

Minutes of SAMIRA Workshop - Management of spent fuel and radioactive waste arising from non-energy uses of nuclear and radiation technologies on 13 November 2019

Session 1: Setting effective strategies for waste management from non-energy uses.

Chair: Liisa Heikinheimo, Deputy Director General Nuclear Energy and Fuels, Energy Department, Ministry of Economic Affairs and Employment, Finland

1. Management of spent fuel and radioactive waste in the context of the Council conclusions on non-power nuclear and radiological technologies and applications, Roxana Banu, Permanent Representation to the European Union, Romania
2. Management of non-energy spent fuel and radioactive waste in Sweden, Erica Brewitz, Senior specialist, the Swedish Radiation Safety Authority, SSM
3. Management of non-energy spent fuel and radioactive waste in Lower Saxony, Hilke Hattermann, Specialist, Ministry for the Environment, Energy, Building and Climate Protection of the State of Lower Saxony, Germany
4. Management of non-energy spent fuel and radioactive waste in Spain, Elena Vico Del Cerro, head of the Safety and Licencing Dept., ENRESA
5. The Euratom Joint Programme EURAD – the ROUTES project, Elisa Léonie, position, IRSN

Use on nuclear and radiation technologies is important in all Member States. The technologies are in use on several vital areas, such as medicine, industry, research and environment. A wide variety of technologies is currently in use in these areas.

The nuclear and radiation technologies produce radioactive waste and/or spent nuclear fuel in all Member States. Waste has been and will be produced regularly for long times. However, the amounts of radioactive wastes compared to other wastes are small. The characteristics of wastes differ between technologies in use. Some of the wastes are more difficult to manage than others.

Members States must take responsibility of management of radioactive waste produced in the connection of use on nuclear and radiation technologies. This is required in the directive 2011/70/Euratom. These wastes must also be included in the Member States national policies, strategies and programmes according to the directive. The safe and cost-effective management of all wastes, including the most difficult ones, is a common challenge to all Member States.

Member States may have different strategies for waste management. Member States may have centralised or distributed facilities for storage and disposal of radioactive waste. Although Member States have the ultimate responsibility of waste management, some responsibility can be assigned to the waste producers. Also private companies offering waste management solutions may be involved. All these strategies have strengths and challenges, and sharing this information is valuable and may enhance Member States' waste management.

The waste management may have linked technical and economic challenges as well as challenges of acceptability to the society. The acceptability of waste management is essential part of responsible and safe management of spent fuel and radioactive waste. Lack of acceptability may be related to the perceived link between radioactivity and nuclear power production and may, in some case, even cause rejection of proven techniques or facilities suitable for waste management. Better and wider public discussion on risks of radioactivity compared to other risks may help addressing these challenges..

The challenges may include, on one hand, the absence of suitable technology for management of certain waste types or, on the other, the lack of appropriate facilities where / when they are needed. Challenges may also include legacy waste with sparse documentation of the waste inventories and aging of the waste packages in stores. Both of these cause also additional costs. Development of techniques might not be attractive business for private companies as the amounts of the wastes are small and differing characteristics of the wastes make standardized and/or industrialized processes difficult to build.

Private companies provide pre-disposal services in some Member States. However, companies' limited affinity to taking economic risks may result in an increase in waste management costs and delays in waste management. The fees the waste producers pay an important role: if the fee is too low to cover the waste management costs this may lead to the company terminating the service; if the fee is too high, the waste producers will search for other possibilities leading to delays in waste management. The long-term nature of waste management is associated with many uncertainties and makes realistic cost estimates quite difficult.

Challenges also exist in the formulation of waste acceptance criteria and the ability of all waste generators to meet these criteria. Although the waste acceptance criteria are essential for safe disposal, unnecessarily tight criteria might lead increased amounts and types of wastes without management plans.

Some Member States with nuclear power programs have organised their management of radioactive waste from non-power nuclear and radiation technologies by integrating them with management of waste from nuclear power production. The combined management has its strengths and challenges. The major strength is the strong know-how, expertise and existing waste management facilities in the nuclear energy sector of production. Also, the characteristics of the wastes are mostly similar although some differences exists. Furthermore, the amounts of wastes and the associated additional work load are small compared to nuclear energy production the nuclear energy sector. The combined management is, however, dependent on the duration of the Member State's nuclear power programme. The combined management will meet the same or similar challenges as non-combined management approach when very specific waste types need to be managed.

As the safe and cost-effective management of radioactive waste is a common challenge to all Member States, there may be opportunities for supra-national cooperation in this area. The initiative for the collaboration must come from the Member States. The cooperation may include, for example, common R&D programmes and frameworks for development of waste management solutions. The cooperation may also include shared and mobile / modular radioactive waste management services and facilities. Shared facilities would require political and societal acceptance. One technical issue to enhance the use of shared facilities would be use of harmonised waste acceptance criteria. The criteria given in EU regulation from 1999 may be useful. The Commission may be given a specific mandate to help in the harmonisation of waste acceptance criteria.

Session 2: Maintaining adequate sectorial skills & resources

Chair: Said Abousahl, Head of Unit Euratom Coordination, Joint Research Centre (JRC), European Commission

1. The Finnish approach to maintaining adequate sectorial skills and resources, Jussi Heinonen, Director of Nuclear Waste Management, Radiation and Nuclear Safety Authority, STUK
2. Radioactive Waste Management - the perfect career, Ian Gordon, Section Head - Waste Technology Section, IAEA
3. Title or presentation TBC, Franck Wastin, Head of Unit Knowledge for Nuclear Security and Safety, JRC

Member States are responsible for maintaining and developing required skills and resources. National radioactive waste management policy, strategy and plan have to also address skills and resources issues. In Member States with advanced waste management programmes, the challenge may be maintaining skills and resources which are used seldom, e.g. only ones in a decade.

It is important that each Member State maintain the skills and resources specific to their needs. The Member State's program may change, e.g. new waste types might be produced and necessitate its handling, storage and disposal. Thus, safety of waste management must be reviewed or further analysed. In addition, the understanding of the overall safety must be kept at all times.

Some Member States have reviewed critical skills and resources, which must be kept in the Member State. The skills and resources are the ones which are specific to the Member States' waste management programme and development of the skill would require long times. Similar reviews have also been done in the EU level. National and EU level R&D programmes are one way to develop and maintain skills and resources.

New persons must also come to the field as waste management activities last for long times. Some Member States have noticed that young people are not interested in a career in management of radioactive waste. This is concerning development, which must be changed, e.g. by influencing young people's attitudes towards radioactivity and management of radioactive wastes.

Session 3: Topical challenges across diverse applications

Chair: Jussi Heinonen, Director of Nuclear Waste Management, Radiation and Nuclear Safety Authority, STUK

1. Status, requirements and way forward for the sustainable management of used nuclear fuel and radioactive waste from EU research reactors, Vanessa Vo Van, Vice-President Back-end Sales, Orano
2. Decommissioning of research reactors in Finland, Linda Kumpula, Senior specialist, Nuclear Waste Management, Ministry of Economic Affairs and Employment, Finland
3. Management of radioactive waste from the production of radioisotopes, Gregory Delecaut, Head of Business Unit Services, Institute for Radioelements, IRE
4. Management of radioactive waste in a busy nuclear medicine department, Jennie Cooke, position TBC, Saint James's hospital Dublin
5. Recumo – Recovery of uranium from residues of ⁹⁹Mo based radio-pharma in Belgium, Sammy Shihab, RECUMO Director, SCK CEN (Belgian Nuclear Energy Center at Mol-Belgium)
6. Management of disused sealed sources and radioactive wastes from non-energy applications in Italy, Alessandro Dodaro, Director of Fusion and Technology for Nuclear Safety and Security Department, ENEA; President, Nucleco SpA

Orano provides used nuclear fuel and radioactive waste management services for EU research reactors. Research reactors consist high variety of materials in small quantities and the challenge is to build standardized / industrialized processes. Orano has been able to develop robust capacities in management of used nuclear fuel including transportation, reprocessing and management of final waste based on decades of industrial experience with reprocessing of power reactors' used nuclear fuel. A way forward is to implement additional service capacity for management of larger range of used nuclear fuel from non-power applications addressing thus the EU research reactors special fuel management needs. Moreover, the EU research reactors operators can rely on Orano's extensive experience in radioactive waste management for its own and also worldwide operator needs to build optimized radioactive waste management strategies.

Based on Finland's experience on Finnish Research Reactor FiR1 and its decommissioning, waste management of non-energy waste is possible to combine nationally with the waste management of waste produced in connection with use of nuclear energy. Combined national waste management needs cooperation between waste producers based on commercial agreements, agreements on liability issues, cooperation enabling legislation and sociological acceptability. In cases of very specific waste types that are unique in the national waste inventory, it might be feasible to have supra-national cooperation for the waste management, either for the treatments of the wastes or both treatments and disposal. Although the amount of waste produced in connection with non-energy use is less than that produced in connection with the use of nuclear energy, waste management must still be in place early enough for both.

Institute for Radioelements, IRE is an important supplier of ^{99}Mo , ^{131}I , ^{133}Xe and $^{68}\text{Ge}/^{68}\text{Ga}$ isotopes. Isotope production produces high, intermediate and low level radioactive waste. IRE ensures a proper management of its radioactive waste through a very good knowledge of its production processes and the resulting waste fluxes; a continuous traceability of the waste packages; an on-site waste storage facility; dedicated radiological characterization systems approved by the relevant authorities; maximizing waste clearance and limiting the production of radioactive waste by increasing workers awareness. The shift, due to security reasons, to low-enriched uranium for radioisotope production will cause a significant increase in the amounts of radioactive waste generated, which should be considered in waste management plans and programmes.

St. James's Hospital, Nuclear Medicine Department uses various isotopes with different half-lives for treatment of patients. Use of isotopes produces radioactive waste requiring different storage times. The wastes are formed during treatment preparations, uptake time and from inpatients. Wastes contain e.g. gowns, gloves, wipes, tray liners, needles, glass vials, vaporisation sets, sheet, towels and body fluids etc. Thus, the waste volumes are quite large. Wastes are stored until decayed to background level. Some wastes have to be stored for up to six months before moving to general waste collection point. The predicted major increase in the use of radionuclide therapy will create new waste management challenges that may be impossible to meet at the level of individual hospitals and would call for national solutions.

Recovery of uranium from residues of ^{99}Mo is developed in RECURO Project (SCK•CEN, IRE). The project will help to ensure the secure supply of radioactive isotopes for medical purposes. The solution is efficient for both HEU and LEU residues. The process will produce solid and liquid radioactive waste. The wastes will be transported to Belgoprocess for further processing and storage. The project is now in its licensing steps and the operation is planned to start in 2023. The planned duration of the facility is more than 20 years.

Management of disused sealed source and radioactive wastes from non-energy applications in Italy have been arranged via several operators. National Agency for New Technology, Energy and Sustainable Economic Development (ENEA) is the public supervisor of the Integrated Service, performing the function of direction and control of the entire management cycle. ENEA assumes the ownership of the collected waste and takes charge of their disposal, releasing the waste producer from any legal responsibility. The Integrated Service is a group of Operators, which ensures all the stages of radioactive waste management cycle produced in the above-mentioned fields. All the plants and operators, which undertake collection activities and possible temporary storage of dismissed sources, may ask to join the Service. The National Operator ensures the long period safety of disused radioactive sources for the purposes of their future disposal, ensuring safe storage for a period of at least fifty years; and comply with the same safety

requirements for the storage of radioactive waste from energy source. The National Operator is the company currently managing the Italian dismissed nuclear facilities: Sogin S.p.A. Sogin has been assigned also the task of siting, building, and operating the Technology Park and the National Repository for radioactive waste.

Closing session: Panel discussion, closing remarks and next steps

Chair: Liisa Heikinheimo, Deputy Director General Nuclear Energy and Fuels, Energy Department, Ministry of Economic Affairs and Employment, Finland

Gianfranco Brunetti (COM) started with the awareness of the public on the radioactive applications and on the waste management issues increases the health of the society.

The full life cycle of the use of radioactive and nuclear applications should be considered when used.

A practical question is how we can ensure that pricing is covering all the future costs of the waste management when the responsibility is handed over to a waste management organisation or company. We know that there are several uncertainties in the sorting of the wastes, the contents of the wastes and in the behaviour of the packages in long-term storages. The second question is how we can estimate the future price for the final deposition. Is this an issue that should be tackled on a governmental level in each of the member country?

Small quantities and very specific wastes will be produced from the various applications. This is a dilemma of the non-power uses of nuclear and radioactive technologies in industry, medical uses and in research. There are 3,5 million m³ radwaste in Europe, meaning 7 liters of waste per inhabitant. The share of wastes from the non-power uses is however very small. It is very important to discuss on this issue with the council and the member states.

In the workshop several suggestions to develop the waste management has been pointed out:

- Pooling of the technologies, services and knowledge is important between the member States.
- The waste acceptance criteria should be developed from the uses to the waste management processes. This initiative could be developed by the Commission if the member states see this needed.
- The concept of graded approach was missing from the workshop presentations, meaning processes developed for different levels of wastes (activity) and different nuclides in the wastes (half time for the nuclides rule the lifetime for the guarding of the wastes after disposal etc. In this approach the nuclear power safety approaches could be mirrored for grading.

Ian Gordon (IAEA) stated that the development of policies and strategies is essential, there is a report by IAEA readily existing for this. An appendix with the "X-land case" is presented in this report.

Practical solutions, mobile solutions, modular solutions for processing and recycling the wastes as appropriate should be developed and benefited, especially when no national or local solutions are available. An example of this is the IAEA modular "box" for handling and packing wastes in areas where local solutions do not exist. For the licensing of this type of solutions, the example of shipping and transportation of spent nuclear fuels could be used.

The standardisation of various solutions and sharing the knowledge on these is very important, standardised solutions are available today if they could be licensed for different member states.

Said Aboushal (JRC) spoke about the competencies and competence build up that should start at a national level.

It is very important to have a strategy, policy level and clear planning for the waste management generated by non power energy uses. The waste management itself is technical and includes the characterisation, conditioning, storage and some of the technologies/techniques can be shared with other hazardous waste technologies or those developed for waste generated by nuclear energy.

Instruments and tools are available to complement the national activities on a European level. A survey on the nuclear skills at European level is available and help triggering new initiatives for training and education.

IAEA and OECD NEA organisations are important for this field too with their international guides and standards covering the nuclear and radioactive waste management.

Synergies between nuclear, non-power and hazardous chemical wastes may be further explored.

In the last session some active solutions were presented by Orano and SCK. It would not be wise to isolate the waste incinerator applications to be used only for the wastes from the nuclear power uses. The decommissioning wastes are also close to other wastes from the non-power uses.

Jussi Heinonen (STUK) stated that there different types of waste streams need to be recognised. Different solutions and developments are available for these. Countries with nuclear energy-production have different solutions and paths for the wastes from the non-power uses that countries without the energy uses. The management solutions are different.

Disposal is difficult to reach due to the political issues and local acceptance problems for the repositories. To overcome the risks in the storage common requirements for the handling and packing would be needed.

In different countries different solutions exist, both national solutions and commercial solutions. With standard requirements and acceptance criteria these would be equally safe in uses.

A difficulty in benefiting the services outside of a country exist due to the banning of waste export or import. We could think of a graded approach also to these limitations and make the radioactive waste management available more widely.

Georgi Simeonov commented that the waste generation is very distributed, the wastes are of various types and the amounts are often quite small. More development and flexibility in the waste management (and the licensing and regulations) may be needed. This situation calls for a direct exercise of Member States' responsibility through national solutions for collection, processing and storage of radioactive waste from non-power applications.

Closing remarks were made by Jan Jilek (COM), he thanked FI for initiating this topic for the workshop. The debate fulfils the goals of the workshop. An important issue would be enabling the shared solutions for the waste management when sought.