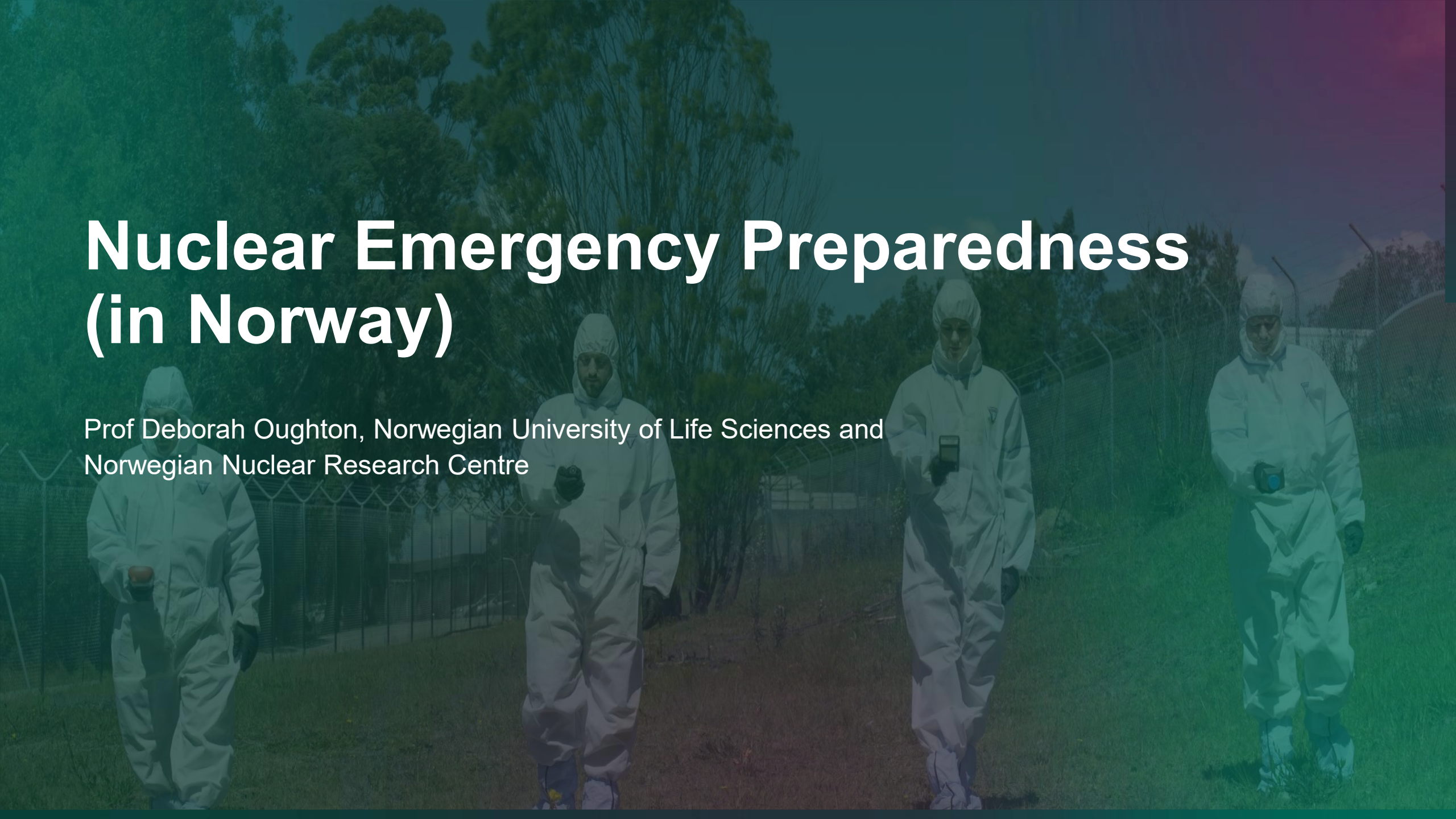
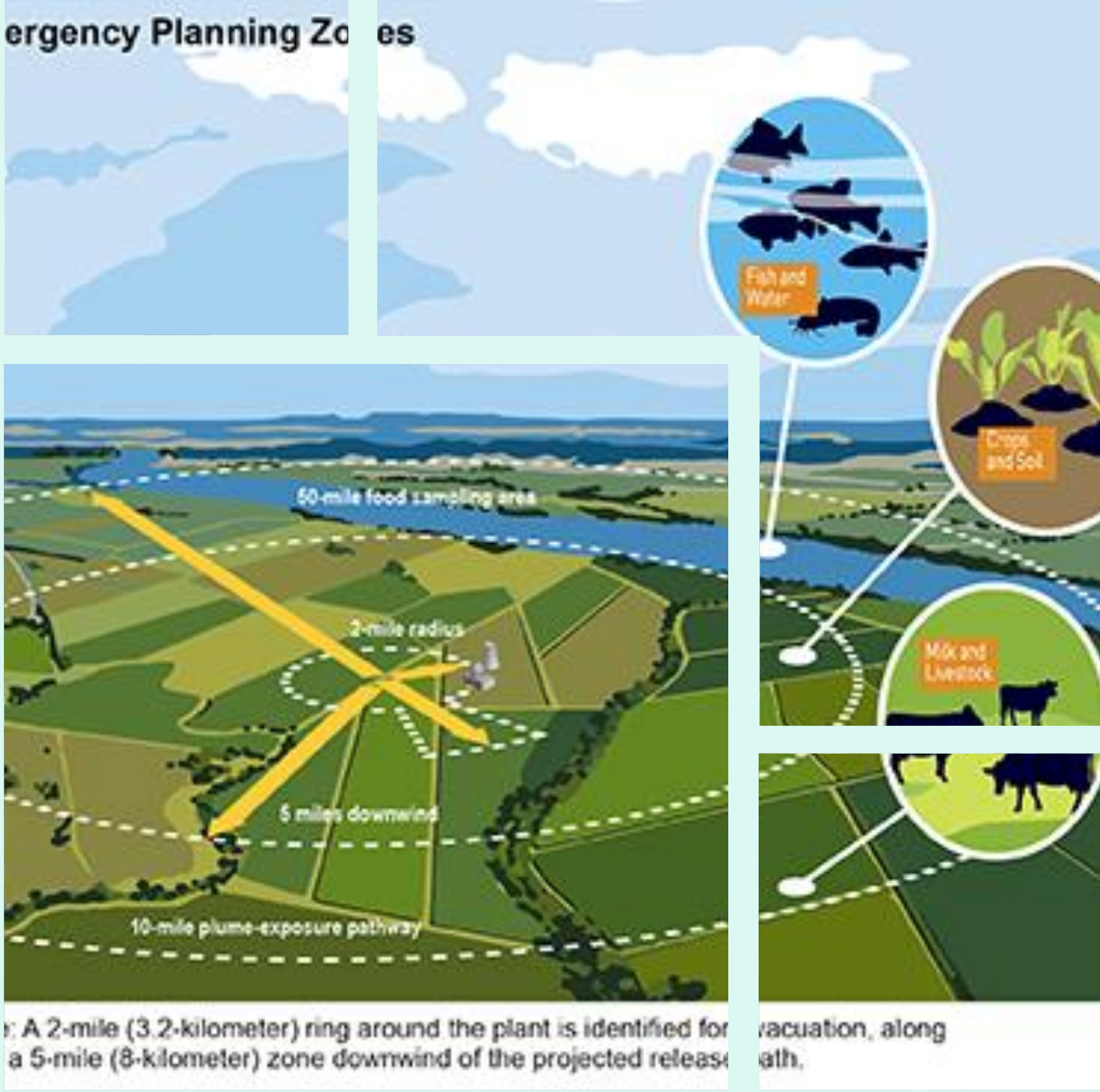


Nuclear Emergency Preparedness (in Norway)

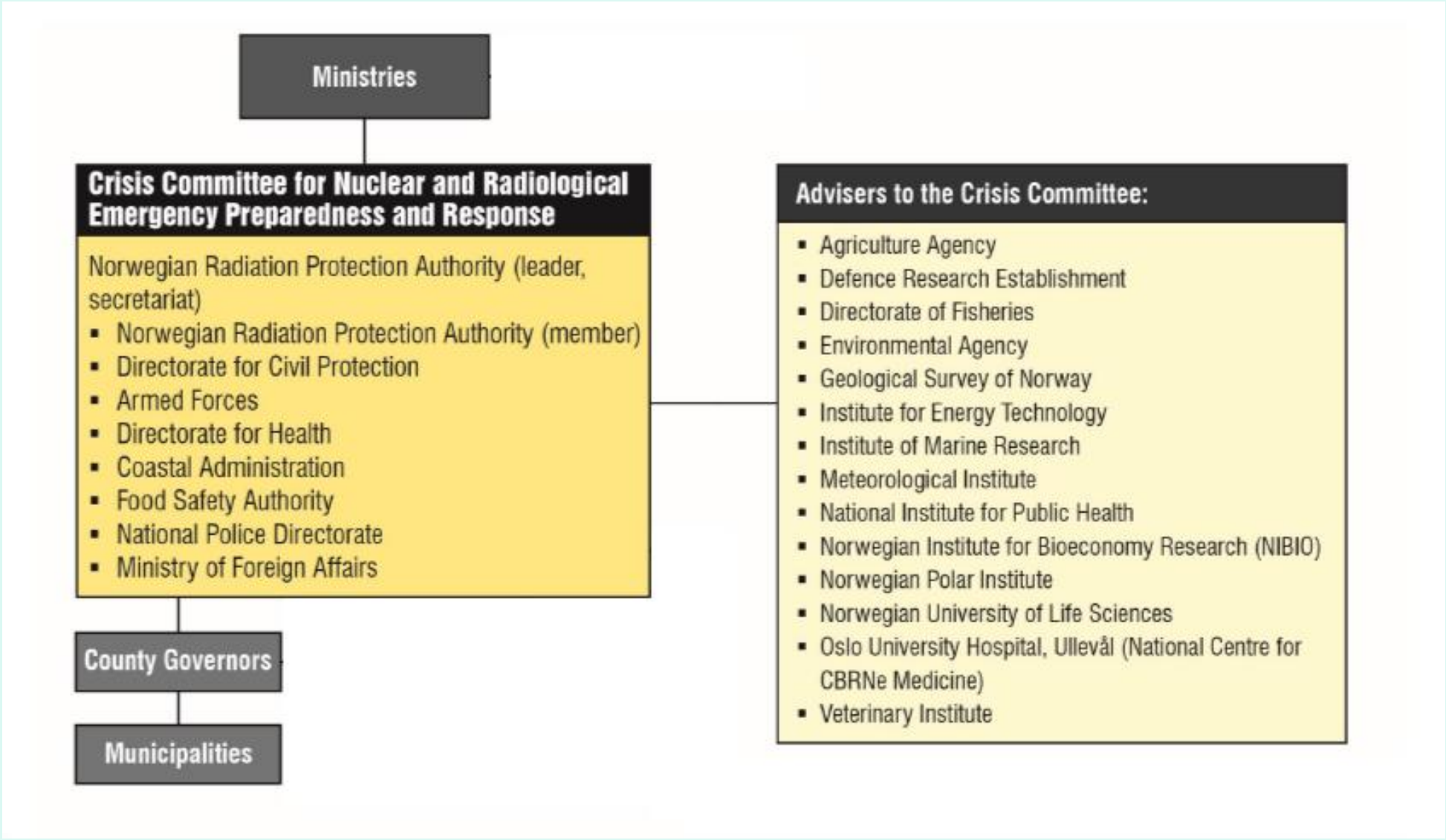
Prof Deborah Oughton, Norwegian University of Life Sciences and
Norwegian Nuclear Research Centre

Overview

- Nuclear Emergency Preparedness in Norway
- Key Components of Emergency Preparedness
- Some current challenges



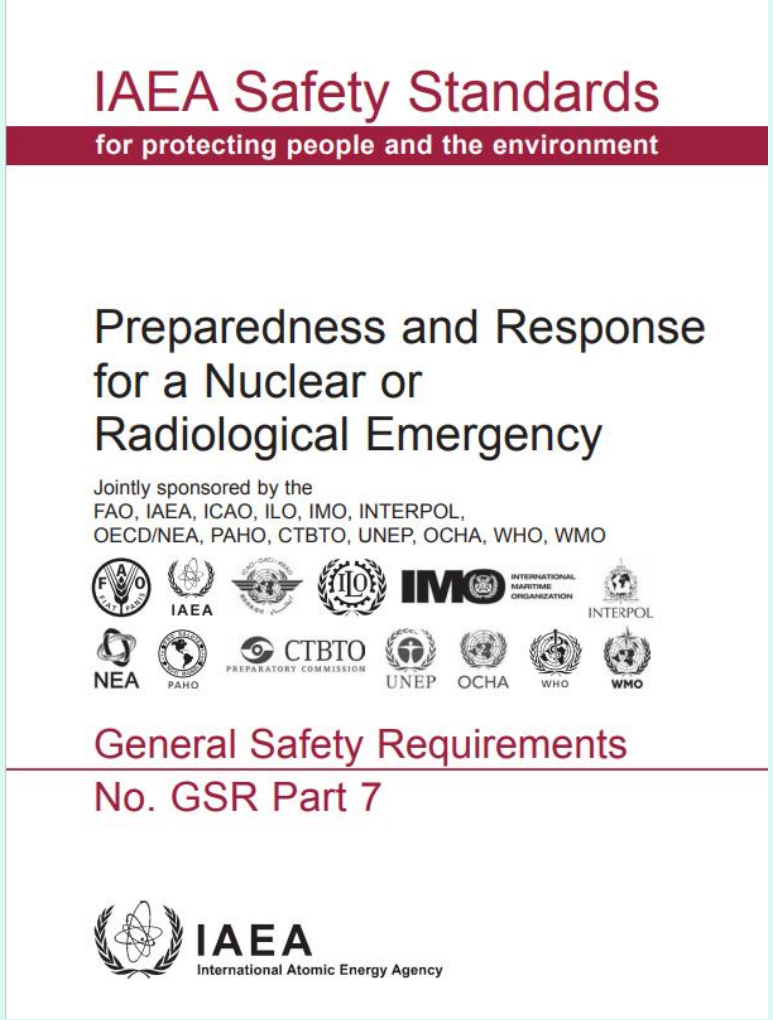
Norway's nuclear (and radiological) emergency preparedness and response organization



GOALS OF EMERGENCY PREPAREDNESS AND RESPONSE

GOAL OF EMERGENCY PREPAREDNESS

- To ensure that an adequate capability is in place within the operating organization and at local, regional and national levels and, where appropriate, at the international level, for an effective response in a nuclear or radiological emergency.



GOALS OF EMERGENCY PREPAREDNESS AND RESPONSE

GOALS OF EMERGENCY RESPONSE

(a) To regain control of the situation and to mitigate consequences

(b) To save lives;

(c) To avoid or to minimize severe deterministic effects;

(d) To render first aid, to provide critical medical treatment and to manage the treatment of radiation injuries;

(e) To reduce the risk of stochastic effects;

(f) To keep the public informed and to maintain public trust;

(g) To mitigate, to the extent practicable, non-radiological consequences;

(h) To protect, to the extent practicable, property and the environment;

(i) To prepare, to the extent practicable, for the resumption of normal social and economic activity

Planning scenarios for radiological and nuclear emergency preparedness and response

Scenario 1:
Large airborne release from another country

Scenario 2:
Airborne release from a facility in Norway

Scenario 3:
Local event from a mobile source

Scenario 7:
Use of nuclear weapon in or close to Norway

Scenario 4:
Local event evolving over time

Scenario 5:
Marine release, and/or fear of contamination

Scenario 6:
Severe events abroad without direct consequences for Norwegian territory

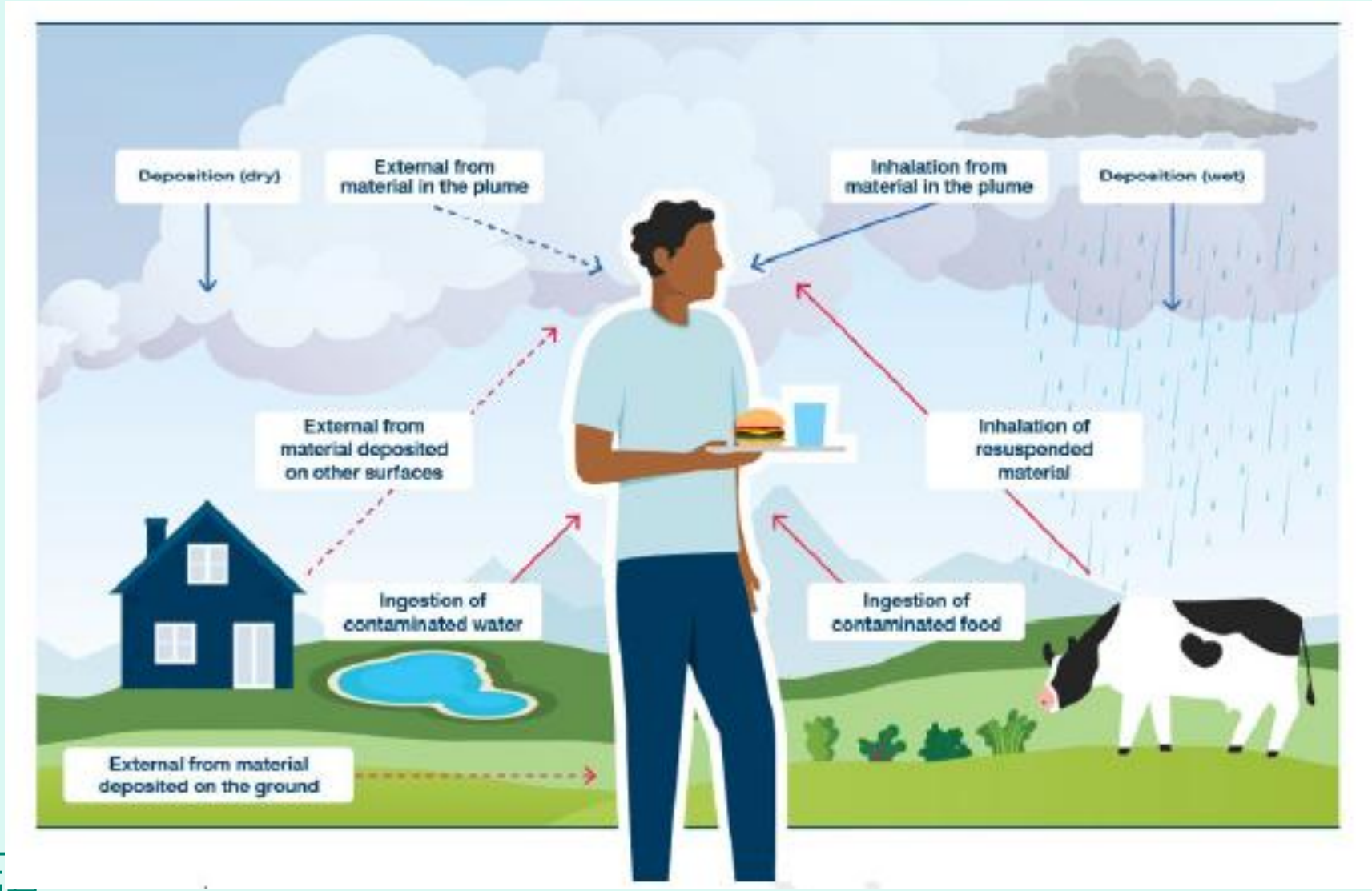
Source characterisation

Disperion modelling

Dose assessment

Environmental Impact

Exposure Pathways – how best to protect?



<u>Early</u>

Inhalation

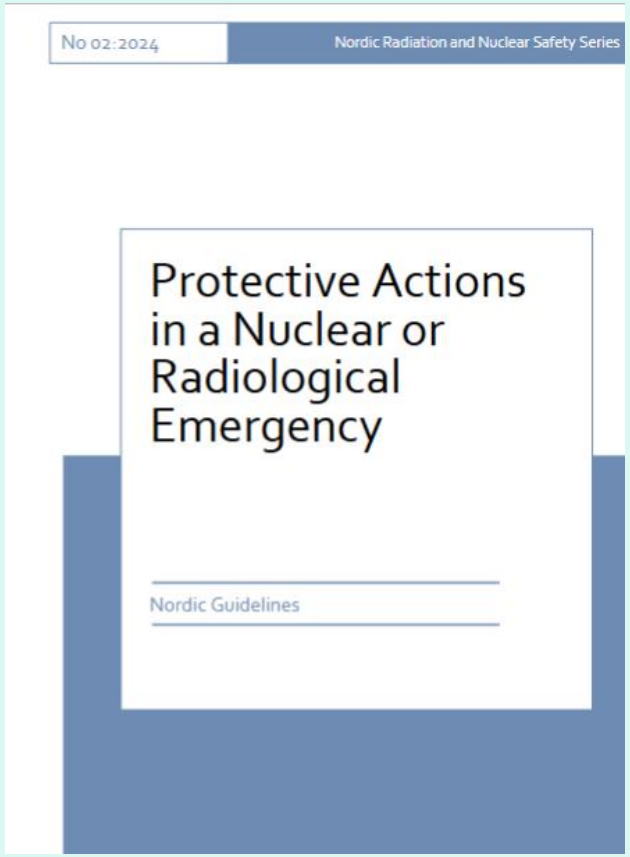
External irradiation

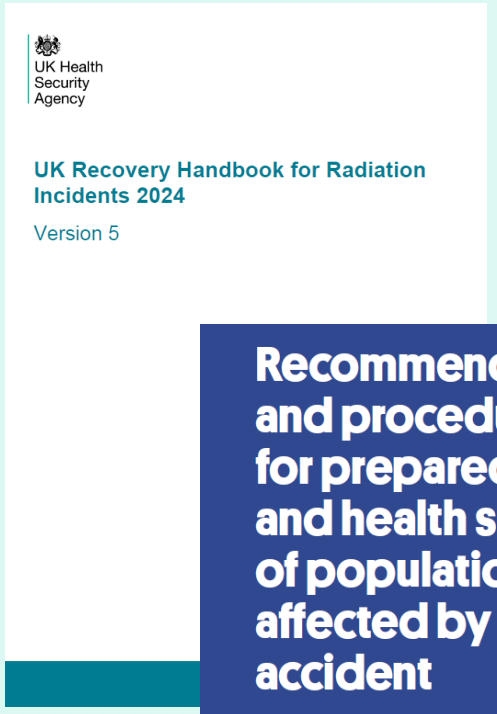
<u>Late</u>

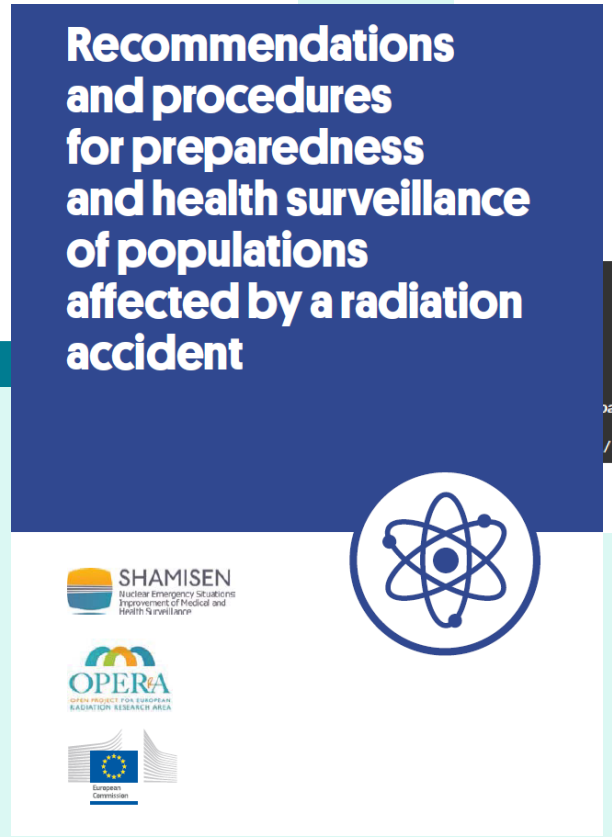
Food ingestion

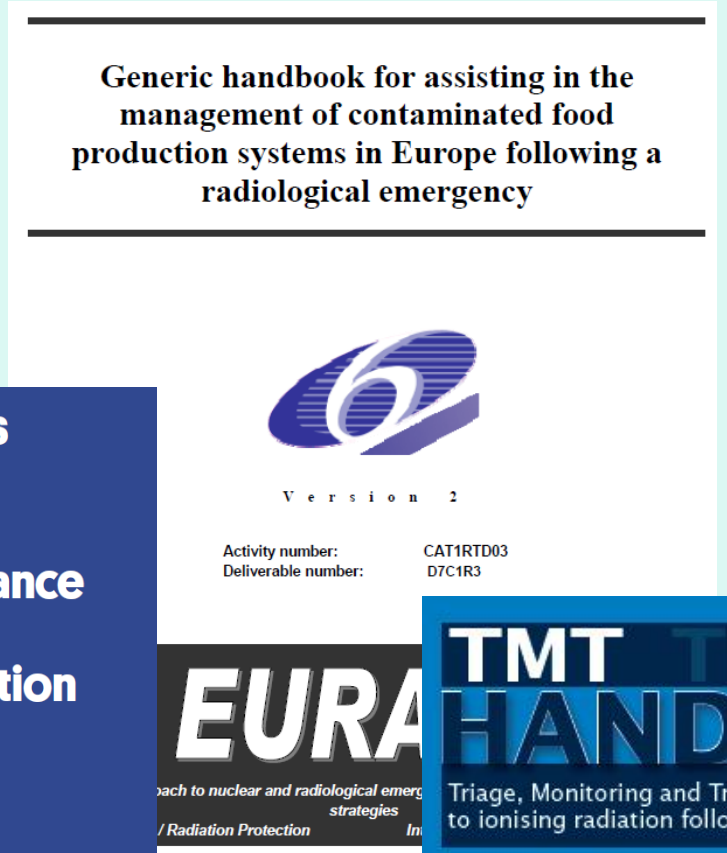
External irradiation

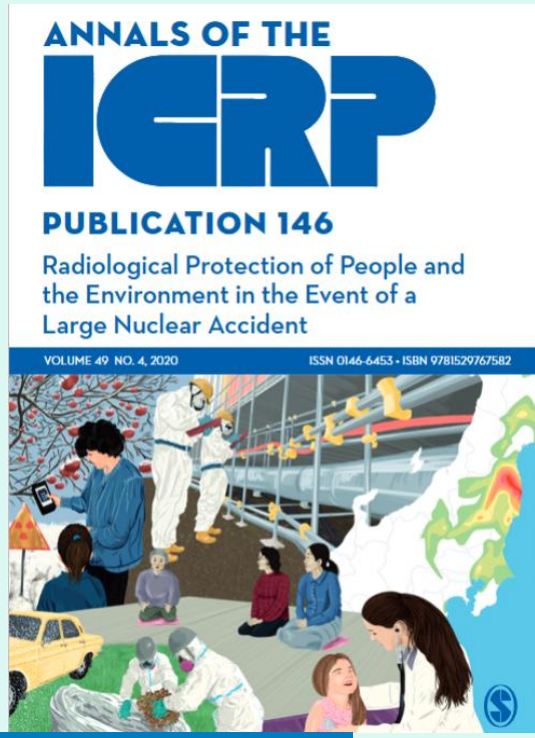
Lots of Guidance

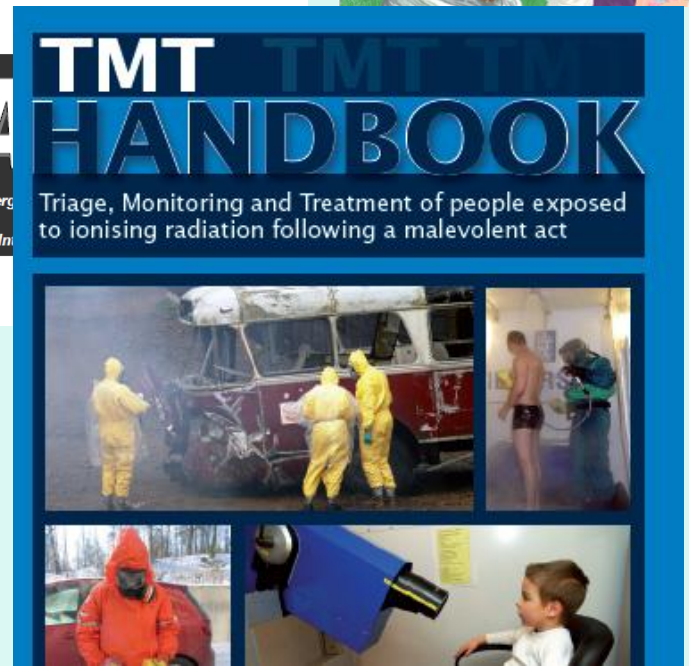












Short-term phase – Urgent and early Response

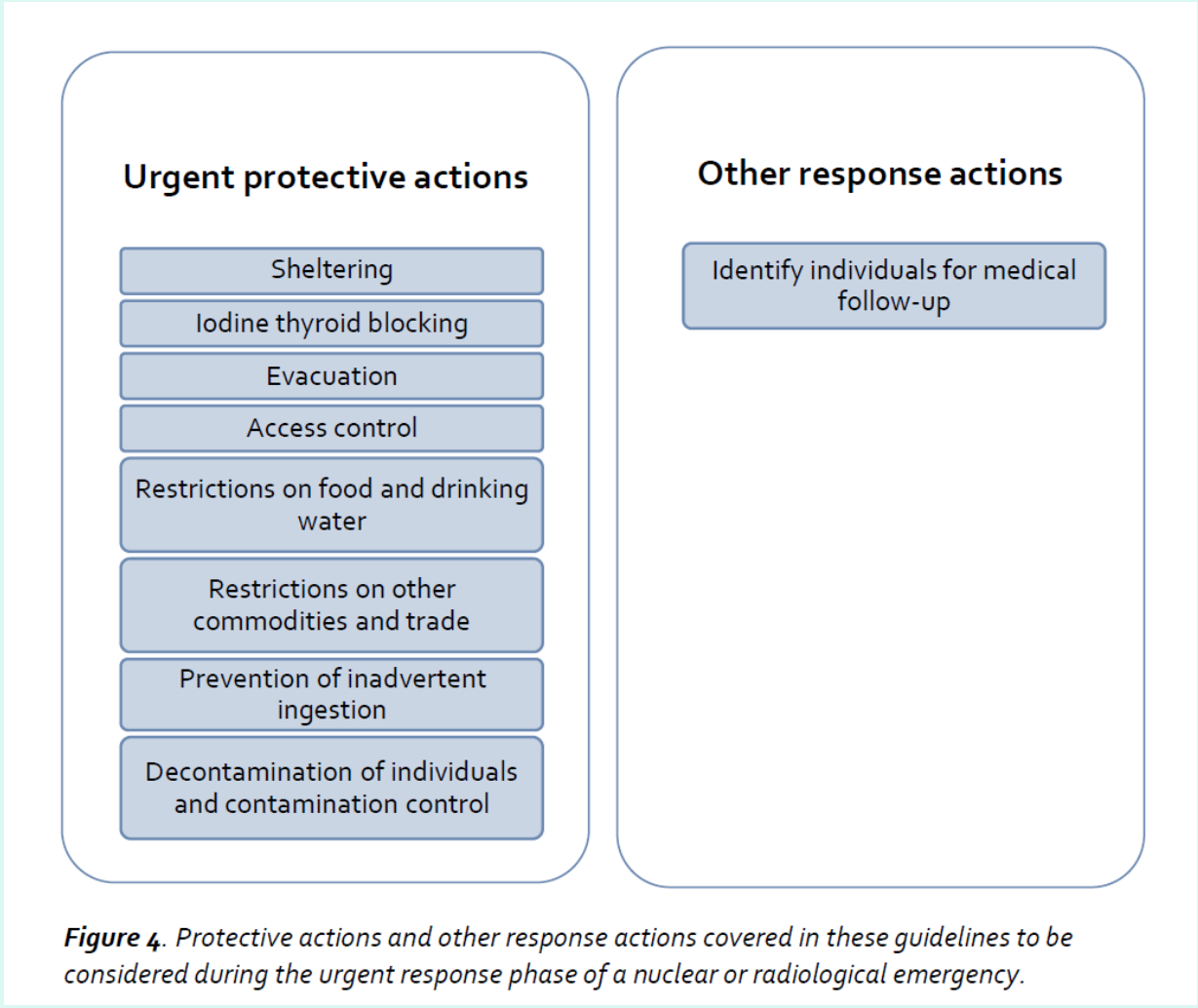
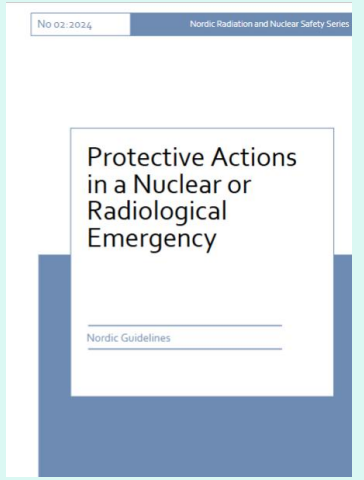


***Figure 4**. Protective actions and other response actions covered in these guidelines to be considered during the urgent response phase of a nuclear or radiological emergency.*



Recognition that this is not just a technical challenge

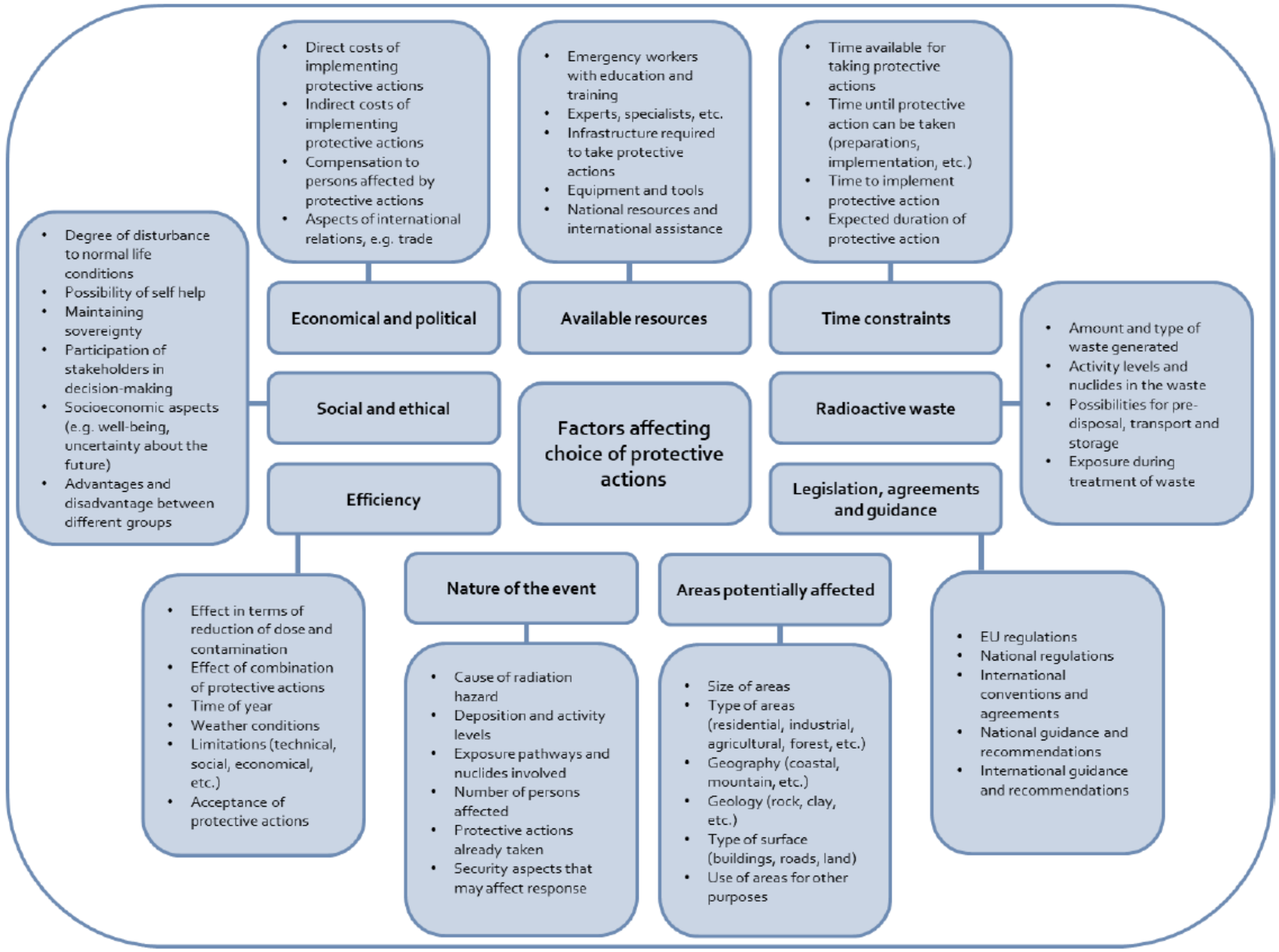
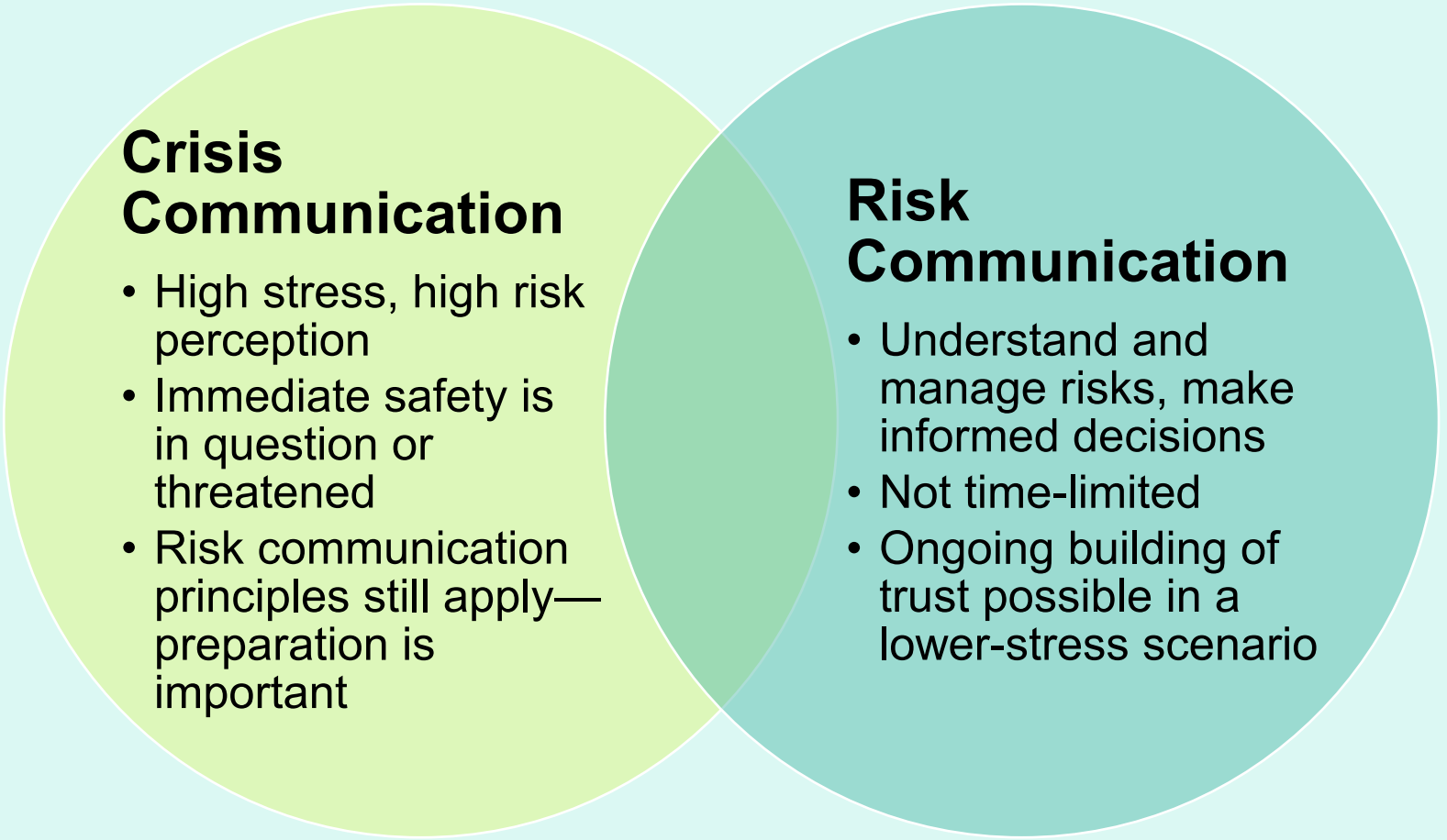


***Figure 3**. Other factors affecting protective actions.*

Managing radioactive waste in an emergency

Risk Communication and Crisis Communication

Risk Communication and Crisis Communication



Some Emerging Challenges

Resilience to RADiological Events in Wartime (RRADEW)

The Russia-Ukraine war exposed multiple gaps in nuclear regulations and existing Emergency Preparedness, Response and Recovery (EPR&R) systems

RRADEW uses scenario-based approaches to explore how armed conflict may impact feasibility and adequacy of current planning, response and recovery strategies.

Co-funded by the European Union

Radiation protection and armed conflicts

Physical and Logistical Challenges

Overlapping Military and Radiological Threats

- Physical Security Challenges
- Restricted Access and Delays
- Dual Risk to Responders
- Impact on Emergency Operations.

Radiation protection and armed conflicts

Constraints on Emergency Response Logistics

Complexity of Evacuation

Challenges in Protective action strategies

Vulnerable Groups

Access to medical facilities

Personnel Shortages

Radiation protection and armed conflicts

Physical and Logistical Challenges

Damage to Critical Nuclear and Civil Infrastructure – deliberate or accidental

- Electrical Power Dependency
- Cooling Water Vulnerability
- Transportation and Logistics
- Communication Networks

AI and Emergency Preparedness

Citizen engagement, AI-supported decision and trust for radiological impact assessment and emergency response – CIThARA

- Dispersion modelling
- Drones and UVA
- Citizen measurements and monitoring networks (LORACON)
- Analysis of Radionuclide composition
- Livestock monitoring and control
- Societal aspects: Ethics and Communication

CIThARA

Personal Dosimetry and Apps

After Fukushima, personal dosimeters were widely distributed to allow people to monitor their own doses, and control exposure

Since 2011 a range of apps and tools have been developed that will likely increase the use of personal dosimetry should another accident occur.

Technical and societal challenges

Nuclear weapons detonation – PREDICT EU project

- Challenges with communicating the importance of sheltering over evacuation
- Links to general preparedness

Thank You!

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Protection strategy for a nuclear or radiological emergency

Justification

Demonstrating that a protective action will be beneficial, considering both radiological and non-radiological detriments (public health, economic, societal).

Optimization

Ensuring that protection is as low as reasonably achievable (ALARA), economic and social factors being taken into account.

Reference Level

A key tool for optimization, expressed as a residual dose. GSR Part 7 sets this in a range of 20–100 mSv (acute or annual).

From the strategy, pre-established criteria (Emergency Action Levels, Operational Intervention Levels) are derived to trigger specific actions.

Timeline of a Large Nuclear Accident

The management of a nuclear accident is divided into distinct phases, which correspond to two fundamental types of exposure phases

SNAP-27 on the Moon (NASA)