SNETP response to the public consultation on the evaluation of the Radioactive Waste Directive (2011/70/Euratom) and the Directive on Shipments of Radioactive Waste and Spent Fuel (2006/117/Euratom)

The Sustainable Nuclear Energy Technology Platform (SNETP) welcomes the European Commission's initiative to evaluate the Radioactive Waste Directive (2011/70/Euratom) and the Directive on shipments of radioactive waste and spent fuel (2006/117/Euratom). As an ETIP and a non-profit association promoting research and innovation in the European nuclear sector, SNETP represents an important network of industrial, research and academic organisations committed to foster collaboration towards the development of safe, sustainable and innovative nuclear technologies contributing to the Europe's energy transition, industrial competitiveness and strategic autonomy.

Nuclear energy is a key lever for achieving the EU's decarbonization objectives, as recognized in the Nuclear Illustrative Programme (PINC) and the Net-Zero Industry Act (NZIA). Responsible management of radioactive waste and used fuel is essential to maintain public trust, operational safety and the long-term sustainability of nuclear power in Europe. Emerging nuclear projects and cutting-edge reactor technologies present new possibilities for refining the existing framework while satisfying societal demands.

Since the inception of nuclear energy in Europe, the industry has produced a significant amount of electricity, contributing to the continent's energy needs. At the same time, like all industries, nuclear generates waste. For example, construction waste such as the steel and concrete used in a nuclear power plant or the radioactive waste which results from reprocessing used fuel.

On average each year one person generates about 54g of radioactive waste (source OECD/NEA, The World Bank 'What a Waste 2.0') that constituted by 90.1% of very low-level and low level (such as clothing, paper towels, concrete used in nuclear power plants, research facilities), about 9.7% of intermediate level waste (resulting from historical research activities, instrumentation used close to the core of the reactor) and less than 0.2% of high level waste that are the residues remaining from the treatment/recycling of used fuel. Thus, the amount of radioactive waste produced is remarkably small in comparison with other conventional industrial sectors. Unlike others, the nuclear sector is one of the few industries which takes full responsibility for the handling and traceability of its waste. It also follows the 'polluter pays' principle. As a result, it manages its waste in such a way so as to protect people and the environment. This demonstrates the efficiency and safety of nuclear energy as a low-waste, high-output power source.

The nuclear industry is highly responsible and committed to the safe management of radioactive waste. The waste generated is meticulously contained and protected, with stringent measures in place to ensure that nothing can escape from designated storage facilities. Both the European and global nuclear sectors adhere to the International Atomic Energy Agency's (IAEA) guidelines for managing radioactive waste. This commitment to safety and responsibility is a cornerstone of the industry's operations.

Under EURAD and EURAD-2, co-funded partnerships in the framework of EURATOM, many organizations from different countries are partnering to develop better knowledge and long-term solutions. These collaborations have enabled the scientific community, with the support of Member States, to harmonize their approaches and create some of the most advanced knowledge in the world regarding radioactive waste management. This collective effort is instrumental in developing innovative solutions and best practices for the safe and sustainable management of radioactive waste.

Current Directives and challenges

The Radioactive Waste Directive (2011/70/Euratom) and the Directive on Shipments of Radioactive Waste and Spent Fuel (2006/117/Euratom) established a robust framework for the responsible and safe long-term

management of used fuel and radioactive waste, allowing Member States and nuclear stakeholders to develop programmes that cover the entire life cycle of these materials. While many Member States have operational near-surface or intermediate disposal facilities for low-level waste, long-term deep geological disposal solutions for intermediate and high-level waste remain a critical milestone yet to be fully operational across the Union. Finland, France, and Sweden lead with advanced programmes (Finland/Posiva is expected to get the ONKALO operating license for final disposal of spent fuel during 2026. Sweden and France are constructing the repositories) but timelines in the majority of Member States extend from the 2050s to the 2070s, or even later.

They also provide clear rules for the supervision and control of cross-border shipments, which contribute to high safety standards across the EU, reducing fragmentation and ensuring a level playing field for nuclear operators. As the EU moves toward deeper cross-border collaboration, any regulatory simplification that aims to reduce administrative burdens must maintain the strict prior consent and high safety control standards established by this framework to prevent risks.

While the guidelines have laid a solid foundation, SNETP and its members have identified opportunities for improvement and challenges to be addressed. Specifically, some Member States with aspirations for a civil nuclear energy program have yet to establish comprehensive national policies for the long-term management of all radioactive waste streams. Disparities in the funding and governance mechanisms of these national programmes can delay and threaten their sustainability.

The evolution of these directives must consider the blueprints for the progression of nuclear technology (SMRs, AMRs and medical radioisotopes, among others) as well as recent initiatives for electrification and deployment (the European Industrial Alliance of SMRs and countries choosing nuclear energy to decarbonize their energy mix, for instance).

SNETP Recommendations

The revised directives should help Member States to strengthen their national programs by encouraging programs that cover all waste streams (legacy waste, used fuel, waste from medical, industrial and research activities) and promoting reprocessing and recycling, as well as intermediate storage solutions. The EU has the potential to foster optimal approaches for long-term financing of waste management and transnational collaboration among nations with advanced programs compared to others.

To further enhance the management of radioactive waste, it is essential to minimize the waste generated through specific treatments such as improved characterization and minimization. Research and development (R&D) in this area are crucial, and the nuclear community is actively working to develop advanced systems, including Generation IV (GEN IV) reactors, that can use the remaining high level waste as an energy source. This approach would not only reduce the volume of waste but also decrease Europe's dependence on third countries for nuclear fuel and waste treatment. Achieving this vision requires a long-term perspective and continuous support for R&D initiatives.

Some EU countries (Finland, Sweden, Germany, France …) and industrial actors (Fortum, Cyclife, GNS, ORANO, …) have advanced expertise in the treatment and disposal of waste. It would be, therefore, necessary to simplify the approval processes for cross-border transport (including import-export control) for treatment/processing and then return of the new waste form for final disposal in the country of origin between Member States while maintaining a high level of security, and to promote joint R&D initiatives by funding collaborative research on advanced reactor technologies (GEN IV) that would enable the closure of the fuel cycle and advanced waste management technologies.

Among the future nuclear innovations deployed, new reactor technologies that enable the closure of the fuel cycle or integrate the use of recycled fuel multiply the potential for alignment with the principles of the circular economy and the long-term sustainability goals of the EU. Indeed, the reprocessing and multiple recycling (as planned in EPR2 reactors and other GEN III reactors) demonstrate the viability of these cycles to reduce the volume of high-level waste and maximize resource efficiency.

The EU must also encourage R&D on advanced fuel cycles such as partitioning and transmutation for the recycling of used fuel, fast reactors (Gen IV) that reduce the volume and radiotoxicity of final waste, and alternative fuels with reduced long-life waste. To achieve this, support for industrial demonstration projects of these reactors is needed, which can be done by developing cost-sharing mechanisms for R&D and dedicated infrastructures through European funding.

Beyond financial support, the evolution of directives should explicitly take into account waste streams from future SMRs, AMRs, fusion technologies, and non-electric applications such as nuclear medicine. Thus, the deployment phase of these technologies will not be hindered by inadequate directives, and it will also allow for better transmission of European best practices at the international level, with industries demonstrating their mastery of the safety rules associated with these new technologies.

To support this deployment, SNETP recommends that the Commission address the uneven application of radioactive waste classification schemes across Member States. Moving toward a fully harmonized implementation of the IAEA GSG-1 standard would significantly streamline cross-border cooperation, clarify public communication, and remove technical barriers to common or shared solutions.

SNETP also strongly encourages the exploration of shared pre-disposal and disposal solutions, including multinational repositories. Such shared solutions are highly relevant for Member States with small-to-medium inventories, offering a pathway to safely and efficiently fulfil their obligations without leaving a disproportionate technical or financial burden on future generations.

In parallel, robust Key Performance Indicators (KPIs) should be enhanced in the next reporting cycle, during which Member States are required by the Radioactive Waste Directive to submit their national progress reports to the Commission every three years, to allow the Commission to systematically and transparently monitor national implementation progress.

This comprehensive deployment strategy will also promote a more structured public dialogue on waste management, fostering a deeper, mutual understanding of the issues between the nuclear industry and European citizens. To formalize this, SNETP suggests emphasising the importance of the human and societal dimensions of waste management, recognizing that radioactive waste management is fundamentally a socio-technical challenge rather than a purely engineering one. Because delays in implementing long-term solutions are frequently linked to societal opposition and political inaction, public dialogue should not merely aim for basic societal "acceptance", but rather for early, transparent, two-way engagement that fosters an atmosphere of shared ownership. To achieve this, European research platforms like EURAD-2 and IGD-TP should continue to formally interact with social sciences and humanities research networks (such as the SHARE platform) and civil society organizations. Targeted funding should also continue to support independent civil society engagement to ensure objectivity and informed public debate on advanced fuel processing technologies like reprocessing and transmutation.

Crucially, managing these evolving technical and societal solutions demands a parallel expansion of qualified human capital. The EU must continue supporting specialized education and training for professionals and scientists in radioactive waste management. Moreover, research must be accelerated in innovative fields like software-controlled robotics to handle advanced RWM tasks,use of AI/machine learning for identifying risks associated with waste package integrity and repository site characteristics directly improving occupational health and ensuring the highest safety standards for the nuclear workforce.

Strategic Objectives of the EU and Evolution of Directives

SNETP emphasizes that the evaluation and revision of directives, taking into account future nuclear innovations, are fully aligned with the EU's priorities in terms of energy transition, strategic autonomy, and industrial competitiveness.

Indeed, nuclear energy is recognized as a net-zero technology within the framework of the NZIA and is therefore an inevitable support for the EU's climate neutrality goal, as the Commission highlighted in its 2040 climate target proposal.

The evolution of reactor technologies towards the closure of the fuel cycle will further reduce the EU's dependence on third countries for nuclear fuel and waste management by developing recycling capabilities and European supply chains. This reduction in dependence will also enhance energy security, as the diversification of energy sources, including nuclear, will strengthen the EU's energy resilience. Utilizing advanced fast-neutron reactors (Gen IV) and partitioning technologies allows the EU to tap into the energy potential of existing used fuel, drastically reducing the geopolitical risks associated with importing natural uranium and external fuel services.

Similarly, from an economic perspective, a predictable, harmonized regulatory framework that takes into account future nuclear technologies, accompanied by support for research in these areas, will enable industrial actors to make the necessary investments and thus foster innovation and international competitiveness. This also represents a circular economy challenge, as these future innovations allow for resource efficiency by recycling materials, reducing future waste volumes, and thus minimizing long-term storage needs.

However, achieving this requires absolute financial predictability and strict adherence to the polluter-pays principle. For new technologies like SMRs and AMRs, waste streams, decommissioning costs, and long-term financing mechanisms must be explicitly defined and assessed at an early design stage. This prevents cost escalation over time and ensures that the financial frameworks backing national programmes are robust enough to cover actual future costs, completely insulating future generations from undue financial or environmental burdens.

SNETP supports the efforts of the European Commission to evaluate and improve the Directive on radioactive waste and the Directive on transport and shipments. The current framework has enabled significant progress, but additional action is necessary to address implementation gaps, reduce administrative burdens, and prepare for future challenges. SNETP is ready to provide its expertise and network to support the Commission and Member States in this crucial endeavour.