# WENRA’s Safety Reference Levels contribute to continuous improvements and harmonisation of regulatory approaches for radioactive waste management in many European countries

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**Abstract**

The paper describes the positive impact of WENRA’s Safety Reference Levels (SRLs) in helping to harmonise and improve regulatory approaches for radioactive waste management in many European countries. The Western European Nuclear Regulators Association (WENRA) is a group comprising the heads of the regulatory bodies of 18 European countries, together with 13 associated members and observers from Europe and the rest of the world. WENRA’s aim is to develop a common approach to nuclear safety, and to allow chief nuclear safety regulators in Europe to exchange experience and discuss significant safety issues. WENRA has established three thematic working groups, including the Working Group on Waste & Decommissioning (WGWD) which addresses the regulatory aspects relating to radioactive waste, spent fuel and decommissioning matters, and typically comprises the national regulator’s head of department for radioactive waste management for each WENRA country. WENRA has developed six sets of Safety Reference Levels (SRLs), which reflect expected practices agreed by the regulatory authorities to be implemented in the WENRA countries. SRLs are expectations against which each WENRA member state is assessed, and each WENRA member has committed to implement actions to ensure the SRLs are met within its national regulatory framework. SRLs build on, and are complementary to, the IAEA’s Safety Standards. Three sets of WGWD SRLs (comprising 240 separate Safety Reference Levels) relating to the processing, storage and disposal of radioactive waste are the focus of this paper. The SRLs are administered by WGWD which gives a rating for each member state’s performance against each SRL. Each country undertakes a national self-assessment against each SRL, which is then benchmarked or moderated by the members of WGWD, with a rating of A (fully conforming with SRL), B (not applicable, or SRL addressed satisfactorily in another way) or C (improvements needed). Member states which identified areas for improvement then develop a National Action Plan to respond to the findings, usually within a period of 2 to 3 years, and undergo re-benchmarking. This paper presents the harmonisation approach developed within WGWD and includes case studies on implementation of WENRA SRLs from diverse countries such as the Czech Republic, Spain, France, Ukraine, Slovakia and the UK. The paper concludes with an assessment of the significant progress made by WENRA member states in harmonising and improving their regulatory approaches for radioactive waste management.

## INTRODUCTION

The Western European Nuclear Regulators Association (WENRA) is an international body made up of the heads of nuclear regulatory authorities of European countries with nuclear power plants. WENRA was established in 1999 and comprises 18 European countries, together with 13 associated members and observers from Europe and the rest of the world. The main objectives of WENRA are to develop a common approach to nuclear safety, to provide an independent capability to examine nuclear safety and to be a network of chief nuclear safety regulators in Europe exchanging experience and discussing significant safety issues.

WENRA has established three thematic working groups: the Reactor Harmonization Working Group; the Working Group on Waste & Decommissioning (WGWD); and a newly formed Working Group on Research Reactors. WGWD was established in 2002 and addresses the regulatory aspects relating to radioactive waste (RAW), spent fuel and decommissioning matters. Unlike the regulatory situation with respect to the operation of nuclear reactors, the management of RAW usually involves several licence holders, locations and facilities at different steps of the waste management process.

WENRA has developed six sets of Safety Reference Levels (SRLs), which reflect expected practices agreed by the regulatory authorities to be implemented in the WENRA countries. In December 2005 WENRA members agreed a policy statement in Stockholm committing them to improve and harmonise their nuclear regulatory systems, using as a minimum, the SRLs. Four sets of SRLs have been developed by WGWD and are structured to address thematic activities applicable to a wide range of facilities, regardless of the main purpose of the facility in question. Some of them address specific facilities, like the disposal report; others are primarily activity-oriented, like the processing report.

The four thematic areas developed by WGWD are: storage of RAW and spent fuel; decommissioning of nuclear facilities; disposal of RAW; processing (i.e. treatment and conditioning) of RAW. Across all four WGWD thematic areas there are 302 separate SRLs, for which 240 relate to the processing, storage and disposal of RAW (the focus of the paper) and 62 relate to decommissioning.

The paper describes the methodology used by member states to achieve compliance with the SRLs (and therefore harmonisation) and their progress against the existing WGWD SRLs and describes the experiences of achieving compliance using a series of case studies. The paper concludes with a discussion of the benefits of harmonisation and areas of future work for WGWD.

## Methodology

The process of each member state assessing compliance with the SRLs follows a two-step benchmarking methodology. In the first step all participating countries perform a self-assessment of their national regulatory system against the SRLs. Across all WENRA Working Groups, three scores are used uniformly in the benchmarking of SRLs: A, B and C. An ‘A’ rating means that the requirement is covered explicitly by the national regulatory system: no action is required. A ‘B’ rating means that a difference exists but can be justified from a safety point of view: no action is required. A ‘C’ rating means that a difference exists and should be addressed in the national action plan for harmonisation purposes.

For the self-assessment, each country justifies the proposed rating by quoting the relevant text sections from the corresponding national regulation in an evaluation table. In the second step of the benchmarking, the self-assessment is reviewed by other countries and the results are ratified by the plenary of all WGWD member states. In this open and transparent process, WGWD scrutinises rigorously the evidence presented. Where necessary Member states then develop national action plans (NAPs) to harmonise their national regulations with WENRA SRLs.

## Results

Member states are progressing towards full compliance against the SRLs in each thematic area (Fig. 1). To track progress a ‘snapshot’ is taken periodically by WGWD to update the thematic reports. Between these updates, progress is discussed more informally through bi-annual WGWD meetings.

Greatest progress has been made in the areas of storage and decommissioning; in both areas all member states are either fully compliant or implementing an NAP. With different national programmes for disposal of radioactive wastes and different facility requirements for low activity wastes and higher activity wastes, the pace of progress against the disposal SRLs is more varied and more dependent on the country’s national programme. Processing of RAW, including treatment and conditioning, is the latest and most recent thematic area for which WGWD has developed SRLs and therefore progress by member states towards self-assessment and benchmarking is currently less mature.

To understand where progress is being made in harmonising safety to a common base level, it is necessary to analyse common areas where member states both do and do not achieve compliance with SRLs. Fig. 2 shows the number of countries achieving compliance with the SRLs for RAW storage both during the benchmarking exercise and after implementing an NAP intended to address all shortfalls in compliance. As can be seen in Fig. 2, compliance with SRLs increases markedly with implementation of the NAP.

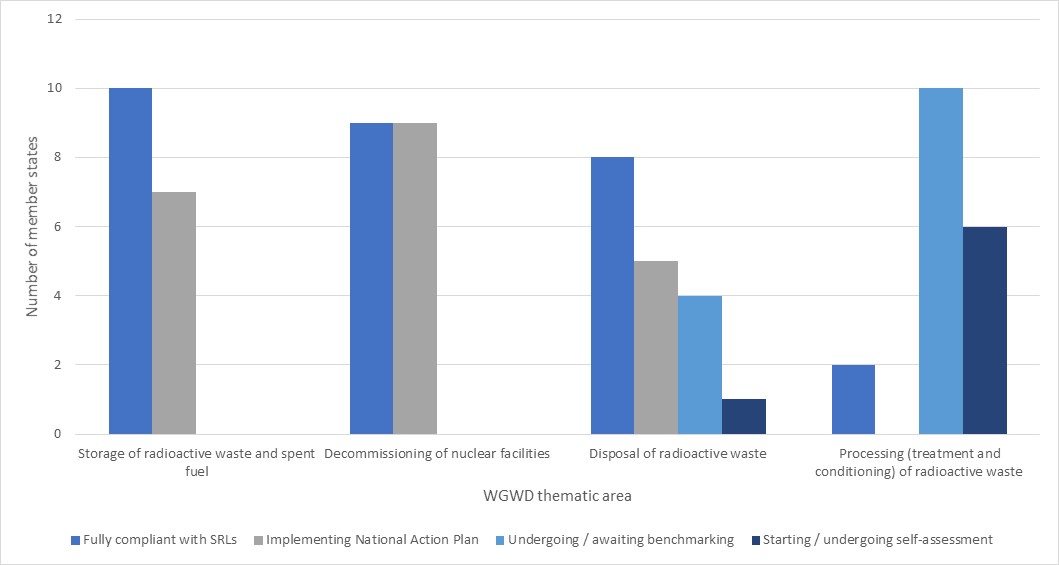


FIG. . Chart showing progress towards full compliance with the SRLs for each of the thematic areas.

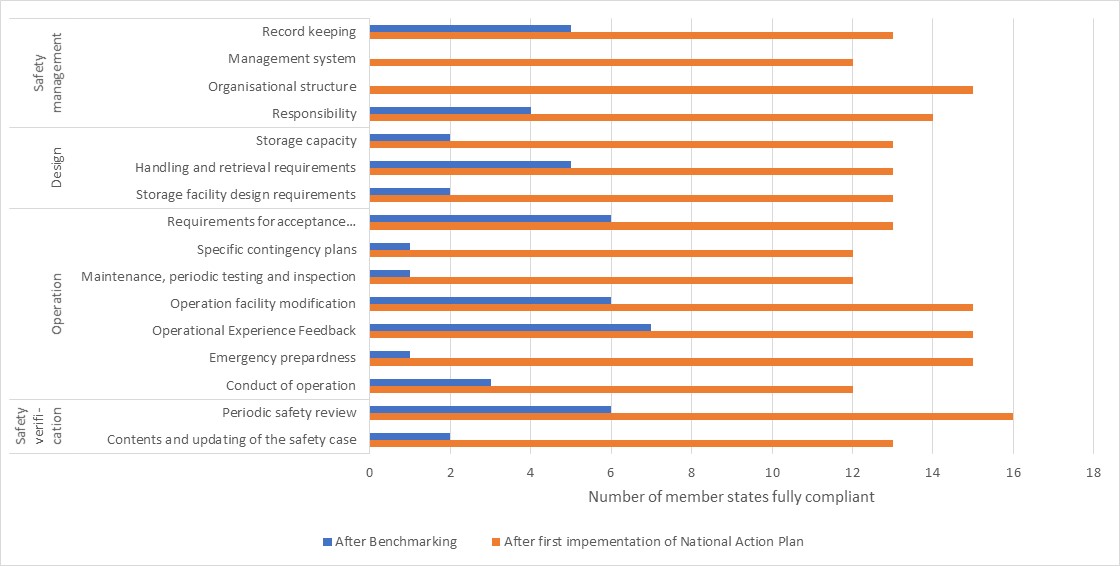


FIG. . Chart showing progress towards SRL compliance for radioactive waste storage.

## Case studies

The results presented above show broadly the level of harmonisation attained across the member states for each of WGWD thematic area. Seven national case studies are presented below illustrating with insights how the SRLs have contributed, or are contributing, to continuous improvements, and the challenges occasionally faced in harmonising regulatory approaches.

### Ukraine

The State Nuclear Regulatory Inspectorate of Ukraine (SNRIU) is a central executive body, whose activities are directly coordinated by the Cabinet of Ministers of Ukraine who are responsible for the formation and implementation of state policy in the field of nuclear energy safety. In 2015, SNRІU became a member of WENRA and WGWD.

The Ukrainian legal and regulatory framework in the field of nuclear energy use, including RAW management, is now largely comprehensive. The first nuclear regulations were developed in the mid-1950s in the former Soviet Union, part of which was Ukraine. Ukraine gained independence in 1991 and since then has continued to improve and develop legislation in the area of nuclear energy use.

The Ukrainian legislative framework governs the use of nuclear energy and nuclear and radiation safety including RAW management. The fundamental document in this sphere is the Law of Ukraine “On Nuclear Energy Use and Radiation Safety” [1] which came into force in 1995, with changes and amendments introduced later. Certain aspects of the use of nuclear energy, nuclear and radiation safety are regulated in special laws, in particular, the laws “On Radioactive Waste Management” (1995) [2], “On Human Protection against Ionizing Radiation” (1998) [3], “On Ratification of Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management” (2000) [4] and “On Permitting Activities in the Field of Nuclear Energy” (2000) [5]. The nuclear legislation system also includes regulations of the Cabinet of Ministers of Ukraine, standards and rules on nuclear and radiation safety.

SNRIU harmonises its regulations with the requirements of the European Union, IAEA recommendations and WENRA SRLs. Membership in WENRA and participation in WGWD encourages SNRIU to develop new regulations and revise existing regulatory acts. WGWD’s benchmarking procedure and SRL-compliance reporting is viewed as a good mechanism to improve national regulations.

SNRIU annually approves plans for the development of new and improvement of existing regulatory requirements (including RAW management and decommissioning). These documents must comply with WENRA’s SRLs. As a member of WENRA, the SNRIU in a short period of time has developed documents on RAW processing facilities, and general safety provisions on decommissioning and RAW disposal taking into account WENRA’s SRLs.

The benchmarking results demonstrate quite good compliance of new Ukrainian regulatory requirements with WENRA’s SRLs. Regarding RAW disposal, the regulatory requirements now fully comply with SRLs. For the storage and processing of RAW, some regulatory requirements need to be improved, in particular, in terms of determining the owner of RAW, the use of mobile installations and the provision of passive protection measures in the design of facilities. SNRIU is committed to making these improvements.

After the above regulatory documents came into force, wherever possible licensees are obliged to bring their activities and facilities for RAW management in line with the new requirements. Licensees must develop appropriate plans for approval by SNRIU, and then implement any necessary corrective measures. New facilities for RAW storage, disposal and processing must be created in full compliance with the new safety requirements.

### Netherlands

The Netherlands has one central facility for interim storage of all radioactive waste and spent fuel: the Central Organisation for Radioactive Waste (COVRA). It is the sole company in the Netherlands tasked with collecting, processing and storing all radioactive waste. All businesses in the Netherlands which have a permit pursuant to the Dutch Nuclear Energy Act to work with radioactive substances are obliged to tender their radioactive waste to COVRA and transfer it as soon as reasonably possible.

As COVRA is the sole facility for the storage of radiological waste and spent fuel in the Netherlands, the WENRA SRLs are implemented not only in national legislation but also directly in the COVRA licence. This ensures practical implementation of the WENRA SRLs in dealing with radioactive waste in the Netherlands.

For the Netherlands, having one centralized storage facility is a security measure that facilitates the implementation of the principles of isolation and control of radioactive waste. It also facilitates the regulatory supervision of the waste facility.

WENRA has introduced SRLs, aiming to harmonise reference levels for nuclear safety, the safe management of spent fuel and radioactive waste and for decommissioning. Within the scope of this paper the WENRA SRLs for storage of radioactive waste and spent fuel and for decommissioning are especially relevant; these must be implemented in the Dutch regulatory framework. An example is the regulation on decommissioning and financial provisions for the costs of decommissioning in the Governmental Decree Bkse, an important part of which was based on the WENRA SRLs.

The Dutch Authority for Nuclear Safety and Radiation Protection (ANVS) participates as the competent authority in the WENRA WGWD. In developing and designing Dutch policy on radioactive waste, regulations and supervision, the ANVS and the ministries involved closely follow European and other international frameworks. Furthermore, links are sought with internationally accepted principles, recommendations, practices and agreements as established under the IAEA, Heads of the European Radiological Protection Competent Authorities (HERCA) and WENRA. To guarantee nuclear safety and radiation protection remain up to date in relation to RAW management, both the competent authority and COVRA participate in international peer review mechanisms. Dutch policy on the management of radioactive waste and spent fuel is also periodically assessed by other countries, in the framework of the Joint Convention treaty and the EU directive 2011/70 Euratom.

### United Kingdom

The nuclear regulatory framework in the UK is different from that in most countries in Europe. The Office for Nuclear Regulation (ONR) is the UK regulator for nuclear safety, security and safeguards, for radioactive materials transport by road and rail and for non-nuclear safety on nuclear sites. Environmental protection on nuclear sites and in respect of radioactive material more widely is regulated by the environment agencies established within each separate country of the UK: the Environment Agency (in England), Natural Resources Wales, the Scottish Environment Protection Agency and the Northern Ireland Environment Agency.

ONR enforces a wide range of legislation including the Nuclear Installations Act 1965 [6], the Health and Safety at Work etc. Act 1974 [7], and associated regulations. The environment agencies also enforce a range of legislation including the Environmental Permitting (England and Wales) Regulations 2016 [8] and the Environmental Authorisations (Scotland) Regulations 2018 [9].

The nuclear industry in the UK is diverse, and includes operating reactors, fuel enrichment and fabrication facilities, research and sites in varying states of decommissioning, some of which have been operated since the 1940s. With such a diverse industry and with well-established legislative and regulatory regimes, the UK decided to join WENRA and WGWD early in their inception. Through the self-assessment and benchmarking process described in Section 2, the UK has been shown to be fully compliant with the SRLs for waste and spent fuel storage, as well as for decommissioning. Compliance with the SRLs for RAW treatment and conditioning, and those for disposal, is ongoing and the UK has been shown to be largely compliant so far. The SRLs for which further evidence is required to demonstrate compliance with, in terms of RAW conditioning and treatment, relate largely to demonstration and assurance of product quality, including acceptance of unconditioned waste against the operating treatment envelope, ensuring the conditioned product complies with its specifications and provisions for products that do not meet those specifications.

ONR’s regulatory guidance considers WENRA’s SRLs to constitute ‘relevant good practice’ in the UK, and this is part of the regulatory basis for considering whether the licensee has met its legal duty to ensure health and safety “so far as is reasonably practicable”. Under the Legislative and Regulatory Reform Act 2006 [10], regulators are required to carry out regulatory activities in a way which is transparent, accountable, proportionate and consistent, and are targeted only at cases in which action is needed. The requirements of the relevant licence conditions and environmental permit conditions are sufficiently goal setting, rather than prescriptive, such that compliance with the SRLs is achieved through the regulatory regime without requiring legislative change.

### France

ASN was created by the 13 June 2006 Nuclear Security and Transparency Act [11]. It is an independent administrative authority responsible for regulating civil nuclear activities in France. On behalf of the French State, ASN ensures the oversight of nuclear safety and radiation protection to protect people and the environment.

Basic Nuclear Installations (BNI) are facilities which, by their nature or by reason of the quantity or activity of radioactive substances they contain, are subject to special provisions to protect people and the environment. The general technical regulations, provided by article L. 593-4 of the environment code, include all the texts of general scope establishing technical rules on matters of nuclear safety, whether they are ministerial orders or ASN regulatory decisions. They are supplemented by circulars, fundamental safety rules (RFS) and ASN guides, which are non-binding. The objective is to have general technical regulations for BNI that are adapted and proportionate to the issues of safety and radiation protection and reflect the best safety standards.

ASN was a founder member of WENRA in 1999 and has participated in WGWD since the beginning of 2002. The most recent benchmarks for France have been performed for ‘Decommissioning’ SRLs in February 2013, ‘Storage’ SRLs in April 2014, ‘Disposal’ SRLs in September 2015, and ‘Waste Treatment and Conditioning’ SRLs in September 2018 and March 2019. The French case study focuses on RAW treatment and conditioning and disposal SRLs.

In January 2019, 89% of WGWD’s SRLs were implemented in French regulations mainly through the Order of 7 February 2012 setting general rules for BNI, and in ASN’s decisions. The remaining SRLs were B‑rated or addressed in an NAP for benchmarking.

Before 2017, in the French legal and regulatory framework, provisions on waste packages and acceptance criteria were limited to a provision in the environmental code which requires that the waste management organisation (WMO) shall provide acceptance criteria for its disposal facilities, and must also give its opinion on the specification of waste conditioning to the competent authority. In chapter VI of the order of 7 February 2012 [12], articles 6.7 and 6.8 require in particular that RAW packages shall be compatible with the subsequent management steps, and that the conditioning of RAW packages intended for RAW disposal facility which is not yet operational is submitted for the approval of ASN.

From 2010 to 2017, ASN developed a decision relating to the conditioning of RAW and the conditions of acceptance of RAW packages in disposal BNIs. At the same time, ASN participated to the development of reports on Disposal SRLs (2014) and Treatment and Conditioning SRLs (2018). Discussions in WGWD assisted an in its decision making. Thus, ASN’s decision contains provisions related to:

* RAW package acceptance criteria for disposal facilities (chapter 2.3 of the Disposal SRL report);
* the process of authorisation of waste package processing operations whether the package is intended for an existing disposal facility (authorised by a WMO) or a facility still under development (authorised by ASN);
* the conditioning baseline requirements needed to be submitted for authorisation;
* clarification of responsibilities between owner and processing facility operator.

The decision was published on 23 March 2017 [13] and came into force in July 2018. Since its publication, ASN has strengthened its inspections in this field.

### Czech Republic

The Czech Republic decided to join WGWD in 2004 to harmonise its regulatory framework with SRLs, and ever since has taken a leading role in WENRA and WGWD. At that time three near-surface and underground RAW disposal facilities and two spent fuel storage facilities were operated in the country and two additional spent fuel stores were under construction or design (both are now in operation).

The first self-assessments for decommissioning and RAW/spent fuel storage showed that, despite implementation of almost all SRLs, there remained a need to harmonise legal documents. National Action Plans were developed and implemented in detail from 2009, when the Czech nuclear safety regulator SÚJB started to review and replace the national legal framework with a new atomic act and an extensive suite of SÚJB decrees.

The impact of WGWD RAW/spent fuel storage SRLs on the requirements of the new legal documents, which have been in effect since 2017, is as follows. For general requirements not specific to RAW management and related mainly to management systems, operational experience feedback (OEF) and periodic safety review, SRLs have directly influenced the text of the Act No. 263/2016 Coll., Atomic Act and related decrees on management system (Decree No. 408/2016 Coll.) and safety assessment (Decree No.162/2017 Coll.). For specific RAW management requirements for facility design, contingency plans and the acceptance of waste and spent fuel packages and unpackaged spent fuel elements, compliance with SRLs was provided particularly in articles of Decree No. 377/2016 Coll., on the requirements for the safe management of radioactive waste and on the decommissioning of nuclear installations or category III or IV workplaces and Decree No. 329/2017 Coll., on nuclear installation’s design requirements.

The implementation of RAW management SRLs introduced to the legal framework the following new specific legal requirements in the following areas:

* Consistency of the licensee’s strategy for RAW management with national RAW and spent fuel management strategy;
* Ageing management programmes for RAW management facilities;
* An OEF programme;
* Licensee procedures for the receipt of RAW failing to meet waste acceptance criteria;
* Periodic safety review;
* The use of mobile RAW processing equipment;
* A characterisation programme for RAW disposal facility sites;
* Disposal facility decommissioning and closure programmes.

Benchmarking of the Czech self-assessment by WGWD members showed that the new legal framework of the Czech Republic complies with the majority of SRLs for RAW management facilities under operation and development. The only ‘B’ ratings relate to the concept of RAW ownership. In the Czech Republic RAW is always owned by the licensee who operates the RAW management facility. The ultimate ‘owner’ of RAW is the Czech Republic, as the disposal of RAW is performed by the state organisation SÚRAO.

As a supplement to the legal documents, SÚJB regularly issues safety guides summarising and in detail developing valid legal requirements. These safety guides are not mandatory but should support the licensee e.g. by the development of licensing documentation. The Safety Guide BN-JB-OD-1.1 [14] on Licensing of RAW Management Activities uses WGWD SRLs not only as a reference, but as a basis for parts of the guidance, and at the end of the safety guide an overview of benchmarking results is provided.

### Slovak Republic

The Slovak Republic joined the European Union on 1 May 2004 and joined WGWD that year also to harmonise its regulatory framework with WGWD SRLs for decommissioning and RAW/spent fuel management. At that time, the following RAW management facilities were already in operation: the near-surface disposal facility for low-level RAW in Mochovce, two centralized RAW processing facilities and a wet spent fuel storage facility. Decommissioning of NPP A-1 was ongoing and NPP V-1 was preparing to transition from operation to decommissioning. Enlargement of the disposal facility for very low-level waste and of the existing spent fuel storage capacity for dry storage were both under consideration at that time as well as a new integral storage facility for RAW which does not comply with the waste acceptance criteria for the Mochovce disposal facility.

The legal and regulatory framework had been already well established at the time when the country joined WGWD. The Atomic Act and respective decrees were developed in the second half of the 1970s in connection with the development and operation of the first nuclear power plants with VVER reactors in the former Czechoslovakia. The original regulatory body, ČSKAE (Czechoslovak Atomic Energy Commission), was replaced by ÚJD SR (Nuclear Regulatory Authority of the Slovak Republic) in 1994.

The first self-assessments for decommissioning and RAW/spent fuel storage provided a very good level of compliance. However, an area for further harmonisation of legal documents was identified. Therefore, two National Action Plans containing details of the harmonisation process were proposed. In 2021 an additional National Action Plan was developed for RAW disposal. Benchmarking against the processing SRLs is currently under preparation.

National Action Plans for storage of RAW/spent fuel and decommissioning were fully implemented by an update of the Atomic Act in 2006 and an extensive set of ÚJD SR’s decrees in force since 2012. Since then, there have been further amendments which also reflect WENRA’s RHWG harmonisation efforts.

The impact of RAW/spent fuel storage SRLs on the requirements of the new legal documents, which took effect in 2006 and were further amended later on, are very similar to those of the Czech Republic given the similarities of the two legal frameworks.

Benchmarking of the disposal self-assessment, performed by WGWD members in 2021, showed that the new legal framework of the Slovak Republic complies with the SRLs for RAW management. The three ‘C’ ratings, which have been proposed by ÚJD SR and agreed by WENRA WGWD, relate to measures necessary for the purpose of accounting for, and the control of, nuclear materials. These will not unacceptably affect the operational and post closure safety of a deep geological repository (DGR) (Di-31) and the need to develop a programme of safeguards before starting the decommissioning and closure of a DGR (Di-69).

Decree No. 30/2012 Coll. [15] on RAW and spent fuel management needs to be further amended to refine the assumptions of the safety case for a DGR. The licensee shall gather information during the construction phase of the DGR to improve the knowledge of the intrinsic properties of the host environment and the response of the host environment to the presence of the disposal facility (Di-52).

It can be concluded that the Slovak legal framework fully complies with all relevant RAW management SRLs for storage and decommissioning and is implemented at all operating RAW management facilities.

The NAP for disposal was agreed in 2021 and changes to legislation are being prepared to fully comply with requirements of Di- 31, Di-52 and Di-69. Processing benchmarking is scheduled to be carried out virtually in 2021.

### Spain

Spanish regulatory requirements for waste disposal facilities are basically the same as for other nuclear facilities. They are subject to the regulatory framework of the Spanish national safety policy and strategy, which is integrated into several legal instruments, the most important of which are: Nuclear Energy Law 25/1964 [16], establishing the general concepts and principles governing peaceful use of nuclear energy; Royal Decree 1836/1999 [17], approving the Regulation on Nuclear and Radioactive Facilities (RINR); Royal Decree 783/2001 [18], approving the Regulation on Sanitary Protection against Ionizing Radiations (RPSRI).

Royal Decree 102/2014 [19] for the Responsible and Safe Management of Spent Fuel and Radioactive Waste, transposing the 2011/70/Euratom European directive, establishes more specific regulatory requirements regarding waste disposal facilities. Additionally, the CSN Creation Law (15/1980) [20] empowers the Nuclear Safety Council CSN as the sole competent body on nuclear safety and radiation protection. CSN issues mandatory and binding reports concerning all issues related to nuclear safety or radiological protection before the granting of the licence by the Ministry.

The above-mentioned regulatory framework is supplemented by CSN instructions and guides, which are technical standards on nuclear safety and radiological protection issues. Instructions are issued by CSN, published in the Official State Gazette and informed to Parliament and European Commission, and are legally binding for every licensee. Guides provide guidance to meet the regulatory requirements but are just recommendations.

CSN can also issue conditions and Complementary Technical Instructions (ITC) to licence holders, whose implementation is mandatory, but only for the licensee receiving them.

The CSN self-assessment showed that a significant quantity of the Disposal SRLs were already incorporated as mandatory in the operation of the ‘El Cabril’ facility either as conditions included in its licence or as specific ITCs addressed to ENRESA. However, most of the SRLs are not yet integrated into general Spanish legislation, especially those requirements related to the final parts of the repository lifetime: the closure and post-closure phases.

In accordance with the objectives of WGWD, the National Action Plans to make mandatory the SRLs which are not yet implemented in Spanish regulations include the issue of specific thematic instructions from CSN. So far there are two instructions already issued and in force (relating to spent fuel storage casks and high activity waste storage facilities) and three more are in draft relating to decommissioning and RAW disposal).

The draft safety objectives for a RAW disposal facility refer exclusively to the incorporation of SRL criteria concerning the disposal of RAW. The Spanish regulations will be in full harmonisation with WGWD safety reference levels for RAW disposal facilities once this instruction is finally approved.

The CSN instructions are compatible also with the incorporation of some SRLs in the main nuclear regulations (RINR) when these are revised. Currently, the RINR is undergoing a major review to transpose some European Directives.

## Discussion

The Ukraine case study is an example where the established or evolving legal framework is informed directly by and aligned to international standards and principles including WENRA SRLs. These may be added verbatim which makes demonstrating compliance more straightforward but may be subject to revision in line with developments to the SRLs themselves. The regulatory authority then approves measures for existing facilities (licensees) to ensure implementation of the legal requirements and to ensure that regulatory decisions are consistent.

Conversely the UK is an example of an enabling legal framework that is goal setting, i.e. focussed on required outcomes for both nuclear and environmental safety. UK legislation enables the regulators to issue a nuclear licence/environmental permit and to attach conditions to each that are legally binding and enforceable. Harmonisation of regulation through SRLs is potentially harder to demonstrate but easier to implement from the national plan. So, while adopting SRLs into legislation directly makes demonstrating compliance easier, the goal-setting legal framework in the UK is suitably flexible to accommodate changes in relevant good practice without requiring continual amendment.

The Czech Republic case study highlights some of the areas that have challenged many member states. The self-assessment process identified requirements to harmonise legal documents, leading to a revised legal framework with additional enforcement powers for the regulator. The broad, encompassing nature of SRLs provides a basis for standardising safety across a similarly broad range of waste management areas, including management systems, periodic review, waste acceptance criteria, use of mobile processing equipment and management of ageing facilities/equipment. Many of these areas are already regulated and taken into account by operators/licensees but the process of harmonisation ensures the requirement to comply has a basis in legislation, as is highlighted in the Spanish case study for RAW disposal.

The French case study for disposal facilities (especially on waste acceptance criteria) and treatment and conditioning RAW activity, emphasises the need to develop regulation in this particular area to give a clearer locus within which the authority can perform control. Indeed, this is not specific to France and many of the case studies have similarities, where the opportunity to discuss them within the wider international community of WGWD has proven to be valuable.

An example of good practice arose in Finland where the Finnish Nuclear and Safety Authority STUK uses commercially-available database software for requirement management and development. The database was first used when STUK made the latest major update to its regulatory guides. It contains all nuclear safety-related legislation, regulations and regulatory guides and is used to manage all requirements set by STUK. All requirements in the database are given attributes based on their related licensing steps, lifecycle phases and other relevant attributes. The SRLs from the Reactor Harmonization Working Group have been added into the database and they have been linked to corresponding national requirements; work to implement the WGWD SRLs to the database is pending. When any requirement is viewed in the database, if it is linked to WENRA SRLs, the relevant SRLs can be seen. If non-conformances have been identified in the SRL benchmarking process, notes about any needs for development can be added and taken into account later on when the requirements are updated. Using a database approach allows all those involved in regulatory development to be aware of SRLs and allows SRLs to be considered when making changes to national requirements to ensure that no changes are made that would result in non-conformance with the SRLs.

As can be seen through the case studies in particular, WENRA has achieved a high degree of harmonisation by keeping the focus of its activities on this target through regular benchmarking exercises to a consistent methodology, and requiring member states to adopt and implement national action plans to address compliance shortfalls. The fact that WENRA is an informal organisation, meeting as regulators and experts and not as national governments, is also pivotal in achieving harmonisation. This approach relies on members not defending their own national performances to the detriment of progress, but rather in being flexible and championing change where it is beneficial to safety to do so.

There are many clear benefits to harmonising safety and setting common minimum standards across all member states through the SRLs. However, the evolution of SRL thematic areas over the previous two decades means that WENRA has had to take steps to maintain a common set of up-to-date SRLs covering all relevant topics and to benchmark their implementation on a regular basis. WGWD is looking currently at opportunities both to rationalise safety areas common to all thematic areas (e.g. management systems) and to make the links from the SRLs to the underpinning safety references more transparent. Rationalisation will allow safety areas repeated in different thematic areas but worded and arranged slightly differently to be presented once in a goal-setting way, such that compliance applies to all safety activities and does not need to be demonstrated more than once. Linking SRLs to their underpinning references ensures their currency can be demonstrated dynamically using electronic tools (such as databases for instance) and allows changes to references (updates, withdrawals, etc.) to be noted early for evaluation by WGWD.

## Conclusions

Since 2002, when WENRA WGWD was established, clear benefits of the harmonisation process have become obvious in all involved member states. WGWD has identified and approved minimum common standards of safety across all member states based on SRLs derived from the IAEA Safety Standards as a baseline, and from the experiences and practices of WGWD countries regulating RAW management activities. In this way WGWD has promoted changes and improvements in member states’ regulations against backdrop of national priorities and existing legal frameworks.

As part of WGWD’s self-assessment and benchmarking activities, the regulatory bodies of member countries have identified overlaps, inconsistencies and complementarities in their national legal frameworks. The harmonisation process is not finished yet, but many member states have already reached a very good degree of harmonisation with the SRLs for RAW management.

WENRA provides an excellent opportunity for regulators to learn informally from the experience of other member states, whether they have similar or different legal frameworks.

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