-2014**



▶ **PREPARE – 2013-2016**



▶ **OPERRA – 2013-2017**

- *CATHyMara; HARMONE; SHAMISEN*



▶ **CONCERT – 2015-2020**

- *CONFIDENCE; TERRITORIES; ENGAGE; SHAMISEN SINGS*



Strategic Research Agenda

- ▶ **Key mission of NERIS to identify gaps and needs for further research and development by addressing new and emerging challenges in the field of EPR&R**
- ▶ **SRA is coordinated by the NERIS R&D Committee**
 - Formal development began in 2011
 - Continuous development accounting for results of research projects, lessons learnt from the Fukushima accident, ongoing research activities
- ▶ **The fourth update and current version of the SRA was released in November 2019**
This version includes:
 - considerations resulting from a gap analysis
 - results and insights gained in European projects
 - feedback from various stakeholder panels carried out within CONCERT



Strategic Research Agenda – Research areas and key topics

▶ **SRA identifies 3 research areas of interest to NERIS:**

- Research area 1. Challenges in radiological impact assessment during all phases of nuclear and radiological events
- Research area 2. Challenges in countermeasures and countermeasure strategies in emergency & recovery, decision support & disaster informatics
- Research area 3. Challenges in setting-up a trans-disciplinary and inclusive framework for preparedness for emergency response and recovery

▶ **For each research area, key topics were defined. For example, for area 3:**

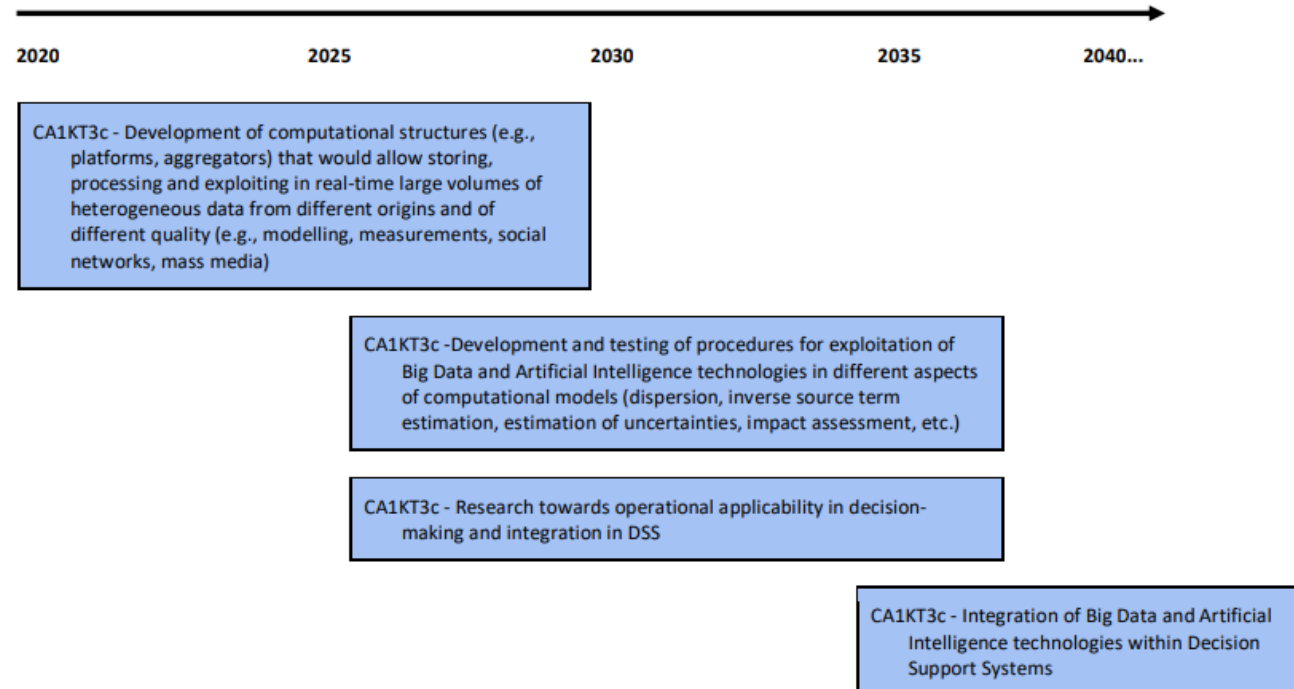
- Key topic 7. Emergency response and recovery framework, including reference levels
- Key topic 8. Stakeholder engagement, involvement of the public & communication
- Key topic 9. Integrated emergency management – non-radiological aspects (health surveillance, ethical aspects, economic issues, etc.)
- Key topic 10. Uncertainty and incomplete information handling

NERIS roadmap

- ▶ **Joint Roadmap developed across European RP research platforms (MEENAS)**
- ▶ **As part of the CONCERT project, NERIS roadmap was published in May 2020**
- ▶ **Took SRA as a basis and set out vision and phases of development for the key topics within each challenge area**

KT3c - Big Data, Data fusion, Artificial Intelligence

VISION: Advanced tools for improved decision-making exploiting Big Data and Artificial Intelligence technologies within Decision Support Systems (in connection to Challenge Area 2).



Links with the MEENAS joint roadmap 'game changers'

- ▶ **Joint roadmap (Impens et al, 2019) identified 8 joint challenges with 20 priority issues referred to as 'game changers'**
- ▶ **Game changer defined as research question that has potential to significantly impact and strengthen the system and/or practice of radiation protection for humans and/or the environment through:**
 - (1) significant improvement of the evidence base
 - (2) development of principles and recommendations
 - (3) development of standards based on the recommendations, and
 - (4) improvement of practices
- ▶ **Crosscutting analysis of both roadmaps identifies NERIS topical research priorities in context of challenges and innovative changes identified in the Joint Roadmap:**
 - Change of radiological impact assessments, decision support and response and recovery strategy through Artificial Intelligence and Big Data (G1);
 - Further development of risk assessment and risk management approaches and technological capabilities to cope with novel threats and accident scenarios arising from new and future nuclear and radiological technologies (G2).



Current challenges and further research proposals

- ▶ **Updating of the NERIS SRA and roadmap is an ongoing activity.**
- ▶ **In 2022, the war in Ukraine triggered a new round of revision which identified new or revised challenges for NERIS.**
- ▶ **NERIS R&D Committee and Management Board identified 4 topics endorsed by the General Assembly:**
 - Optimisation of management strategies for the transition and recovery phase – eg for novel threats, war conditions, use of big data and AI
 - Uncertainty quantification, data assimilation and monitoring strategies – eg aim towards *a priori* knowledge of uncertainties, use of new techniques such as UAVs to improve and optimize monitoring strategies
 - Inverse modelling – eg to localize and quantify unknown sources of detected atmospheric radioactive material including threat situations such as armed conflict in the vicinity of nuclear power plants when normal communication methods may be disrupted
 - Lessons identified from Ukraine and implications for emergency preparedness – eg consideration of risk assessment and risk management approaches which were not necessarily designed with war or armed conflict in mind; citizen communications and behaviours

▶ **Article published in Radioprotection journal - September 2023:**

- Open Access
- Bexon A, Andronopoulos S, Croüail P, Montero Prieto M, Oughton D, Raskob W, Turcanu C. 2023. The NERIS roadmap: research challenges in emergency preparedness, response and recovery. Radioprotection 58(3): 169–180
- DOI <https://doi.org/10.1051/radiopro/2023019>

Radioprotection 2023, 58(3), 169–180
 © The Authors, published by EDP Sciences 2023
<https://doi.org/10.1051/radiopro/2023019>



Available online at:
www.radioprotection.org

ARTICLE OPEN ACCESS

The NERIS roadmap: research challenges in emergency preparedness, response and recovery

A. Bexon¹, S. Andronopoulos², P. Croüail^{3,4}, M. Montero Prieto⁵, D. Oughton⁶, W. Raskob⁷, C. Turcanu⁷ and on behalf of the NERIS platform R&D committee

¹ UK Health Security Agency (UKHSA), London, United Kingdom.
² National Centre for Scientific Research "Demokritos" (NCSR/D), Athens, Greece.
³ Nuclear Protection Evaluation Centre (CEPN), Fontenay-aux-Roses, France.
⁴ Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT), Madrid, Spain.
⁵ Norwegian University of Life Sciences (NMBU), Oslo, Norway.
⁶ Karlsruher Institut für Technologie (KIT), Karlsruhe, Germany.
⁷ Belgian Nuclear Research Centre (SCK CEN), Mol, Belgium.

Received: 12 April 2023 / Accepted: 22 May 2023

Abstract – NERIS as a European Platform on Preparedness for Nuclear and Radiological Emergency Response and Recovery (EPR&R) has developed a roadmap setting out the key research challenges for radiation emergency preparedness, response and recovery. Research projects in this field have been summarised to demonstrate how important areas of development have been identified and addressed. Radiation EPR&R has a continuous need to evolve to meet societal demands, but also to keep pace with scientific and technological developments and opportunities and so the NERIS research priorities as published in the Strategic Research Agenda (SRA) are kept under review. Three challenge areas have been identified covering the topics of radiological impact assessment, protective action strategies and establishing a transdisciplinary and inclusive framework for emergency preparedness, response and recovery. The importance of these challenge areas and the underlying key topics for NERIS have been mapped across to the Joint Radiation Protection Roadmap developed by the consortium of European radiation research platforms known as MEENAS. The war in Ukraine triggered a new round of revision of the SRA that resulted in the identification of four topics as new or revised challenges for the NERIS community. These updated challenges are: (1) optimisation of management strategies for the transition and recovery phase, (2) uncertainty quantification, data assimilation and monitoring strategies, (3) inverse modelling, and (4) lessons identified from Ukraine and implications for emergency preparedness. These four areas will form the priority research areas for the NERIS community to help advance radiation emergency preparedness to meet current challenges and needs that have been identified.

Keywords: emergency planning / accident, management / accident, nuclear / radiation protection / recovery

1 Introduction

Emergency preparedness, response and recovery (EPR&R) related to nuclear or radiological accidents and incidents is a continuously evolving research and innovation field (Bertho *et al.*, 2022; Bourguignon, 2022). To address the complexity of emergency and recovery situations, there is a need to:

- establish robust, transparent and inclusive decision-making processes addressing the different phases of an accident, from early response to the long-term recovery phase and the needs of the different stakeholders;
- assess the consequences of the accident and the efficiency of potential protective actions;
- elaborate strategies to protect people and the environment;
- assess and address the related ethical, economic, social and environmental challenges.

To coordinate research in these areas, and facilitate multi-stakeholder exchanges regarding trends, arrangements and capabilities, the European Platform on Preparedness for Nuclear and Radiological Emergency Response and Recovery (NERIS) was established in 2010. NERIS brings together a wide community of research, policy and practice in the field of EPR&R, including authorities, emergency centres, research

*Corresponding author: pascal.crouail@cepn.asso.fr

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<https://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Conclusions

- ▶ **Strategic Research Agenda**
- ▶ **Roadmap development**
- ▶ **Research challenges**
- ▶ **Ideas for new research challenges are welcomed!**
- ▶ **Contact R&D committee via: sec@eu-neris.net**