Agreed by the IGD-TP Executive Group at EG26 on 5th June 2018

IGD-TP position paper on the need for sustained collaborative research, development and demonstration (RD&D) in the area of radioactive waste management and disposal

1 Purpose

This position paper has been produced and agreed by the European waste management organisations (WMOs) comprising the Implementing Geological Disposal of Radioactive Waste – Technology Platform (IGD-TP). These organisations are charged at the national level with implementing European Union policy (Waste Directive 2011/70/Euratom). The paper sets out the IGD-TP's view on the current and anticipated future need for co-ordinated collaborative research, development and demonstration (RD&D) in the area of radioactive waste management and disposal. Such collaborative research could be funded by the European Commission (i.e. through the EURATOM R&D programme), by the IGD-TP itself (i.e. multilateral WMO funding), or by smaller (i.e. bilateral) WMO partnerships. This paper has been produced to document this collective view and to help to provide clarity to policy makers and funding agencies.

2 Context and background

Whatever an individual nation's national policy is regarding nuclear energy, the safe and responsible long term management of radioactive waste (including spent fuel if it is defined as waste) is required. Waste management and disposal should be clearly recognised as a back-end fuel cycle activity that will not generate profit, but is vital to support a strong and sustainable nuclear industry. Radioactive waste has and will continue to be produced, not only from the operation of existing and future power plants, but also from RD&D, medicine and other industrial uses of radioactivity. The inventory that requires long-term management and ultimately disposal therefore includes legacy waste as well as arisings from the decommissioning of past, current and future nuclear facilities, as well as waste that will likely be produced by advanced future nuclear technologies.

The recycling of actinides in advanced reactor systems (e.g. potentially future Generation IV) would maximise the energy gained from mined uranium. These advanced systems could also help to optimise geological disposal, by reducing future radioactive waste inventories, but importantly should not be thought to eliminate the need for geological disposal as a safe solution for long-term waste disposal. These new reactor systems would still generate substantial amounts of radioactive waste, although the proportion (in volume) of high-level waste is expected to be smaller. It is also unclear as to whether these new systems could realistically handle the existing, legacy high-level waste (HLW) and spent fuel (SF).

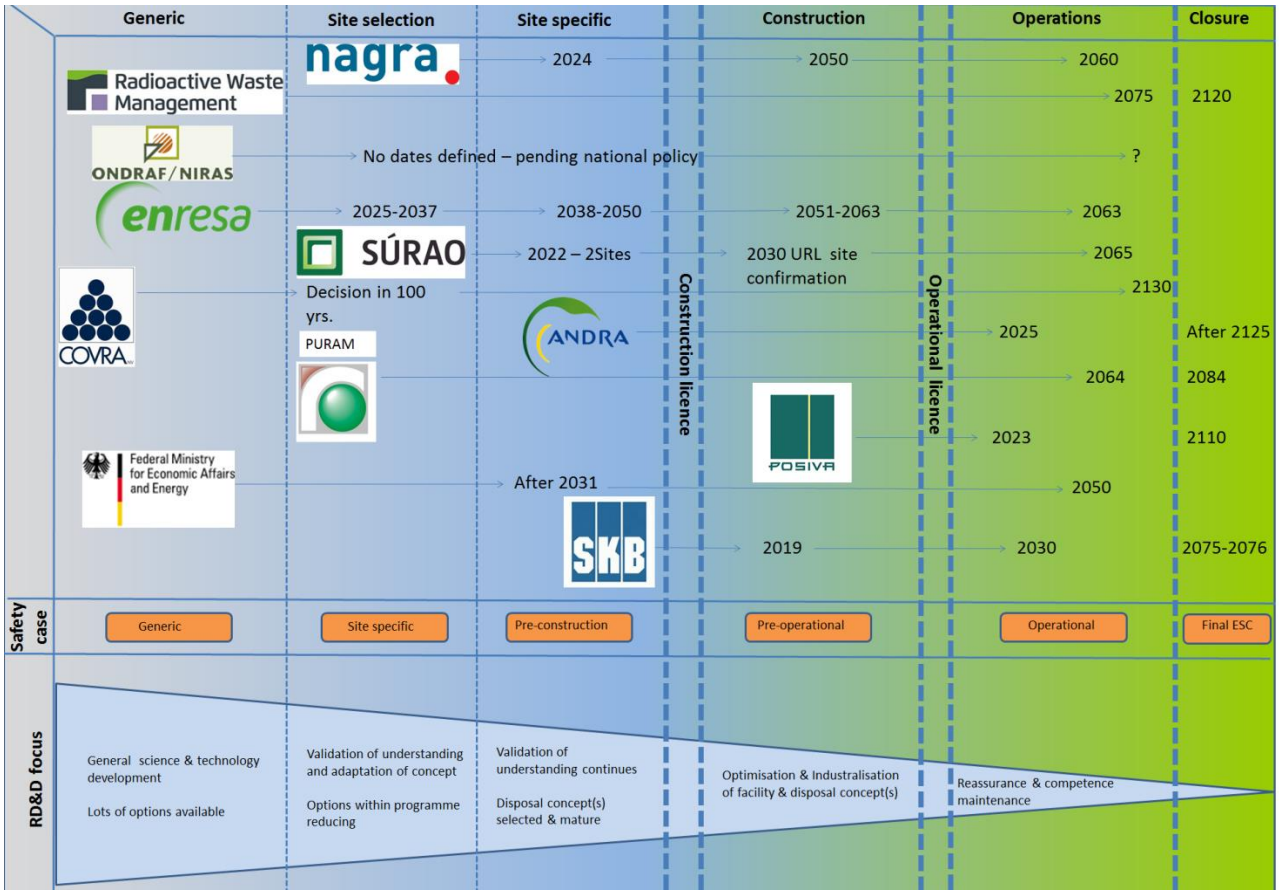
In line with the Waste Directive 2011/70/Euratom, it is of key importance to continue to address the implementation of European geological disposal facilities for high-level waste and long-lived waste in order to provide for the responsible and safe long-term management of such wastes.

The scientific and technological knowledge base that has been acquired from more than 40 years of collaborative international geological disposal research is considerable. This knowledge is now considered to be sufficient and appropriately robust to facilitate progression towards licensing and construction of geological disposal facilities. However, it is of vital importance that this knowledge is maintained, enhanced and increased throughout the incremental development, operation and eventual closure of disposal facilities, which will be spread over many decades.

To date no such geological disposal facility for high-level and long-lived waste is yet operating in Europe. However, good progress is being made in several European Programmes. The first licence for a repository for spent fuel has recently been granted and Finland has recently commenced construction. Beside the more advanced disposal programmes, several other European countries are starting to progress their own national disposal programmes.

3 Need for RD&D at different stages of programme advancement

RD&D serves several purposes. It provides input to system design and optimisation and makes essential contributions to siting of repositories. Furthermore, it contributes to achieving a sufficient level of system understanding to allow an adequate evaluation of safety. The priorities of RD&D depend upon the stage of the programme's lifecycle and change as the programme progresses. The current stage of advancement towards HLW/SF disposal facilities for each of the European waste management organisations that comprise the IGD-TP is depicted below, along with a broad indication of their RD&D focus, which is closely related to their stage of advancement.



In the early generic/site-selection phases the emphasis is on the development of basic concepts, combined with an evaluation of safety and of technological feasibility, taking into account country-specific boundary conditions. This early phase is followed by a site-specific phase where the focus turns towards system optimisation, with an emphasis on post-closure safety and, correspondingly, on site-specific geology and design concepts. The system of engineered barriers is increasingly tailored to the specific geological conditions. In the later stages (i.e. construction phase onwards), when moving towards implementation, practical issues become increasingly important, such as construction procedures, operational safety and optimisation of technology (including "industrialisation" of repository operation). RD&D does not however stop following the commencement of facility construction; it will need to continue throughout the construction and early operational phases.

RD&D effort is therefore necessary throughout the entire lifecycle of radioactive waste management and disposal programmes in order to ensure optimisation of management routes in general and of disposal solutions in particular, as well as to comply with Waste Directive obligations. RD&D must also continue in order to address evolving societal and regulatory concerns.

4 Need for continued investment in RD&D

Underpinning knowledge base

In line with the Waste Directive 2011/70/Euratom, in order to provide responsible and safe radioactive waste management it is vital that the European community continues to develop underpinning knowledge that facilitates implementation of geological disposal and demonstrates the operational and long-term safety of disposal facilities. This is instrumental in building public and regulatory confidence, as well as in demonstrating the implementation of national policies.

Human resources and infrastructure

When establishing an RD&D programme, sufficient thought has to be given to the personnel and infrastructure necessary to undertake the work; for that purpose, it is highly beneficial to stimulate opportunities for co-operation with other waste management organisations in a bilateral or multilateral manner or within the framework of international projects and organisations. Specifically, the IGD-TP provides many opportunities for RD&D collaboration in a flexible manner.

As quoted in the Waste Directive 2011/70, the IGD-TP has a role in knowledge and technology transfer towards national programmes at earlier levels of advancement or European nations wishing to embark on a nuclear programme.

There is a high risk of shortage, at the European level and at short to medium timescales, of the skilled, multidisciplinary human resources needed to develop, assess, licence and operate geological disposal facilities; this shortage may affect not only waste management organisations, but also authorities, research organisations, academia and supplier industries. Furthermore, this risk is relatively unique to the radioactive waste community/domain due to, for example, the energy shift, nuclear phase out in certain countries and the long duration of geological disposal projects. Dedicated RD&D efforts have an additional benefit of helping bridge this shortage.

Flexibility to address arising stakeholder concerns

Stakeholders' concerns regarding the safety of geological disposal and protection of the environment must be addressed in a systematic way and the commitment of local communities that will host geological disposal facilities must be maintained over many years. Dedicated RD&D will likely help to address any arising future concerns.

Continuous improvement

The challenge of managing radioactive waste through geological disposal is no different to any other domain or challenge that necessitates a highly technological solution. Continued RD&D will be required throughout a stepwise implementation programme in order to be able to deliver continuous improvement and optimisation of geological disposal facilities. This need will remain even once the first European geological disposal facilities are constructed and safely operating.

RD&D plays a major role in addressing these four needs.

5 IGD-TP Position

As representatives of the implementers of geological disposal in their respective nations, the IGD-TP Executive Group asserts that a sustained, co-ordinated and collaborative RD&D programme in the area of radioactive waste management and disposal is vital to ensure that all European countries, at various levels of advancement, continue to progress towards implementation of geological disposal. The group also highlight that RD&D will not stop following successful implementation, but should remain during the construction and operational phases. The same level of RD&D effort will not be applied continuously, it will need to be adapted and re-prioritised as national programmes progress and the European Community's needs evolve. If near-term investment was to be substantially reduced the consequences would be significant, potentially risking the ability of European Member States to successfully implement geological disposal of spent fuel, high-level waste and other long-lived radioactive waste in a timely manner. Finally, the IGD-TP is acutely aware of the importance and significance that regulators and host communities (current, potential and future) often place upon involvement in international collaborative RD&D. RD&D efforts should therefore be maintained to help build and maintain societal confidence in geological disposal.