GAP ANALYSIS NERIS

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The following document provides proposal for research activities based on a first GAP analysis on research activities proposed by the NERIS community and that were not fully visited via national or international research project.

Proposal for research activities based on the GAP analysis

▶ Improvement of hydrological models, including urban hydrology, surface run-off and marine environment

▶ Application of foodchain models at the local level to derive sensible countermeasure strategies

▶ Improvement of dose assessment models considering both environmental monitoring data and personal monitoring data (e.g. personal dosimeters, thyroid measurements, whole body measurements)

▶ Improved monitoring including lay people, drones and European wide harmonisation of tools and methods

▶ Methods and guidance to optimise countermeasure strategies: development of measuring strategies to guide practical countermeasure implementation

▶ Methods and guidance to optimise countermeasure strategies: how to implement/apply the residual dose approach, how to implement fully the guidance from ICRP in terms of simulation and guidance for decision maker

▶ Research on lifting of countermeasures by developing an integral approach with simulation models and Operational Intervention levels (OIL); improved OILs extending the IAEA approach

▶ Stakeholder engagement database, better analysis of societal needs for an evaluation of legal instruments and governance frameworks, methods and tools for stakeholder engagement

▶ "emergency ethics" vs. "normal ethics" to develop guidelines for evacuation and post-accident management, compensation schemes

▶ Development of health surveillance approaches, dose reconstruction methods, socio-psychological and economic aspects of medical follow-up

First NERIS GAP analysis

The analysis focuses on former EU projects such as EURANOS (2004 – 2009), DETECT (2009 – 2011), NERIS-TP (2011 – 2014), PREPARE (2013 – 2016), HARMONE as part of OPERRA (2015 – 2017), SHAMISEN as part of OPERRA (2015 – 2017) and CONFIDENCE, TERRITORRIES, and ENGAGE as part of CONCERT (2017 ongoing).

The following tables provide the key research areas and if work was performed so far in these projects. It is not exhaustive as most of the simulation models implemented in decision support systems (DSSs) require improvement in various areas.

Research area 1. Challenges in radiological impact assessment during all phases of nuclear and radiological events

Area 1. Key topics	Sub-topics	Work performed
Key topic 1. Improved modelling	Atmospheric transport and dispersion modelling (ATM/ADM)	PREPARE, HARMONE, CONFIDENCE **Missing**: (a) development, sensitivity analysis and incorporation in DSSs of modelling tools for particular source terms (e.g., explosions, two-phase releases, aerosol sprays, fires, etc.), and dispersion of particular forms of substances (e.g., aerosol, phase-changing, particles with spectrum of different size, chemical transformations, etc.), (b) development, evaluation and incorporation in DSSs of fast but accurate modelling tools for dispersion in built-up areas (e.g., urban, industrial sites, etc.) and within large buildings
	Hydrological transport modelling	EURANOS, PREPARE **Missing**: urban hydrology completely missing; Improvements in marine foodchain, run-off modelling, radionuclide behaviour in lakes (behaviour in laces of Fukushima difficult to understand) and long term transport in river networks
	Dose modelling	HARMONE: ERMIN **Missing**: Intercomparison of models for use in a DSS; dose assessment considering both environmental monitoring data and personal monitoring data (e.g. personal dosimeters, thyroid measurements, whole body measurements)
	Radioecological modelling	PREPARE, HARMONE, CONFIDENCE **Missing**: Development of process based models not only for Cs, better customisation approaches for operational application of model also for local conditions, local and national wide application in one model environment

Area 1. Key topics	Sub-topics	Work performed
Key topic 2. Improved monitoring	Monitoring techniques and strategy	DETECT **Missing**: Integrated monitoring strategies with simulation and resource management, international harmonisation
	Data collection	HARMONE **Missing**: Development of guidance for data collection also for lay people and how to integrate this into operational approaches
	Optimization	DETECT **Missing**: Research on new equipment such as drones for dose monitoring and environmental monitoring and LIDAR for optimal use by atmospheric dispersion models
Key topic 3. Data assimilation	Improved source term estimation	PREPARE, CONFIDENCE **Missing**: (a) Link of inverse with in-plant (e.g. FASTNET project) source term estimation methodologies, (b), Further evaluation and improvement of operational aspects of source term reconstruction methods in DSSs, (c) development, evaluation and incorporation in DSSs of inverse methods for estimation of unknown radioactive substances source location (d) methodological research in mathematical procedures, data assimilation techniques and computer methods for complex matrices
	Improved impact assessment	CONFIDENCE **Missing**: Only started in CONFIDENCE and this will address only the basic principles for this related to key uncertainties
	Big Data, Data fusion	PREPARE **Missing**: Methods and tools to analyse the huge amount of calculations performed for preparedness in terms of usability in a real event. First attempt was done with the Analytical Platform, but potential is much bigger

Research Area 2. Challenges in countermeasures and countermeasure strategies in emergency & recovery, decision support & disaster informatics

Area 2. Key topics	Sub-topics	Work performed
Key topic 4. Countermeasures and countermeasure strategies	Countermeasures/management options	EURANOS, NERIS-TP, PREPARE, HARMONE **Missing**: Methods and guidance to develop countermeasure strategies well in advance and for all levels (local to national and international)
	Development of protection strategies or portfolios	**Missing**: Methods and tools for the local level
	Implementation and monitoring of countermeasures, including lifting of	EURANOS, NERIS-TP, SHAMISEN **Missing**: Methods and approaches for lifting of countermeasures, how to monitor the success of a strategy, compensation schemes, how to define OILs (besides the IAEA definition) and how to use them
	Consequence assessment and optimisation of countermeasure strategies	EURANOS, NERIS-TP, PREPARE, HARMONE **Missing**: Methods and guidance to optimise countermeasure strategies, how to implement/apply the residual dose approach, how to implement fully the guidance from ICRP in terms of simulation and guidance for decision maker
Key topic 5. Formal decision support	Robust decision making, including multi-criteria analyses	EURANOS, CONFIDENCE **Missing**: only first attempt in CONFIDENCE for paving the road
	Decisions under high uncertainty	CONFIDENCE **Missing**: only first attempt in CONFIDENCE, in particular which approaches are applicable under high uncertainty
	Methods and tools to support decisions	CONFIDENCE **Missing**: developing suitable tools besides MCDA in the nuclear area, decision making in a group with group performance implications
Key topic 6. Disaster informatics	Analytical platform	PREPARE **Missing**: explore operational value and potential end user, combine with natural disasters
	Knowledge database	NERIS-TP, PREPARE, ENGAGE **Missing**: expand to improved database using the assessments performed for preparedness, combine with big data analysis and extent accordingly to the other exposure situations (medical, post-accident, indoor radon, etc.)
	DSS interface, output and coupling	EURANOS, NERIS-TP, PREPARE **Missing**: coupling with Command and Control (C2) systems for tactical decision making, perform research on the usability of existing DSS, tailor to users need
	Virtual and augmented reality	**Missing**: Development of serious gaming tools to train the emergency actors

Research area 3. Challenges in setting-up a multi-faceted framework for preparedness for emergency response & recovery (with input from all perspectives)

Area 3. Key topics	Sub-topics	Work performed
Key topic 7. Emergency response and recovery framework, including reference levels	Assessment and understanding of risk and vulnerabilities	**Missing**: Vulnerability and risk assessment as starting point for strategy development beyond simple dose or contamination criteria
	Criteria, factors and considerations for protection strategy recommendations and decisions	**Missing**: Add human, societal and ethical factors to the decision making process in preparedness and response (e.g. critical groups)
	Managing the transition to recovery	**Missing**: development of criteria and procedures to lift countermeasures and prepare for the recovery phase, explore the need to change the political framework to properly address the recovery process (e.g. are legal and political structures appropriate to deal with a nuclear disaster?
	Operational issues (resources, capabilities and best practices)	**Missing**: how to use ICRP recommendations beyond the numbers – which is also problematic, optimisation and methods to apply
Key topic 8. Stakeholder engagement, involvement of the public & communication	Stakeholder and public engagement processes	EURANOS, NERIS-TP, PREPARE, CONFIDENCE, TERRITORRIES, ENGAGE **Missing**: Stakeholder engagement database, better analysis of societal needs for an evaluation of legal instruments and governance frameworks, methods and tools for stakeholder engagement
	Citizens Science	ENGAGE **Missing**: how to engage citizens to produce science
	Communication	PREPARE, CONFIDENCE, ENGAGE **Missing**: Role of social media in communication, long-term communication approaches, improved radiation protection culture
Key topic 9. Integrated emergency management – non-radiological aspects (health surveillance, ethical aspects, economic issues, …)	Health Surveillance	SHAMISEN **Missing**: Better health surveillance approaches, dose reconstruction methods, socio-psychological and economic aspects of medical follow-up
	Ethical aspects	**Missing**: "emergency ethics" vs. "normal ethics" to develop guidelines for evacuation and post-accident management, compensation schemes
	Socio-economic factors	PREPARE **Missing**: Methods to better define conditions for social trust, combination of psychological science and RP
	Radiation protection culture for emergency preparedness and post-accident management	ENGAGE **Missing**: Development of tools, methods, processes to build, maintain and transmit RP culture
Key topic 10. Uncertainty and incomplete information handling	Decisions under high uncertainty	CONFIDENCE, TERRITORRIES CONFIDENCE, TERRITORRIES perform research on that topic but are only starting point, so future

Area 3. Key topics	Sub-topics	Work performed
		research can be defined when both projects are completed
	Communication of uncertainties	CONFIDENCE, TERRITORRIES CONIDENCE, TERRITORRIES perform research on that topic but are only starting point, so future research can be defined when both projects are completed