

Planning Decommissioning at the Early Stages of the Lifecycle of Nuclear Power Plant: International Legal Framework

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ABSTRACT *Amid growing global energy demand and recent crises leading to energy shortfalls, nuclear energy has regained political and economic momentum as a reliable, low-emission energy source. The global revival of nuclear projects brings challenges extending beyond the construction and operation of facilities, particularly the issue of their future decommissioning. Decommissioning is a process of administrative and technical actions leading to the removal of the facility from regulatory control. These actions include, inter alia, facility and site decontamination, dismantling and materials management. Taking into account the complexity of the decommissioning process, international organisations such as the IAEA or the OECD NEA advocate for the introduction of regulations requiring decommissioning planning at the early stages of nuclear projects. It should be emphasised, however, that international legislative efforts remain confined to the development of soft law instruments, with no corresponding establishment of legally binding regulations. Therefore, the ultimate responsibility for establishing sufficient regulation lies with the national legislation. The goal of this research study is to analyse existing international standards that have the potential to serve as a foundation for the development of binding legal provisions concerning early decommissioning planning. The analysis demonstrates that, while the international hard law instruments do not impose specific obligations for early decommissioning planning of nuclear power plants, the IAEA Safety Standards provide comprehensive non-binding guidance that can effectively fill this gap. The study concludes that transforming selected elements of these standards into binding international obligations would significantly strengthen nuclear safety and regulatory consistency across jurisdictions.*

KEYWORDS *nuclear decommissioning, decommissioning planning, International Atomic Energy Agency, hard law, soft law.*

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1. Introduction

The global energy transition and recent energy crises have brought nuclear power back to the centre of policy debates. Governments view it as a means to secure energy independence and meet climate commitments. Some authors claim that the world is entering the era of a nuclear renaissance.¹ Whether or not the term is overused, the fact remains that approximately 65 reactors are currently under construction worldwide, with about 90 more planned.² It appears that the focus on the development of nuclear projects often overlooks the other side of the coin, namely the challenge of decommissioning. Failing to consider decommissioning at an early stage of the project³ should be considered as a significant mistake. As the International Atomic Energy Agency (IAEA) persuades, planning decommissioning from the design stage has numerous advantages, such as facilitation of conducting the process and optimisation of protection of decommissioning workers, the public and the environment.⁴

The importance of planning for decommissioning in the early stages may have been demonstrated by the experience of some countries, especially in cases where nuclear units were built at a time when awareness of the problem was not yet widespread. Such an example is Finland, which, in April 2024, completed the decommissioning of the FiR1 TRIGA research reactor built in the 1960s.⁵ However, due to the absence of contracts for nuclear waste management, which, in the case of Finnish policy, are concluded with commercial companies, the process of reviewing the application for the decommissioning licence took about

¹ Alexander Wimmers, Fanny Böse, and Leonard Göke, “Assessing the Viability of Non-Light Water Reactor Concepts for Electricity and Heat Generation in Decarbonized Energy Systems,” *arXiv working paper*, (2024): 1–2, <https://ideas.repec.org/p/arx/papers/2412.15083.html>; Erik Funkhouser, “Why the Nuclear Energy Renaissance Is Real — and Necessary,” *Utility Dive*, July 21, 2025, <https://www.utilitydive.com/news/nuclear-energy-renaissance-smr-good-energy/753471/>; Andries Lodewikus Lombaard and Ewert P.J. Kleynhans, “The Feasibility of a Nuclear Renaissance: A Cost-Benefit Analysis of Nuclear Energy as a Source of Electricity,” *Acta Commercii* 16, no. 1 (2016): 10, <https://doi.org/10.4102/ac.v16i1.373>.

² “Plans for New Reactors Worldwide,” World Nuclear Association, updated October 29, 2025, <https://world-nuclear.org/information-library/current-and-future-generation/plans-for-new-reactors-worldwide>.

³ Planning decommissioning at the early stage of the project will be considered in this research study as planning decommissioning until the operation stage, including also planning decommissioning during the application process for an operation license.

⁴ IAEA, *Decommissioning of Nuclear Power Plants, Research Reactors and Other Nuclear Fuel Facilities*, IAEA Safety Standards, Specific Safety Guides, No. SSG-47 (IAEA, 2018), 41, https://www-pub.iaea.org/MTCD/Publications/PDF/P1812_web.pdf.

⁵ Antti Ketolainen, “First Lessons Learned from Nuclear Decommissioning in Finland,” *Fortum*, November 6, 2024, <https://www.fortum.com/news-and-publications/forthedoers-blog/first-lessons-learned-nuclear-decommissioning-finland>.

four years.⁶ This appears to be relatively long, considering the estimated length of the procedure.⁷

Moreover, during the early preparations for the process of decommissioning, the details required for the design and planning of work to meet regulatory criteria were underestimated, which affected the aspects of funding and timeline.⁸ Due to this fact, the operator encountered a funding gap, which resulted in an application to the Government for additional funds to be paid into the Nuclear Waste Management Fund.⁹

The case study described above illustrates the necessity of ensuring early considerations on the decommissioning stage during the design stage and maintaining appropriate plans throughout the lifetime of the facility. Afterwards, Finland adopted amendments to the Nuclear Energy Act 1987 (1987 Nuclear Energy Act) (No. 990/1987)¹⁰ and the YVL guides, which were issued by the Radiation and Nuclear Safety Authority (STUK).¹¹

The Finnish experience not only highlights the practical challenges of inadequate early decommissioning planning but also underscores the importance of a coherent international regulatory framework. While national amendments, such as those adopted in Finland, can address gaps at the domestic level, they also reveal the limitations of relying solely on national initiatives in an increasingly interconnected nuclear sector. These lessons reinforce the need to examine whether existing international instruments sufficiently promote early decommissioning planning, or whether a stronger, binding global standard is required. The following sections, therefore, analyse the extent to which international law currently addresses this issue and identify potential pathways for enhancing regulatory consistency worldwide.

⁶ IAEA, *Considerations on Decommissioning in the Design and Operation for Research Reactors*, IAEA Technical Reports Series, No. XXX (IAEA, 2023), 110, https://nucleus.iaea.org/sites/connect/RRIHpublic/Documents/Considerations%20on%20Decommissioning_RRs_Draft%202023_04_26.pdf.

⁷ IAEA, *Considerations on Decommissioning in the Design and Operation for Research Reactors*, IAEA Technical Reports Series, No. XXX (IAEA, 2023), 110, https://nucleus.iaea.org/sites/connect/RRIHpublic/Documents/Considerations%20on%20Decommissioning_RRs_Draft%202023_04_26.pdf.

⁸ IAEA, *Considerations on Decommissioning in the Design and Operation for Research Reactors*, IAEA Technical Reports Series, No. XXX (IAEA, 2023), 113., https://nucleus.iaea.org/sites/connect/RRIHpublic/Documents/Considerations%20on%20Decommissioning_RRs_Draft%202023_04_26.pdf.

⁹ IAEA, *Considerations on Decommissioning in the Design and Operation for Research Reactors*, IAEA Technical Reports Series, No. XXX (IAEA, 2023), 113., https://nucleus.iaea.org/sites/connect/RRIHpublic/Documents/Considerations%20on%20Decommissioning_RRs_Draft%202023_04_26.pdf.

¹⁰ Finland Nuclear Energy Act 1987 (1987 Nuclear Energy Act) (No. 990/1987).

¹¹ IAEA, *Considerations on Decommissioning*, 113.

2. International agreements

Upon analysing various binding international instruments, it can be initially observed that the decommissioning phase of nuclear power plants is largely neglected within the framework of international legislation. No binding international instrument deals specifically or comprehensively with this issue. Even international agreements addressing related areas, such as nuclear safety or radioactive waste management, fail to provide an adequate or detailed regulation of decommissioning. The only provision explicitly related to this issue, within the framework of international regulations, is Article 26 of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention),¹² concluded on 5 September 1997 in Vienna.¹³ It is Article 26 of the Joint Convention, which stipulates that:

Each Contracting Party shall take appropriate steps to ensure the safety of decommissioning of a nuclear facility. Such steps shall ensure that:

- (i) qualified staff and adequate financial resources are available;
- (ii) the provisions of Article 24 with respect to operational radiation protection, discharges and unplanned and uncontrolled releases are applied;
- (iii) the provisions of Article 25 with respect to emergency preparedness are applied; and
- (iv) records of information important to decommissioning are kept.¹⁴

According to the definition set out in Article 2(f) of the Joint Convention, “‘nuclear facility’ means a civilian facility and its associated land, buildings and equipment in which radioactive materials are produced, processed, used, handled, stored and disposed of on such a scale that consideration of safety is required.”¹⁵ A nuclear power plant, by its very nature, involves the use of nuclear material and inherently requires rigorous safety measures. Consequently, nuclear power plants fall within the scope of this definition and, as a result, are subject to Article 26.

As it can be derived from linguistic interpretation, this provision does not impose *expressis verbis*, the requirement to ensure the existence of comprehensive decommissioning plans at the early stages of a nuclear project. Nor does it place an obligation on the regulatory body to provide sufficient legal mechanisms to enforce such a requirement on the operator.

¹² Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (1997), IAEA Doc. INFCIRC/546, 2153 UNTS 357, entered into force 18 June 2001 (Joint Convention).

¹³ Christian Raetzke, “Licensing & Regulation of Decommissioning and Spent Fuel & Radioactive Waste Management,” slideshow presented at the International School of Nuclear Law, NEA and University of Montpellier, Montpellier, France, 29 August 2024.

¹⁴ Joint Convention, Article 26.

¹⁵ Joint Convention, Article 2 (f).

Point (i) of the analysed provision obliges the Contracting Parties to ensure qualified staff and adequate financial resources,¹⁶ which undoubtedly requires prior planning. However, it is not indicated at which stage these requirements should be ensured. References to the Joint Convention's other provisions in point (ii) and (iii) relate, in turn to radiological protection and emergency preparedness.¹⁷ While these aspects could potentially be included in a comprehensive decommissioning plan, the Joint Convention does not impose any requirement for planning these issues specifically for the decommissioning phase at the early stages of nuclear projects. Point (iv) of Article 26 mandates the Contracting Parties to store the relevant records from the operation and other stages of the nuclear power plant lifecycle that may be relevant for the decommissioning phase.¹⁸ In fact, such records containing, for example, site characterisation, types and quantities of materials used in the construction or abnormal occurrences reports¹⁹ might prove crucial for the decommissioning. What is important in the context of the absence of the requirement to ensure a comprehensive decommissioning plan is that the IAEA, in its guidance, emphasises that the early establishment of such plans would facilitate the selection of the records relevant to the decommissioning phase.²⁰

Considering the above analysis, Article 26 of the Joint Convention, to some extent, enforces planning for certain aspects of decommissioning at the earlier stages of the nuclear power plant lifecycle. However, as has already been emphasised, it does not impose an obligation of structured and comprehensive planning of this process, beginning from the design stage.

In relation to the issue of an early decommissioning plan, it is necessary to mention two other provisions included in the Joint Convention namely, Article 7 (ii) and Article 14 (ii).

Article 7 (ii) states that: "Each Contracting Party shall take the appropriate steps to ensure that at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a spent fuel management facility are taken into account".²¹ The content of Article 14 (ii) is essentially the same, except that it involves another facility. According to this provision: "Each Contracting Party shall take the appropriate steps to ensure that at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a radioactive waste management facility other than a disposal facility are taken into account".²² As can be derived from these provisions, the Joint Convention imposes an obligation on Contracting Parties to ensure appropriate planning of

¹⁶ Joint Convention, Article 26 (i).

¹⁷ Joint Convention, Article 26 (ii-iii).

¹⁸ Joint Convention, Article 26(iv).

¹⁹ IAEA, *Record keeping for the Decommissioning of Nuclear Facilities: Guidelines and Experience*, Technical Reports Series, No. 411 (IAEA, 2002), 2, https://www-pub.iaea.org/MTCD/Publications/PDF/TRS411_scr.pdf.

²⁰ IAEA, *Record keeping for the Decommissioning of Nuclear Facilities: Guidelines and Experience*, Technical Reports Series, No. 411 (IAEA, 2002), 12–13.

²¹ Joint Convention, Article 7.

²² Joint Convention, Article 14.

decommissioning, beginning as early as the design stage. These provisions regard, however, only the facilities for disposal of spent nuclear fuel and radioactive waste. Nuclear power plants do not fall under the scope of these norms. The Joint Convention does not preclude any provision that would impose similar obligations on Contracting Parties with regard to the nuclear power plants. As one of the main focuses of the Joint Convention is to establish a legislative and regulatory framework for spent fuel and radioactive waste management,²³ and a nuclear power plant, by its nature, is not intended to serve as a disposal facility for nuclear waste or spent fuel (although disposal facilities may be integrated within a nuclear power plant), one may consider this approach is justified. However, taking into account the other objectives of the Joint Convention, expressed in its Preamble – such as promoting an effective nuclear safety culture, and the absence of sufficient provisions regulating early planning of decommissioning with regard to nuclear power plants in other instruments constituting the international framework of nuclear law, it could be reasonable to include such provision in the Joint Convention. This is especially justified since the Convention already contains a more general provision concerning decommissioning of nuclear power plants in Article 26.

3. The European Union legislation

Similarly, as in the case of the international legal system, the EU legislative legal framework does not provide sufficient measures concerning the issue of early planning of decommissioning. Council Directive 2009/71/Euratom of 25 June 2009 establishing a Community framework for the nuclear safety of nuclear installations²⁴ appears not to address the issue of decommissioning at all. The other directive that could seem relevant from the perspective of the analysed issue – Council Directive 2011/70/Euratom of 19 July 2011 establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste²⁵ – admittedly refers in some provisions to the problem of decommissioning. However, it does not establish solutions related to decommissioning planning at early stages, especially for nuclear power plants. Within the framework of EU legislation, the act which addresses in the most explicit manner the issues connected with the decommissioning of nuclear facilities is the Commission Recommendation of 24 October 2006 on the management of financial resources for the decommissioning of nuclear

²³ Amelia de Kagenneck and Cyril Pinel, “The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management,” *International & Comparative Law Quarterly* 47, No. 2 (1998): 410, <https://doi.org/10.1017/S0020589300061911>.

²⁴ Council Directive 2009/71/Euratom of 25 June 2009 establishing a Community framework for the nuclear safety of nuclear installations, *Official Journal of the European Union* (OJ) L 172 (July 2, 2009) (2009 Safety Directive).

²⁵ Council Directive 2011/70/Euratom of 19 July 2011 establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste, *Official Journal of the European Union* (OJ) L 199 (August 2, 2011) (Waste Directive).

installations, spent fuel and radioactive waste.²⁶ However, the aforementioned recommendation focuses only on one issue concerning decommissioning planning, which is the funding of the decommissioning process. Moreover, it does not necessarily refer to ensuring funding at the early stages but as a general requirement. It should be noted that EU recommendations are non-binding instruments and do not impose legal obligations on Member States, which are therefore not required to comply with them.²⁷

In 2021, the European Union introduced two regulations – Council Regulation (Euratom) 2021/100 of 25 January 2021 establishing a dedicated financial programme for the decommissioning of nuclear facilities and the management of radioactive waste, and repealing Regulation (Euratom) No 1368/2013²⁸ and Council Regulation (EU) 2021/101 of 25 January 2021 establishing the nuclear decommissioning assistance programme of the Ignalina nuclear power plant in Lithuania and repealing Regulation (EU) No 1369/2013²⁹ – which addressed the issue of decommissioning plan and defined specifically what a decommissioning plan should contain. However, they were introduced in connection with the decommissioning of specific units within EU territory, rather than to impose general obligations on the Member States regarding decommissioning planning or early decommissioning planning. Therefore, according to the content of decommissioning plans, the specific provisions of these recommendations will not be further analysed.

In conclusion, the European Union also fails to provide a sufficient legal framework with regard to the issue of early planning of decommissioning.

4. *Soft law measures*

In light of the absence of sufficient legal solutions devoted to the issue of early decommissioning plans within the international *hard law* instruments, attention should be shifted to *soft law* measures. Such measures do not have a binding character. However, they may have a substantial role in framing the national legal frameworks. In some cases, especially regarding complex issues such as the use of nuclear energy, when states are reluctant to adopt international *hard law* measures, *soft law* may prove even more beneficial as a tool for the harmonisation

²⁶ Commission Recommendation of 24 October 2006 on the management of financial resources for the decommissioning of nuclear installations, spent fuel and radioactive waste, *Official Journal of the European Union* (OJ) L 330 (September 28, 2006).

²⁷ Klaus-Dieter Borchardt, *The ABC of EU Law* (Publications Office of the European Union, 2016), 108.

²⁸ Council Regulation (Euratom) 2021/100 of 25 January 2021 establishing a dedicated financial programme for the decommissioning of nuclear facilities and the management of radioactive waste, and repealing Regulation (Euratom) No 1368/2013, *Official Journal of the European Union* (OJ) L 34 (February 1, 2021).

²⁹ Council Regulation (EU) 2021/101 of 25 January 2021 establishing the nuclear decommissioning assistance programme of the Ignalina nuclear power plant in Lithuania and repealing Regulation (EU) No 1369/2013, *Official Journal of the European Union* (OJ) L 34 (February 1, 2021).

of legal standards and the development of safety culture. As it is highlighted in the literature:

When it comes to entering binding obligations, due to particular domestic sensitivities or sovereignty cost, soft law could be a preferred option. The threshold for states is lower when an instrument does not take form of hard law. States that view a particular issue as falling squarely in the domestic realm may nonetheless be willing to coalesce around prescribed actions if they entail no legal obligation, nor, perhaps, more importantly, the possibility of being held responsible for a wrongful act.³⁰

4. 1 IAEA Safety Requirements

The IAEA Safety Standards play a significant role in the nuclear industry and in the system of international nuclear law, and they consist of three groups of publications: the Safety Fundamentals, the Safety Requirements and the Safety Guides. They are “recommended for implementation as part of the national regulatory system in order to ‘establish a consistent and comprehensive basis for the proper protection of people and the environment against radiation risk.’”³¹

Within the scope of IAEA publications, it is possible to find those related to the issue of decommissioning nuclear power plants. One of them is IAEA Safety Standards Series No. GSR Part 6, Decommissioning of Facilities (GSR Part 6)³² published in 2014.

It should be noted that all considerations regarding decommissioning included in this publication apply to nuclear power plants. This presumption can be derived from para.1.3 of the Introduction, which states that: “‘facility’ means buildings, and their associated land and equipment, in which radioactive material was or still is produced, processed, used, handled or stored on a scale with such a degree of hazard and risk that consideration of protection and safety is required.”³³ As the nuclear power plant constitutes a building in which radioactive material is used and due to hazard risk, it requires consideration of protection and safety; it undoubtedly falls under the scope of the definition provided in para. 1.3. of GSR Part 6.

In this publication, the IAEA also included requirements relevant from the perspective of early planning of decommissioning. At the very beginning of the publication – in para.1.6. of the Introduction –it expresses a conviction that:

Planning for decommissioning begins at the design stage and continues throughout the lifetime of the facility. It includes: preparation of an initial

³⁰ Jonathan Herbach, *International Arms Control Law and the Prevention of Nuclear Terrorism* (Edward Elgar Publishing, 2021), 131.

³¹ Stephen G. Burns et al., “Regulation, Licensing and Oversight of Nuclear Activities,” in *Principles and Practice of International Nuclear Law*, ed. K.S. Nick and Stephen G. Burns (OECD Publishing, 2022), 172.

³² IAEA, *Decommissioning of Facilities*, IAEA Safety Standards, General Safety Requirements, No. GSR Part 6 (IAEA, 2014), <https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1652web-83896570.pdf>.

³³ IAEA, *Decommissioning of Facilities*, para 1.3.

decommissioning plan; collection of relevant information and data to facilitate future decommissioning; selection of a decommissioning strategy; radiological characterization of the facility; preparation of a final decommissioning plan; estimation of costs; identification of the provision of financial resources for the decommissioning project; submission of the plan to the regulatory body for review and approval; and any activities for public consultation in accordance with national requirements.³⁴

This approach is applied in the following part of the publication. Requirement 5 of GSR Part 6 focuses on the responsibilities of the regulatory body for decommissioning. A part of Requirement 5 is explicitly devoted to the issue of decommissioning planning, as it constitutes that: “The regulatory body shall regulate all aspects of decommissioning throughout all stages of the facility’s lifetime, from initial planning for decommissioning during the siting and design of the facility, to the completion of decommissioning actions and the termination of authorization for decommissioning”.³⁵ Para. 3.3. supplementing Requirement 5 later also indicates the requirements for decommissioning planning, which the regulatory body should establish. These requirements are as follows:

- Specification of the typical content of decommissioning plans and supporting documents for review or approval;
- Establishment of the review process for decommissioning plans and supporting documents (as prescribed in national regulations) and the timeframe for such reviews;
- Review of the initial decommissioning plan and updates, review and approval of the final decommissioning plan and supporting documents, and review and approval of updates after the final decommissioning plan has been approved.³⁶

Under Requirement 5 of GSR Part 6, the regulatory bodies are also mandated to inspect and review decommissioning actions, and, in case of non-compliance with the national legal and regulatory framework or with the authorisation or licence conditions, they should take appropriate enforcement actions.³⁷

Requirement 5 of GSR Part 6 is particularly important because it recognises the necessity of implementation by regulatory bodies, within national legal systems, such mechanisms that will enable enforcement of early decommissioning process planning by the licence holder. The responsibility of ensuring the safe and efficient decommissioning process is not only the licensee’s concern. Rather, the states shall actively enhance and enforce the comprehensive planning of decommissioning in advance. Nevertheless, it is a licence holder who will ultimately be responsible for conducting the decommissioning activities. Therefore, it is necessary to emphasise Requirement 10 of GSR Part 6, which mandates the licensee to plan for decommissioning. As outlined in its content: “The licensee shall prepare a decommissioning plan and shall maintain it

³⁴ IAEA, *Decommissioning of Facilities*, para. 1.6.

³⁵ IAEA, *Decommissioning of Facilities*, Requirement 5.

³⁶ IAEA, *Decommissioning of Facilities*, para.3.3.

³⁷ IAEA, *Decommissioning of Facilities*.

throughout the lifetime of the facility, in accordance with the requirements of the regulatory body, in order to show that decommissioning can be accomplished safely to meet the defined end state.”³⁸

In para. 7.1. following the content of Requirement 10 of GSR Part 6, the IAEA emphasises the role of a regulatory body, specifically in ensuring that the licensee will adopt the means facilitating the decommissioning process throughout all the stages of the facility’s lifetime.³⁹ The initial plan for decommissioning should be submitted together with the application for authorisation to operate the facility, and it should be updated periodically – typically every five years – or due to specific circumstances.⁴⁰ Moreover, in cases where a decommissioning plan was not drafted during the initial phases of the nuclear project, it should be prepared by the licensee as soon as possible.⁴¹ The licence holder should also retain appropriate records and reports drafted throughout the lifetime of a facility that might be relevant for the decommissioning stage.⁴²

With regard to the preparation of initial decommissioning plans, it is necessary to consider a graded approach. The graded approach is a method applied to any process that is related to regulatory control. It ensures that the degree of regulatory requirements correlates with the potential risk.⁴³ Such an approach is suggested in Requirement 2 of GSR Part6, stating that: “A graded approach shall be applied in all aspects of decommissioning in determining the scope and level of detail for any particular facility, consistent with the magnitude of the possible radiation risks arising from the decommissioning.”⁴⁴ In terms of early decommissioning planning, the content of the paragraphs following Requirement 2 appears to be even more relevant. According to para. 2.4.: “The type of information and the level of detail in the decommissioning plans and supporting documents, including the safety assessments, shall be commensurate with the type, scale, complexity, status and stage in the lifetime of the facility and with the hazards associated with the decommissioning of the facility.”⁴⁵

The conclusion drawn from the above guides is that the aspects to be included in the decommissioning plan should be tailored to the current needs. Therefore, regulations within legal systems should allow for some flexibility regarding these plans and avoid imposing an overly detailed structure in advance. However, the legal frameworks should clearly specify the main issues that should be considered in the decommissioning plan.

³⁸ IAEA, *Decommissioning of Facilities*, Requirement 10.

³⁹ IAEA, *Decommissioning of Facilities*, para. 7.1.

⁴⁰ IAEA, *Decommissioning of Facilities*, para. 7.5.

⁴¹ IAEA, *Decommissioning of Facilities*, para. 7.6.

⁴² IAEA, *Decommissioning of Facilities*, para. 7.7.

⁴³ “Applying the graded approach: Improving radiation protection in practice”, IAEA, accessed November 5, 2025, <https://www.iaea.org/sites/default/files/20/11/rasa-applying-graded-approach.pdf>.

⁴⁴ IAEA, *Decommissioning of Facilities*, Requirement 2.

⁴⁵ IAEA, *Decommissioning of Facilities*, Requirement, para. 2.4.

4. 2 IAEA Safety Guides

GSR Part 6 imposes the requirements both on the regulatory body and on the licensee to ensure a decommissioning plan from the initial phase throughout the lifetime of the facility. The next step should be the determination of essential aspects that the decommissioning plan should contain. Although providing some hints on that matter, the aforementioned publication does not explicitly provide a comprehensive list of all the essential elements that such a plan should include. The publication in some of the paragraphs indicates the necessity of determining a decommissioning strategy in the initial plan,⁴⁶ estimated costs of decommissioning and the mechanism of providing financial assurance,⁴⁷ or estimated categories and quantities of waste that will be generated during decommissioning.⁴⁸ These elements, although greatly important for the decommissioning planning, do not appear to cover the full scope of essential aspects that should be addressed in the initial plan and its updated versions throughout the lifetime of the facility. They are also not structured in a manner that facilitates their identification by potential users but rather are dispersed throughout the document. Moreover, the necessity of implementing these issues in the decommissioning plan is, in most cases, not explicitly expressed in the particular requirements. Instead, it is provided in the paragraphs following the main requirements.

Among the publications within the scope of IAEA Safety Standards, there is one published in the series of IAEA Safety Guides, which appears to be more specific in identifying the suggested essential elements of the initial decommissioning plan – IAEA Safety Standards Series No. SSG-47, Decommissioning of Nuclear Power Plants, Research Reactors and Other Nuclear Fuel Facilities (SSG-47).⁴⁹

As the publications in the series of IAEA Safety Guides provide recommendations and guidelines on how to align with the IAEA Safety Requirements,⁵⁰ this publication is complementary primarily to GSR Part 6. This relationship is explicitly expressed in para. 1.14.⁵¹

This paragraph also defines the scope of application for this publication, stating that: “This Safety Guide addresses decommissioning considerations and actions for decommissioning”, including, among other facilities, nuclear power plants.⁵² The essential elements for the initial decommissioning plan can be found listed explicitly in para. 7.10. According to this list, the initial decommissioning plan:

⁴⁶ IAEA, *Decommissioning of Facilities*, Requirement, para. 3.4.

⁴⁷ IAEA, *Decommissioning of Facilities*, Requirement para. 7.4.

⁴⁸ IAEA, *Decommissioning of Facilities*, Requirement.

⁴⁹ IAEA, *Decommissioning of Nuclear Power Plants*.

⁵⁰ For an overview of the structure of the publications within IAEA Safety Standards, see IAEA, *Decommissioning of Nuclear Power Plants IX*.

⁵¹ IAEA, *Decommissioning of Nuclear Power Plants*, para. 1.14.

⁵² IAEA, *Decommissioning of Nuclear Power Plants*.

- a) Should preferably be based on the immediate dismantling strategy; however, a deferred dismantling strategy for individual facilities might be considered, such as in the case of a multifacility site;
- b) Should include a generic feasibility study of decommissioning, based on the selected decommissioning strategy, which should consider design provisions and operating experience for facilitating decommissioning, including the proposed end state (preferably release without restrictions), related key decommissioning actions and basic safety issues;
- c) Should include a schedule for major decommissioning actions;
- d) Should include the approach for management of radioactive waste, and should provide initial identification of waste classes and an initial estimate of waste quantities;
- e) Should provide a basis for a preliminary cost estimate of the decommissioning project and should specify the means to ensure financial provisions for the decommissioning;
- f) Should demonstrate that the decommissioning can be performed in a safe manner.⁵³

As already noted, the publication under the current analysis – SSG-47 – is complementary to GSR Part 6. Therefore, it is remarkable that most of the issues covered by the paragraphs in the latter publication overlap with the elements indicated on the list above from SSG-47. One of them is the selection of a decommissioning strategy, which is included in para. 3.4 of GSR Part 6. Para. 7.10. (a) of SSG-47 specifies that immediate dismantling should be the preferred strategy over deferred dismantling or entombment.⁵⁴

The issue of preferred strategy requires further consideration. The main difference between immediate and deferred dismantling is the period between shut down of the facility and the beginning of the dismantling. The first one involves a period of a few years between these actions, while the latter strategy involves a period of *safe enclosure* between the removal of spent fuel and peripheral items and the beginning of dismantling. The period of *safe enclosure* lasts from 30 to 100 years.⁵⁵ The last strategy recognised within the nuclear industry is entombment, which involves “encapsulating the facility on site and keeping it isolated until the radionuclides have decayed to levels that allow the site to be released from nuclear regulatory control.”⁵⁶

Another overlapping aspect is listed in the para. 7.10. (d) of SSG-47. It is the identification of waste classes and an initial estimate of waste quantities, which is also indicated in para. 7.4. of the GSR Part 6. However, para. 7.10. (d) of SSG-47 additionally stipulates that the initial plan should include “the approach for the

⁵³ IAEA, *Decommissioning of Nuclear Power Plants*, para. 7.10.

⁵⁴ IAEA, *Decommissioning of Nuclear Power Plants*, para. 7.10.(a).

⁵⁵ NEA, *Selecting Strategies for the Decommissioning of Nuclear Facilities* (OECD Publishing, 2006), 12, <https://www.oecd-neo.org/upload/docs/application/pdf/2019-12/nea6038-decommissioning.pdf>.

⁵⁶ NEA, *Selecting Strategies for the Decommissioning of Nuclear Facilities* (OECD Publishing, 2006), 12.

management of radioactive waste”.⁵⁷ This term is not defined within the framework of SSG-47. Therefore, it is difficult to determine whether it presupposes solely strategic approaches as defined in IAEA Nuclear Energy Series No. NW-G-1.1, *Policies and Strategies for Radioactive Waste Management*⁵⁸ also takes into account more detailed technical solutions that can be found in IAEA Nuclear Energy Series No. NW-T-1.27, *Design Principles and Approaches for Radioactive Waste Repositories*.⁵⁹ From the systemic interpretation of the analysed publication, it can be concluded that this term regards the issues considered in paras. 8.34-8.43 as such delegation is provided concerning “approach for radioactive waste management” with regard to updating the decommissioning plan in para. 7.13.⁶⁰ Nevertheless, it can be derived from the content of para. 7.10. (d) that the sole identification of waste classes and their quantities in the initial decommissioning plan is not sufficient, and the issue of radioactive waste management should be addressed more comprehensively as early as drafting the initial plan for decommissioning. The ultimate aspects on the list, which overlap with the issues indicated in GSR Part 6 – particularly para. 7.4. – are connected to demonstrating the feasibility of the decommissioning and ensuring sufficient financial resources and included in para. 7.10. (b) and (e). The issue of funding the decommissioning is one of the most comprehensive aspects of the decommissioning plan, extensively analysed within the literature. In most of the states, according to the polluter pays principle, the licensee is obliged to provide sufficient financial resources.⁶¹ However, the states which are parties to the Joint Convention, on the basis of Article 26 (i), “are obliged to ensure that ‘qualified staff and adequate resources are available’ to ensure the safety of decommissioning.”⁶² The issue of funding of the decommissioning, being too comprehensive, will not be analysed in detail in this research study. The other aspects indicated on the list in SSG-47, apart from the “approach for management of radioactive waste”,⁶³ particularly the schedule of major

⁵⁷ IAEA, *Decommissioning of Nuclear Power Plants*, para. 7.10.(d).

⁵⁸ This publication recognises four strategic approaches towards the issue of nuclear waste management such as: waste recycling, immediate disposal, deferred disposal, a multinational solution, see: IAEA, *Policies and Strategies for Radioactive Waste Management*, IAEA Nuclear Energy Series, No. NW-G-1.1 (IAEA, 2009), 31–32, https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1396_web.pdf.

⁵⁹ IAEA, *Design Principles and Approaches for Radioactive Waste Repositories*, IAEA Nuclear Energy Series, No. NW-T-1.27 (IAEA, 2020), https://www-pub.iaea.org/MTCD/Publications/PDF/PUB1908_web.pdf.

⁶⁰ IAEA, *Decommissioning of Nuclear Power Plants*, para. 7.13.

⁶¹ Kalman A. Robertson, “Decommissioning Nuclear Power Reactors,” in *Learning from Fukushima: Nuclear Power in East Asia*, ed. Peter Van Ness and Mel Gurtov (ANU Press, 2017), 299.

⁶² Kalman A. Robertson, “Decommissioning Nuclear Power Reactors,” in *Learning from Fukushima: Nuclear Power in East Asia*, ed. Peter Van Ness and Mel Gurtov (ANU Press, 2017), 299.

⁶³ IAEA, *Decommissioning of Nuclear Power Plants*, para. 7.10.(d).

decommissioning actions⁶⁴ and demonstrating that decommissioning can be performed in a safe manner,⁶⁵ are not explicitly addressed in GSR Part 6 as a necessary element of the initial decommissioning plan. It can be deduced that cost estimation will require some level of consideration on major decommissioning actions. It is also understandable that, in principle, the concept of early planning decommissioning ensures that the process is carried out safely. Nevertheless, it should be recognised that SSG-47 explicitly indicates them as essential elements of the initial decommissioning plan. Therefore, as noted before, the list of essential elements for the decommissioning plan indicated in SSG-47 appears to address these issues in a more comprehensive and clearer manner than they are addressed in GSR Part 6.

Apart from the elements included on the list, the Nuclear Energy Agency (NEA), in one of its reports – *Decommissioning Considerations for Nuclear Power Plants* – proposes also to address occupational exposure within the scope of the initial decommissioning plan.⁶⁶ This issue was not explicitly mentioned on the list. However, it may fall under the scope of para. 7.10. (b), which mandates that in the initial decommissioning plan, a generic feasibility study of decommissioning should be included, considering, among others, basic safety issues.⁶⁷ Nevertheless, this may be interpreted as only a broad acknowledgement of the necessity to manage occupational exposure. Therefore, national authorities could consider explicitly adopting occupational exposure as an element of the initial decommissioning plan within the national legal frameworks.

5. Conclusion

The comparative analyses of the presented legal frameworks lead to a set of conclusions regarding the issue of early decommissioning planning.

Early planning of decommissioning contributes to carrying out this process more efficiently. It enables proper estimation of the costs, reduces the time of the process and perhaps most importantly, enables to optimise the protection of decommissioning workers, the public and the environment.⁶⁸

The findings outline the gap within the international *hard law* instruments regarding the sufficient regulation of the analysed issue. The only international agreement which addresses the issue of decommissioning as the last stage of the nuclear power plant lifecycle is the Joint Convention. However, it does not constitute any provision that would impose an obligation on Contracting Parties to ensure planning decommissioning for nuclear power plants, beginning at the design stage and updating these plans throughout the lifecycle of the facility.

⁶⁴ IAEA, *Decommissioning of Nuclear Power Plants*, para. 7.10.(c).

⁶⁵ IAEA, *Decommissioning of Nuclear Power Plants*, para. 7.10.(f).

⁶⁶ NEA, *Decommissioning Considerations for Nuclear Power Plants* (OECD Publishing, 2010), 6, <https://www.oecd-nea.org/upload/docs/application/pdf/2019-12/nea6833-decommissioning-considerations.pdf>.

⁶⁷ IAEA, *Decommissioning of Nuclear Power Plants*, para. 7.10.(b).

⁶⁸ IAEA, *Decommissioning of Nuclear Power Plants*, para. 7.1.

Moreover, the European Union also fails to provide sufficient legal measures in the context of early decommissioning planning.

This absence in international law should be recognised as a regulatory shortcoming, especially considering the substantial benefits that early decommissioning planning provides. Addressing this gap would enhance global consistency and ensure that all States adopt proactive, safety-oriented approaches to decommissioning. Until such developments take place, the primary responsibility for ensuring adequate regulation lies with national legislators and regulatory authorities.

At present, the vacuum in binding international norms is partially filled by the *soft law* instruments developed by the International Atomic Energy Agency (IAEA). In particular, the IAEA Safety Standards – GSR Part 6 and SSG-47 – provide comprehensive guidance that may serve as a model for national frameworks and as a benchmark for regulatory bodies. Although non-binding, these documents play a crucial role in shaping consistent international practice.

It therefore appears that, in order to strengthen the global regulatory architecture for decommissioning planning, it would be necessary to move towards the adoption of binding provisions at the level of *hard law*. Incorporating early decommissioning planning obligations into international or regional treaties would not only harmonise approaches among States but also reinforce the fundamental objectives, such as nuclear safety, sustainability, and long-term environmental protection.