

ICARUS project in EURAD-2

Eros Mossini – POLIMI (Italy)

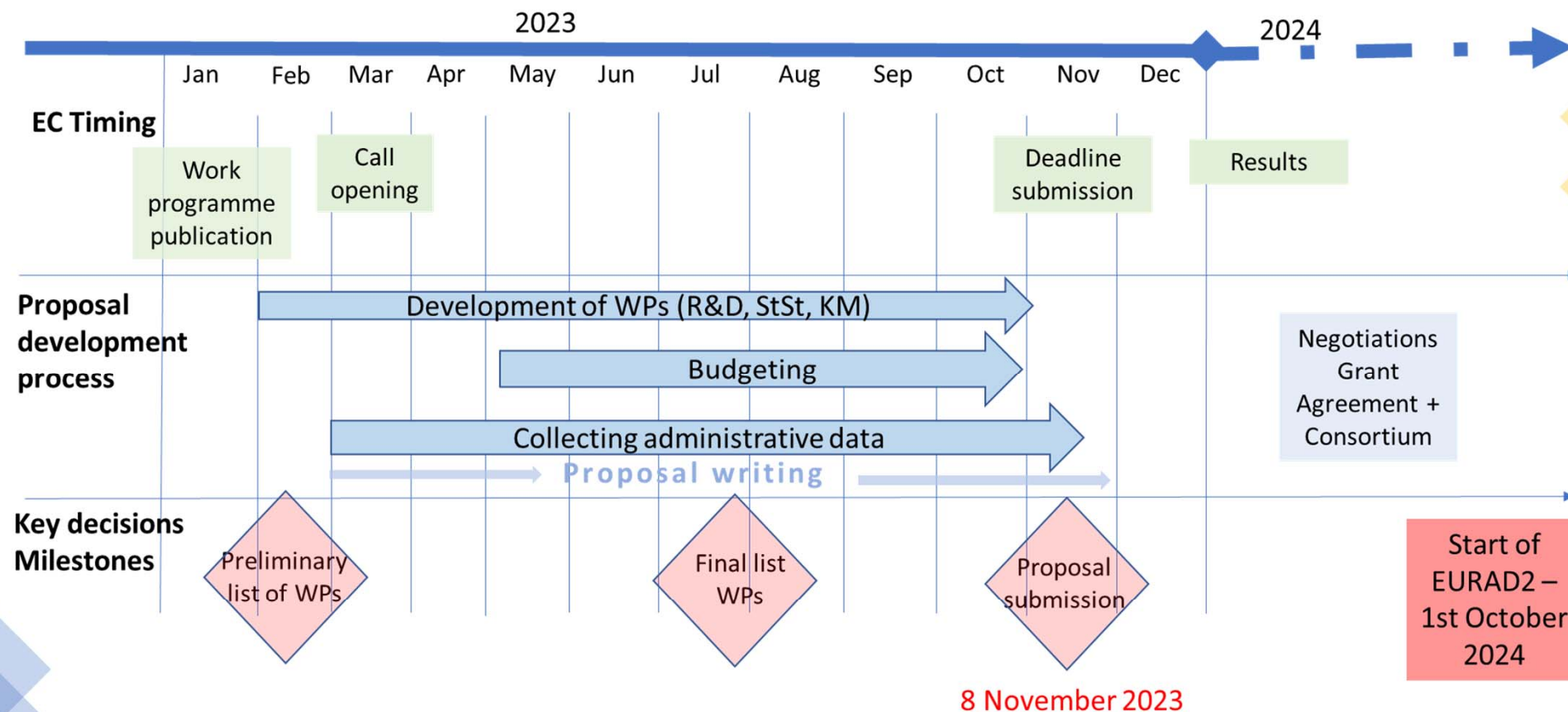
14/02/2024

PREDIS Webinar on DTM radionuclides

EURAD-2: scope and rules

- **All types of disposal:** RWM activities from cradle to grave (except decommissioning) and full range of radioactive waste (from VLLW to HLW)
- Based on the same documents: EURAD [Vision](#), [Roadmap](#) and [updated SRA](#)
- Same objectives and type of activities:
 - Develop, maintain and consolidate the scientific and technical basis of radioactive waste management ⇒ **R&D WPs**
 - Address important & complex issues and enable expert networking ⇒ **Strategic Studies WPs**
 - Enhance KM and transfer between organisations, MS and generations ⇒ **KM WPs**
- **Flexible** and inclusive programme
- **Co-funded partnership**

EURAD-2: Timeline



It has already been a long road...

WP5 – ICARUS

Innovative ChARacterisation techniques for large volUmeS

Further development, optimization and harmonization of innovative techniques for characterizing radiological, physical and chemical properties of LLW/ILW-mixed waste which could be critical for the safe implementation of radioactive waste management programmes, including destructive techniques (DT) on laboratory scale and its relation to non-destructive techniques (NDT) and scaling factors (SF) at the raw waste and package scale user cases.

- Identification of **relevant use cases** for an industrial application.
- Development of characterization methodologies for **mixed wastes** from decommissioning, to acquire accurate radiological and chemical inventory necessary for defining pre-disposal management.
- Identification of **relevant DTM radionuclides**, including limitations and difficulties that remain for their proper characterisation.



4.4 M€
(funded 50 %)



5 years

WP5 – ICARUS: tasks

Task title	Task leaders
1) Management/coordination of the WP	Eros Mossini, POLIMI
2) Knowledge Management	Yevheniia Kudriashova, SSTC NRS
3) NDT design for industrial implementation	Bas Janssen, NRG
4) DT design for DTM radionuclides	Xiaolin Hou, DTU
5) Scaling Factor optimization	José Luis Leganés Nieto, ENRESA



R&D

- **1st use case:** improved NDT methods and approaches for radiological characterization of raw waste in complex large package
- **2nd use case:** improved NDT methods for characterisation of physical-chemical properties and chemicals inventory

- **3rd use case:** development-optimisation-innovation of fast and cheap DTs to characterise DTM radionuclides C-14, Cl-36, Ca-41, Se-79, Zr-93, Mo-93, Tc-99, Pd-107, Cs-135, Cm-243, Cm-244
- **4th use case:** development of innovative methods for the optimization and validation of SF methodology

WP5 – ICARUS: challenges for DTM

Aim: developing **sensitive** and **reliable** analytical methods to improve the **detection limits** and to replace the conventional **expensive** and **time-consuming** radiochemical analysis for long-lived DTM radionuclides.

DTM radionuclides have been selected due to lack of **reliable** (Se-79, Zr-93, Pd-107) or **quick** (C-14, Cl-36, Tc-99) analytical methods, or because **difficult to be standardized** (Ca-41, Mo-93, Cs-135).

- **Task 4.1: Development of new radiochemical methods:** rapid and effective methods to extract DTM analyte radionuclides from the sample matrix and purify them from all **interfering nuclides**.
- **Task 4.2: Development of new measurement methods:** quick, sensitive, and accurate methods (liquid scintillation counting and **mass spectrometry**: QQQ-ICP-MS, AMS and MC-ICP-MS...).
- **Task 4.3: Implementation of destructive techniques on real waste:** validation, demonstration and harmonization of the developed analytical methods by **intercomparison exercises** on certified reference materials or **real waste samples** provided by project partners.

WP5 – ICARUS: partners



Participants:

29 partners from 17 countries

ARAO, ORANO, CIEMAT, CSIC, CNRS, IMT Atlantique, CVUT, DTU, SORC, ENEA, CAEN, UNIPI, ENRESA, INGENIC, US, FTMC, JSI, Energorisk, NCSR, NRG, NTUA, RATEN, SCK CEN, Tractebel, SKB, SSTC NRS, VTT

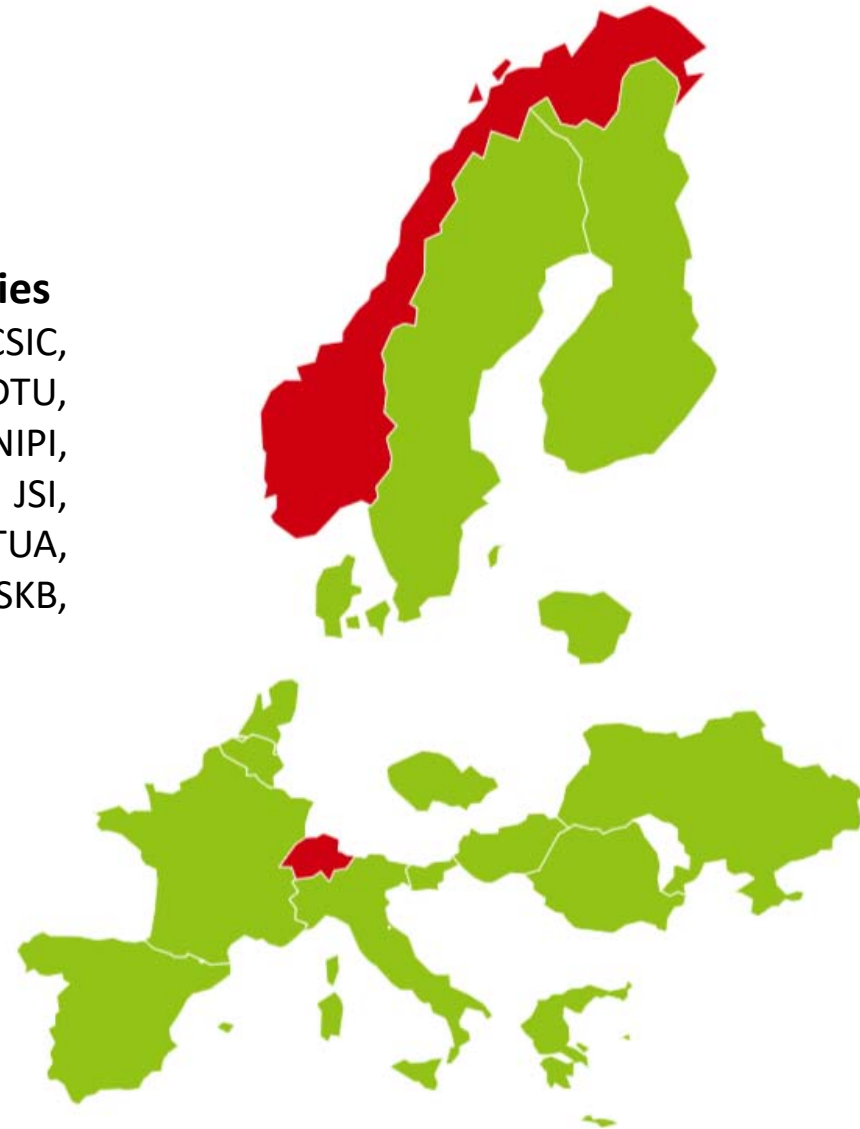
Associated Partners:

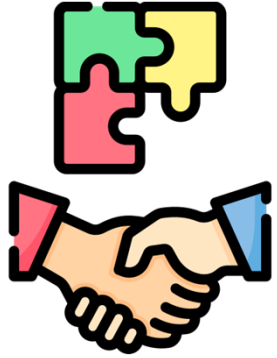
IFE, PSI



End-users:

ANDRA, SOGIN, NAGRA, IAE, NES, PURAM, TVO, ONDRAF/NIRAS...





Thank you for the attention!

**We are looking forward to collaborating and sharing
the outcomes of this research**

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