



PREDIS

2.2.1 DI Characterization

Domain Insight with EURAD Roadmap

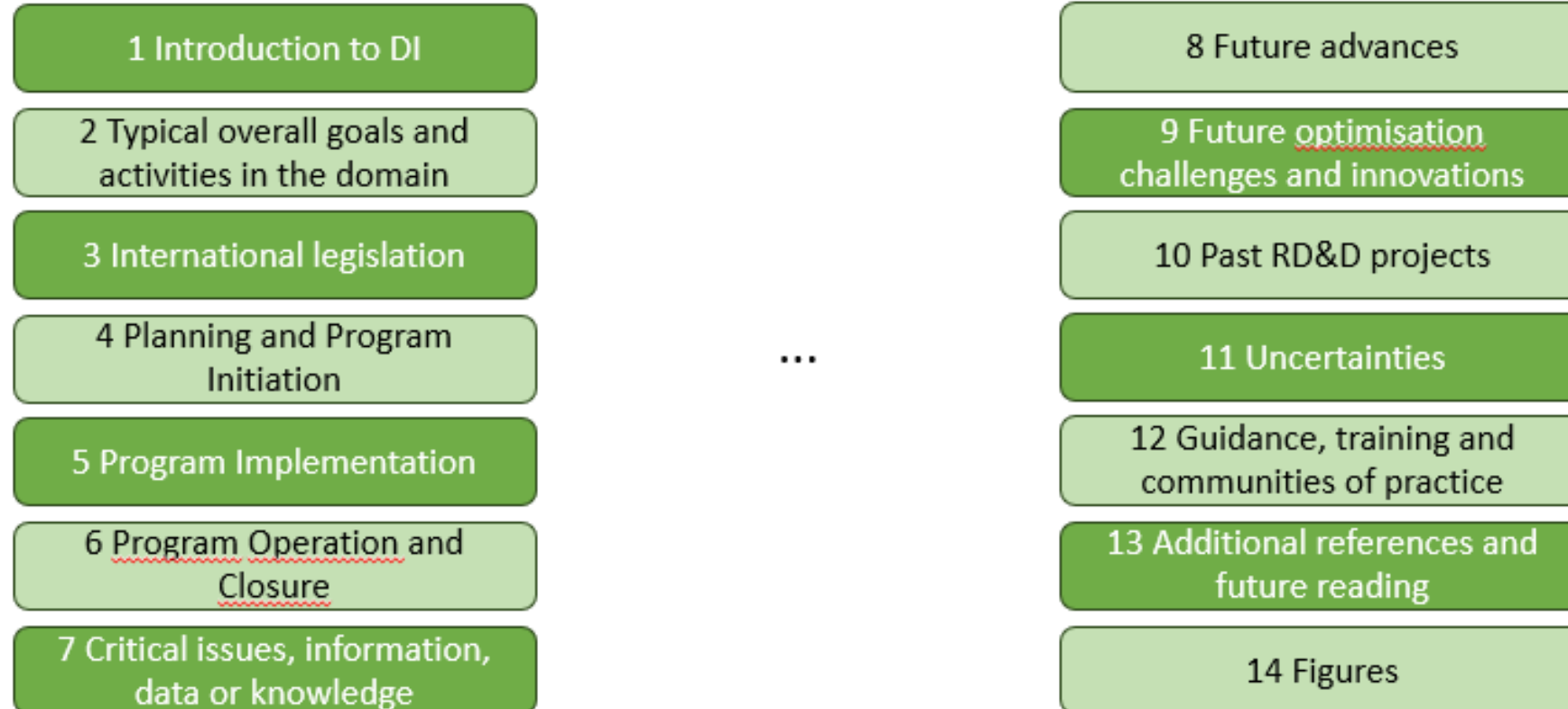
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VERSION (MARCH 2024)



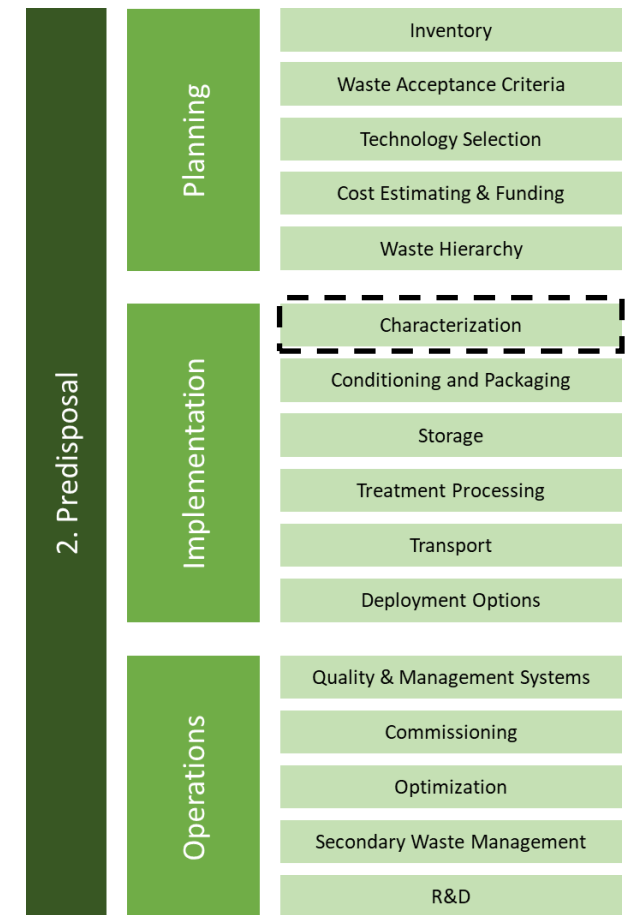
This project has received funding from the Euratom research and training programme 2019-2020 under grant agreement No 945098.

Outline



Introduction to DI Characterization

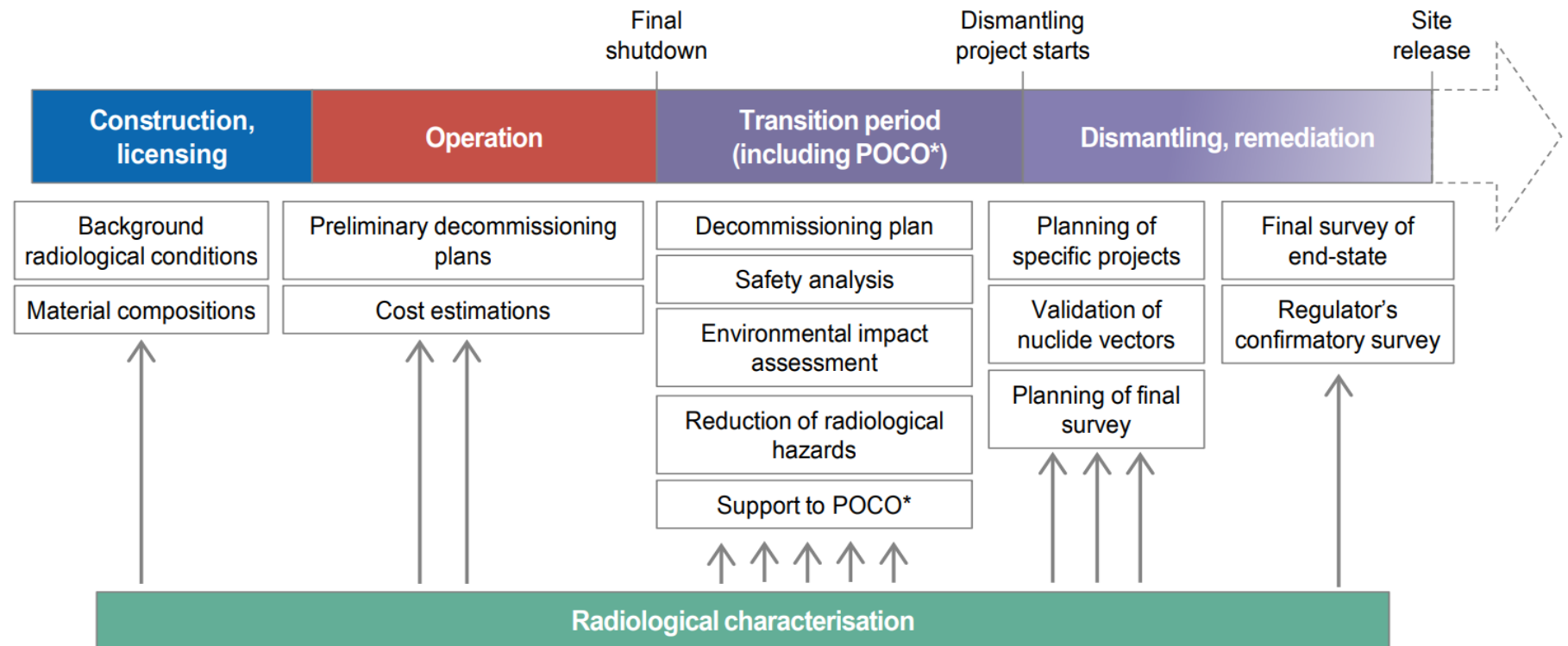
- Key aspect in its cradle-to-grave management
- Regulatory compliance
 - Ensuring safety
- Identification and classification of materials
 - Release materials
 - Radioactive waste
- Methodologies and techniques
- Traceability and documentation



Introduction to DI Characterization

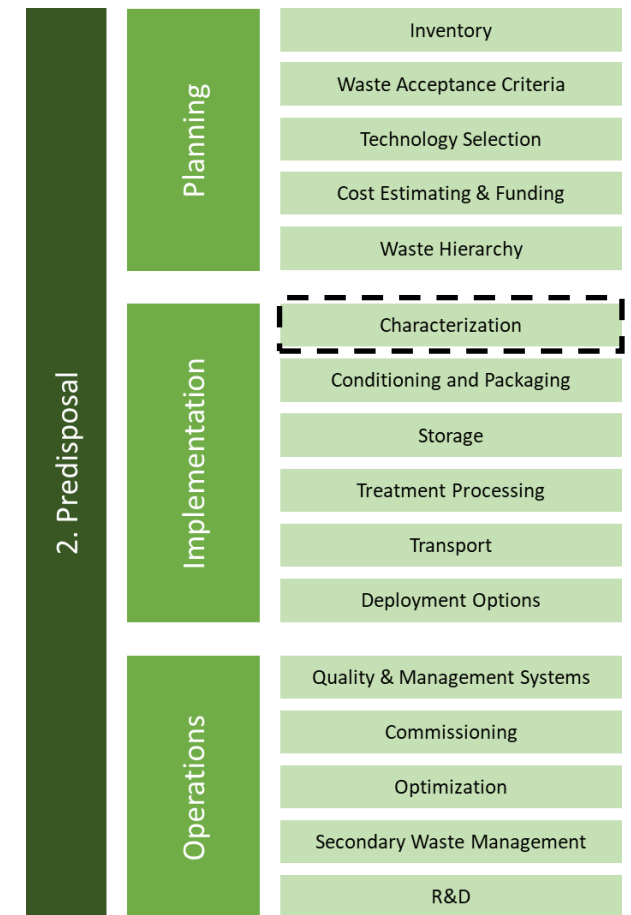
NEA report 7373 (2017)

Characterization objectives through a facility life cycle supporting decommissioning and materials & waste end states



Introduction to DI Characterization

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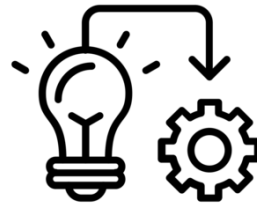


Typical overall goals and activities in the domain (Based on EURAD Roadmap GBS)

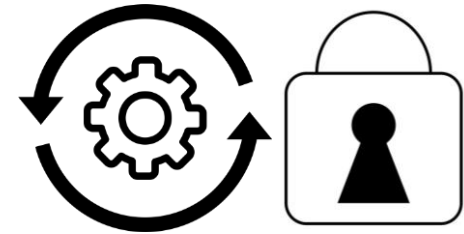
- Domain Goal
 - Sort, classify and quantify in accordance with requirements
- Domain Activities



- Assessment waste inventory, WAC and strategic planning
- Early stakeholder involvement and proactive characterization strategies



- Best practices, comprehensive characterization plans
- Interaction various stakeholders



- Continuous review and adjustment
- Thorough assessments
- Management characterization records

International Legislation

- Guidelines and standards
- Ensuring consistency and rigorous approach to characterization
 - Global scale
 - Accurate and comprehensive characterization
 - Internationally accepted practices
 - Safety and security
- Framework for safe management
 - Quality control (reliability)
 - Safe processing and disposal





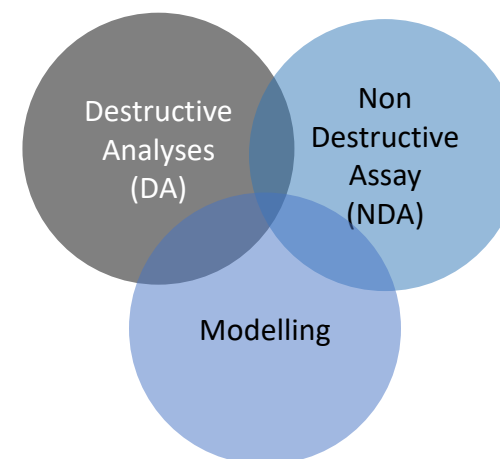
International Legislation

- International guidelines and standards
 - **IAEA**
 - Strategy and methodology for RW characterization (TEC-DOC-1537)
 - Predisposal management (WS-G-2.5; WS-G-2.6)
 - Methods for maintaining records of waste packages (Technical report nr. 434)
 - **IAEA Labonet**
 - **NEA**
 - **ISO standards**
 - ISO 9001 (characterization projects within this wider framework)
 - ISO 17025 (laboratories use methods that are accredited)
- European Union Directive
 - European Union Directive: “Radioactive Waste and Spent Fuel Management”
- National variation



Planning and Program Initiation

- Assessing current and future RW inventory
- Strategic planning
 - Proper segregation
 - Enhancing accuracy and efficiency
 - Early involvement with regulators
 - Investigation quality waste packages
 - Various measurement techniques
 - Scaling factor method

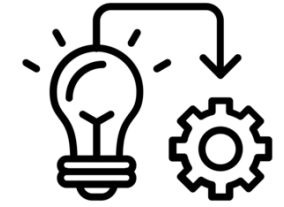




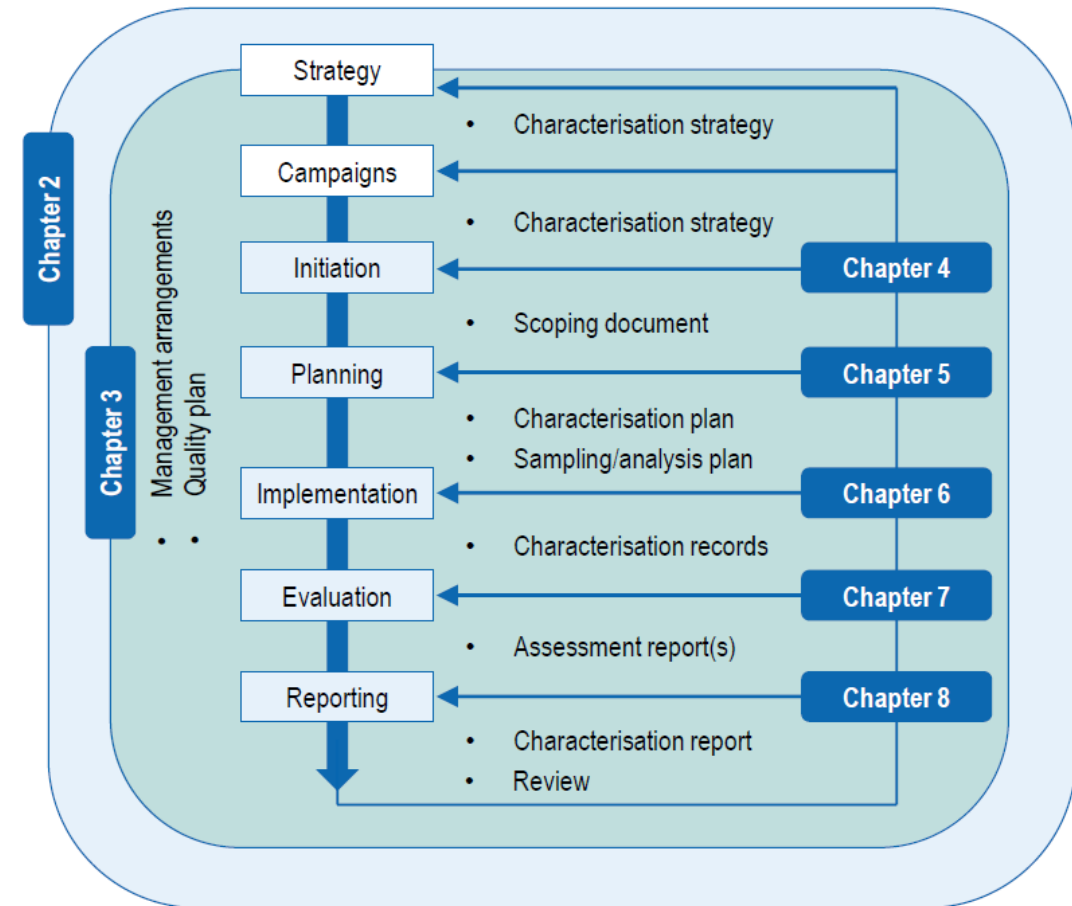
Planning and Program Initiation

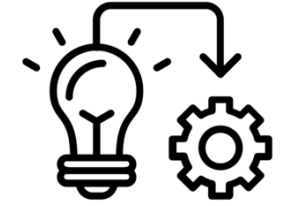
- Understanding and assessing
 - WAC
 - Safety assessment for RWM
 - Environmental safety aspects
 - Quality control (characteristics to be assessed, expertise, equipment, etc.)
 - Standards
- Evaluation available data
- Characterization across the entire lifetime
 - Defining standard approaches
 - Worker safety

Program Implementation



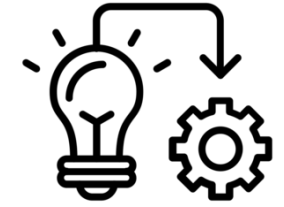
- NEA report 7373 (2017)
 - Guidance on implementing characterization
- IAEA-TECDOC-1537 (2007)
 - Methodologies and strategies





Program Implementation

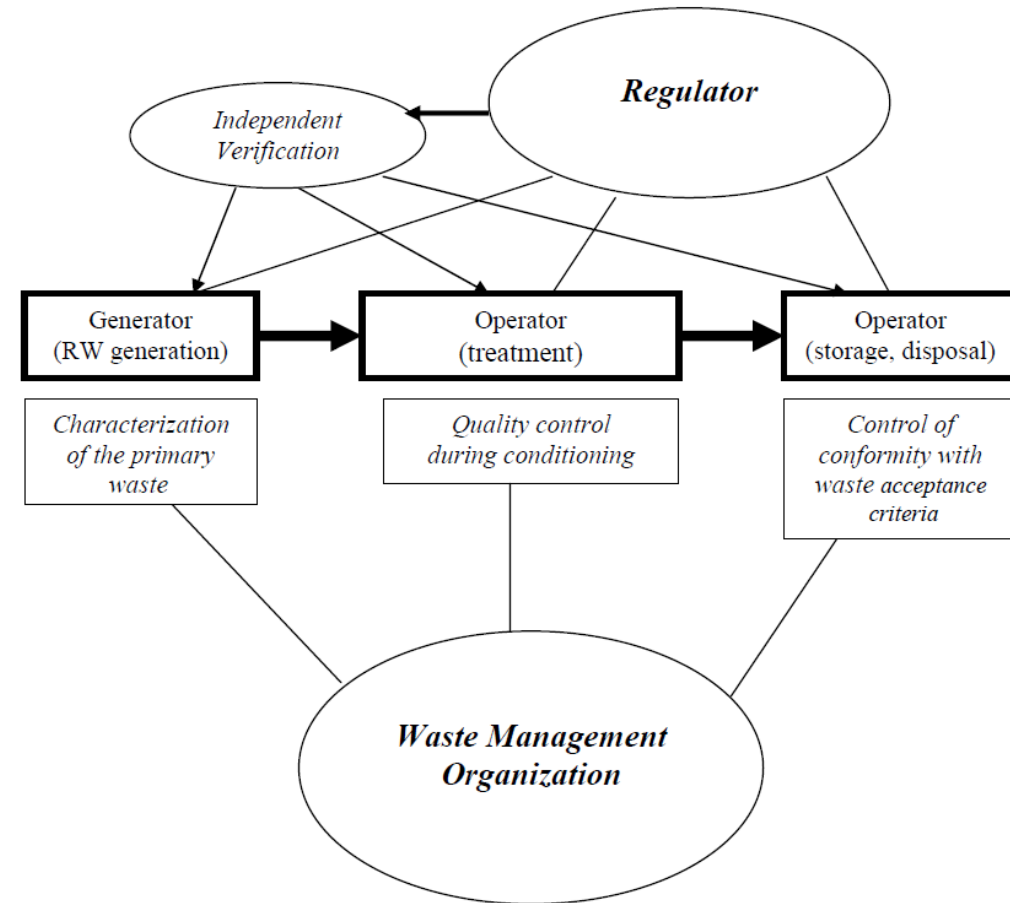
- Incorporation of best practices
- Outlining characterization activities
 - Area preparation
 - In-situ measurements
 - Sample collection
 - Analysis
- Work instructions
- Training and qualifications
- Documentation

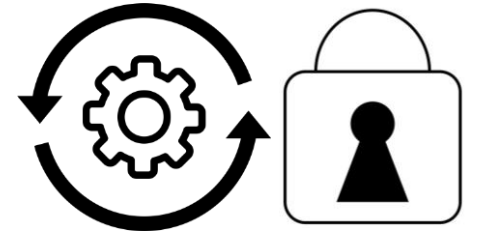


Program Implementation

- Update strategy according to
 - Potential dangers
 - Scaling factors

- Organizational structure





Program Operation and Closure

- Continuous review and adjustment
- Integration of new technologies
- Optimization cost and safety
- Worker exposure minimization
- Regulatory oversight
- Characterization records management
 - Efficient data documentation
 - Waste inventory, WAC, etc.

Critical issues, information, data or knowledge in the domain of characterization

- Critical issues



Waste characteristics



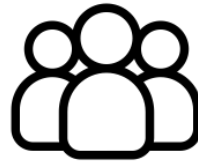
Compliance WAC



Laboratory capability



Data reporting systems



Public awareness and education



Waste segregation

Critical issues, information, data or knowledge in the domain of characterization

- Challenges
 - Lack of harmonization
 - Lack of standardized classification system
- Knowledge management
 - Processes and methodologies
 - Characterization information and records
 - Traceability from generator to disposal operator

Future advances

- Development of remote, integrated and automated methods
- Fast, cost-effective, and straightforward methods for measuring DTM radionuclides
- Improving understanding of non-radiological properties
- Innovative methods for validating scaling factors
- Development of mobile monitoring and characterisation systems
- Improvement of sampling techniques

Future optimization challenges and innovations

■ Challenges

- Efficient and safe
- Legacy RW characterization
- Robotics
- Mapping entire life cycle
- Harmonization

■ Enhancing safety

- Educational and training program
- Exchange of experiences
- Digitalization and simulation
- Data processing



Past RD&D projects on characterization

- CHANCE <https://www.chance-h2020.eu/>
- INSIDER <https://insider-h2020.eu/>
- MICADO <https://www.micado-project.eu/>
- PLEIADES <https://cordis.europa.eu/project/id/899990>
- CLEANDEM <https://cordis.europa.eu/project/id/945335>
- SHARE <https://share-h2020.eu/>

Uncertainties

- Absence of final WAC for waste disposal
- Changes in regulatory framework
- Prediction long-term behavior
- Human errors and incidents
- Incomplete information regarding composition and characteristics
- Measurement uncertainties

Guidance, training and communities of practice

Guidance

- INTERNATIONAL ATOMIC ENERGY AGENCY, Characterization Handbook, Characterization of Radioactive Waste and Waste Packages, IAEA LABONET, Vienna, under review (only available via members area) (https://nucleus.iaea.org/sites/nefw-projects/IMMONET/Handbook_Project/Shared%20Documents/Forms/Characterization.aspx)
- INTERNATIONAL ATOMIC ENERGY AGENCY, Pre-disposal Management of Radioactive Waste. General Safety Requirements Part 5, IAEA GSR Part 5, Vienna (2009) (https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1368_web.pdf)

Training

- **IAEA e-learning** ([Global search \(iaea.org\)](https://www.iaea.org/Training/E-learning)). Opportunity for following a wide range of courses regarding radioactive waste characterisation

Active communities of practice and networks

- **ENTRAP** (European Network of Testing Facilities for the Quality Checking of Radioactive Waste Packages) (No website available, but activities are outlined in <https://www.cambridge.org/core/services/aop-cambridge-core/content/view/5D156B0382D8835AB7EBC1B8F28296EB/S0026461X00001444a.pdf/entrap-and-its-potential-interaction-with-european-networks.pdf>)
- **IAEA Labonet** (Laboratories for Nuclear Waste Characterization) (<https://nucleus-ga.iaea.org/sites/connect/LABONETpublic/SitePages/Home.aspx>)

Additional references and future reading

- INTERNATIONAL ATOMIC ENERGY AGENCY, Predisposal Management of Low and Intermediate Level Radioactive Waste, IAEA Safety Standards Series No. WS-G-2.5, IAEA, Vienna (2003a).
- INTERNATIONAL ATOMIC ENERGY AGENCY, Predisposal Management of High Level Radioactive Waste, IAEA Safety Standards Series No. WS-G-2.6, IAEA, Vienna (2003b).
- INTERNATIONAL ATOMIC ENERGY AGENCY, Methods for Maintaining a Record of Waste Packages during Processing and Storage, Technical Reports Series No. 434, IAEA, Vienna (2005).
- INTERNATIONAL ATOMIC ENERGY AGENCY, Strategy and Methodology for Radioactive Waste Characterisation, IAEA-TECDOC-1537, Vienna (2007).
- INTERNATIONAL ATOMIC ENERGY AGENCY, Determination and Use of Scaling Factors for Waste Characterization in Nuclear Power, IAEA Nuclear Energy Series No. NW-T-1.18, Vienna (2009).
- Nuclear Energy Agency (NEA), Radiological Characterisation from a Waste and Materials End-State Perspective: Practices and Experience, Radioactive Waste Management, NEA No. 7373 (2017).
- International Organisation for Standardisation, Quality Management Systems – Requirements, ISO 9001, ISO, Geneva (2015a).
- International Organisation for Standardisation, General Requirements for the Competence of Testing and Calibration Laboratories, ISO 17025, ISO, Geneva (2015b).

Questions?

