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The PIANOFORTE CATAPULT Project: Comprehensive Assessment and Preparedness for Emerging Nuclear Technologies

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Motivation

- The current knowledge supporting Environmental Impact Assessment (EIA) and Emergency Preparedness and Response (EP&R), regulatory approaches, and risk communication is mainly based on large water-cooled reactors
- SMRs and AMRs pose several challenges regarding
 - **limited state-of-art modelling for EIA and EP&R for near field**
 - need to address the **Euratom Basic Safety Standards** for deployment
 - the public concerns about new nuclear technologies, for which **communication and community engagement must rely on trust and transparency**
- **EIA not independent from the public concerns and wider risks at stake and vice versa**
- Further isolated research in the modelling, compliance, and communication areas will not deliver on practical solutions to the existing challenges

The CATAPULT Project

- **CATAPULT aims at building a comprehensive guidance for EIA and EP&R applied to Small (water-cooled) and Advanced Modular Reactors (Gas- and Lead-cooled) with tight cross-links between technical and social aspects**
- Highly interdisciplinary team (research centers, TSO, universities)
- PIANOFORTE Call 2, Topic 2, duration: 3 years (01.02.2025-31.01.2028)

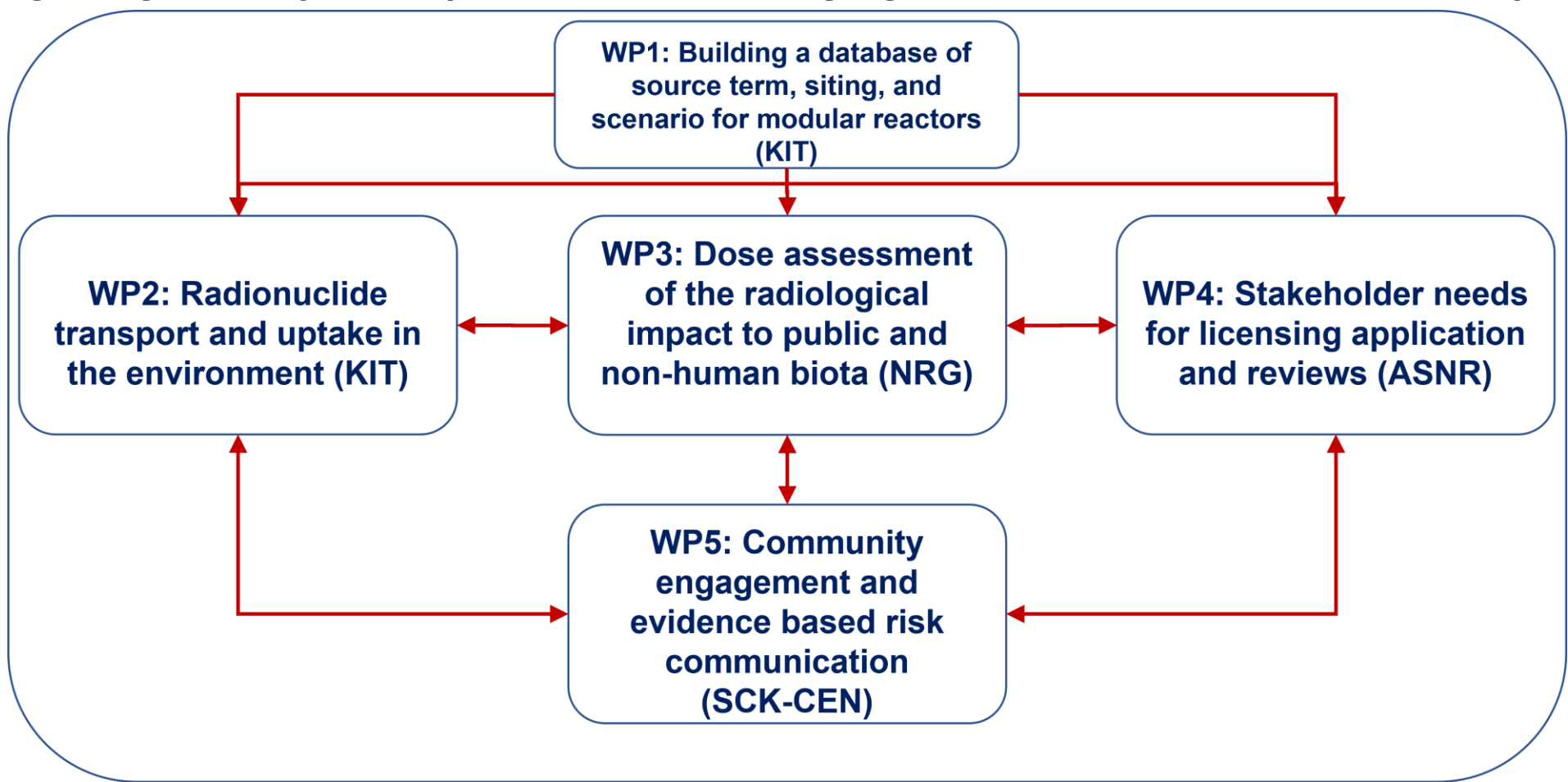


Pillars, Scope, and Main Goals

- **Environmental and dose modelling**
 - **Improving/adapting the dose impact and the environmental transport models**
 - Delivering an **analysis framework tailored to the needs of modular reactors and their typical site locations** to guide end-users in EIA and EP&R modelling
- **Science-based regulatory compliance**
 - **Delivering a comprehensive set of recommendations to authorities, operators, and licensees** to ensure the scientific credibility of the demonstration of radiation protection of the public, including workers from nearby industries, and the environment
- **Community Engagement & Risk communication**
 - **Community-driven participatory framework**, to engage general public, relevant stakeholders, and communities to increase trust, transparency and co-decisions, towards a more holistic EIA
 - **Providing evidence-based, co-designed communication tools that clearly present EIA results and inform the public about modular reactors**

Work Plan and Methodology

- Cross-fertilization of research disciplines tailored to develop a fit-for purpose framework on EIA modelling, regulatory compliance, and engagement with the community



WP2 – Radionuclide transport and uptake in the environment (KIT, ASNR, NRG, SCK-CEN, STUK)

- **Adaptation and enhancement of state-of-the-art atmospheric and aquatic radionuclide transport and dispersion** as well as food chain models
- Improving the atmospheric transport and dispersion models for small-scale and urban conditions (LASAIR + JRODOS, FLEXPART + AROME)
- Aquatic transport and dispersion models (3D hydrological/compartment, high-resolution 2D-3D hydrological modelling of radionuclide pollutants, freshwater and low-flow rivers)
- Food chain models (e.g., JRODOS, SYMBIOSE, D-DAT)

WP4 – Stakeholder needs for licensing application and reviews (ASNR, NRG, RATEN, STUK)

- **Development of regulatory guidance** based on
 - **case studies** (WP1, WP2, WP3)
 - **round-tables with experts** from authorities and TSO involved in the reviewing of applications from prospective licensees
 - **feedback from a wider audience**, including developers of modular reactors, their subcontractors and representatives of public engagement and risk communication (WP5)

Summary

- CATAPULT is tailored at the **specific needs of modular reactors** in assessing their radiological risks to the environment during routine and accidental operation
- CATAPULT uses **cutting-edge modelling, novel communication science**, and **broad stakeholder co-design** to deliver transparent, evidence-based EIAs
- With a **multi-disciplinary team**, CATAPULT aims at delivering **essential guidance** to authorities, TSOs, operators, and licensees, advancing a standardized, **fit-for-purpose EIA and EP&R approach**

WP1 – Building a database of source term, siting, and scenario for modular reactors (KIT, RATEN, STUK)

- **Source terms database (nominal and accident conditions, atmospheric and effluent)**
 - Water-cooled SMR (submerged containment, 60 Mwe)
 - Lead-cooled ALFRED-like (125 MWe)
 - Gas-cooled HTR-like (200 MWth)
- **Extensive database of the siting (websites, maps, tables)**
 - **Industrial site** next to heavy/chemical industry (Stein, Limburg, Netherlands)
 - **Urbanized site** - close to urban and industrial zones (Arnhem, Gelderland, Netherlands)
 - **Natura2000 site** - Petten (Netherlands)
 - **Urbanized site for district heating** (Helsinki, Finland)

WP3 – Dose assessment of the radiological impact to public and non-human biota (NRG, ASNR, SCK CEN, STUK)

- **Review and analysis of present models and selection of exposure conditions** for members of the public including workers from nearby industries and for non-human biota **based on stakeholder needs**
 - Dose calculations and a sensitivity analysis on the variations in exposure conditions to establish variations in dose for the (critical) reference person and wildlife
 - Identify deficiencies providing input for a work plan on future development
- **Prioritisation of features** that are important in the assessment (interaction with WP4)

WP5 – Community engagement and evidence based risk communication (SCK CEN, COFAC-UL, MERIENCE)

- **Develop a two-stage Community-Driven approach** to enhance public perception and address public mistrust, mitigating “not in my backyard” (NIMBY) responses
- **Develop citizen-centred and evidence-based risk communication strategy and materials** related to EIA by providing transparent, accurate and comprehensible information from the other WPs (**Design Thinking Approach**)
- The **Delphi method** will be used to provide implementation guidance for effective and evidence-based risk communication by leveraging a panel of communication experts

Acknowledgements



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