

Regulatory and Legal Framework for Radioactive Waste Management and Decommissioning in Türkiye

ABSTRACT: Nuclear energy and radiation applications are used in many areas such as electricity generation, health sector, industry, and food sector. These activities generate radioactive waste and need to be managed through various specific policies and strategies. In this context, Türkiye's national legal framework and strategy are defined in Nuclear Regulation Law No. 7381. Additionally, Türkiye is a party to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. Furthermore, the country has regulations specifically aimed at governing radioactive waste management. With this regulatory and legal structure, the country aims to manage radioactive waste in a safe, secure, sustainable, and responsible manner within the framework of international agreements and well-accepted standards. Currently, only one radioactive waste processing and storage facility exists in Istanbul, operated by the Türkiye Energy, Nuclear and Mineral Research Agency. Additionally, Türkiye is currently developing a Near Surface Disposal Facility, which is expected to begin accepting radioactive waste in the 2030s. Considering plans for putting its nuclear power plant into operation in the very near future, the country's ever-increasing energy need, and prioritisation of nuclear energy for energy diversity, the current status of Türkiye's nuclear law and regulations regarding radioactive waste is extremely important. This article analyses the basic principles and concepts of Türkiye's regulatory and legal framework for radioactive waste management and decommissioning.

KEYWORDS: Radioactive waste, decommissioning, nuclear law, legal framework, regulatory framework

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1.

Introduction

Nuclear energy and radiation applications are used in many areas, such as electricity generation, health sector, industry, and food sector. However, these activities generate radioactive waste. Given its hazardous nature, radioactive waste needs to be managed via specific policies and strategies. In this context, Türkiye's national legal framework and strategy are defined in Nuclear Regulation Law No. 7381. Additionally, Türkiye is a party to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. Furthermore, it has regulations specifically aimed at governing radioactive waste management. Through this regulatory and legal structure, the country aims to manage radioactive waste in a safe, secure, sustainable, and responsible manner within the framework of international agreements and well-accepted standards. Currently, a single radioactive waste processing and storage facility exists in Istanbul, Türkiye. It is operated by the Türkiye Energy, Nuclear and Mineral Research Agency (TENMAK). Additionally, Türkiye is developing a Near Surface Disposal Facility, which is expected to begin accepting radioactive waste in the 2030s.

Given the country's plan to put a nuclear power plant into operation in the near future, its ever-increasing energy needs, and prioritisation of nuclear energy for energy diversity, understanding the status of Türkiye's nuclear law and regulations regarding radioactive waste is extremely important. This article analyses the basic principles and concepts of Türkiye's regulatory and legal framework for radioactive waste management and decommissioning. Section 1 outlines Türkiye's radiation source summary. Section 2 gives an overview of the nuclear legal framework of Türkiye. Section 3 describes the main provisions about radioactive waste management and decommissioning. Finally, Section 4 offers concluding remarks.

2.

Türkiye's Radiation Source Summary

According to 2023 data, 25 radiation facilities and approximate 60,000 radiation applications were in use in Türkiye.¹ In addition, the country has 3 nuclear power plant projects. The Akkuyu Nuclear Power Plant (NPP), Türkiye's first step into nuclear power generation, has four units of VVER-1200 reactors. The first unit of Akkuyu NPP was granted a commissioning permit on November 21, 2023, while the construction

1 *Türkiye'de Radyasyon Kaynakları.*

of the other three units is ongoing.² For the second nuclear power plant project, the site approval was given in 2024 by the Nuclear Regulatory Authority (NRA). For Sinop NPP, technology providers have not yet been decided. However, negotiations are currently underway under the responsibility of the Ministry of Energy and Natural Resources.³

In addition, the country has two research reactors (TENMAK and İTÜ TRİGA). Furthermore, a rare earth mining and thorium storage project is being planned. Specifically, Eskişehir-Beylikova Complex Ore (Barite, Fluorite, Rare Earth Elements, Thorium) Quarry, Ore Preparation, and Enrichment and Storage Facility obtained the affirmative environmental impact assessment decision in 2020. The NRA granted a limited work permit and construction license to the facility in January 2023.⁴

Additionally, a Radioactive Waste Processing and Storage Facility is operated by TENMAK, which was established in 1986 in İstanbul and plays a crucial role in the management of radioactive waste in Türkiye. This facility is designed for the processing and storage of very low-level radioactive waste together with low and intermediate level radioactive waste resulting from activities conducted in the country.

Additionally, Türkiye has initiated efforts to establish a Near Surface Disposal Facility to meet the disposal needs expected in the meantime, especially with the start of the nuclear power programme. This project is in the site selection stage.⁵

Radioactive wastes generated during the mining and scrap recycling activities with the application of radiation in industry, medicine, research, and calibration are stored in TENMAK Radioactive Waste Processing and Storage Facility in İstanbul, Türkiye. Radioactive wastes generated during the operation phase of the research reactors are also sent to this facility.

This facility's inventory has very short-lived, very low-level, and low and intermediate level radioactive wastes. In Türkiye, no spent fuel and high-level waste exist in the inventory. However, the future operations of research reactors and NPPs are expected to generate spent fuel and high-level waste. As stated in the Agreement Between the Government of the Republic of Türkiye and the Government of the Russian Federation on Cooperation in Relation to the Construction and Operation of an NPP at the Akkuyu Site, May 12, 2010 (IGA), spent fuel of Russian origin may be reprocessed in the Russian Federation through a separate agreement to be concluded between the parties. Negotiations on spent fuel reprocessing are currently ongoing between the parties, and no agreement has yet been signed. Therefore, without an intergovernmental agreement between the parties for the reprocessing of spent

2 [Online]. Available at: <https://www.ndk.org.tr/en-US/licensing-of-akkuyu-nuclear-power-plant> (Accessed: 28 October 2024).

3 *Sinop Nuclear Power Plant: Authorization of Nuclear Facilities.*

4 *Turkish National Report for the Joint 8th and 9th Review Meeting, 2022.*

5 *Country Nuclear Power Profiles: Turkey.*

fuel of the Akkuyu NPP, the spent fuel from the Akkuyu NPP will be stored on site for the lifetime of the Akkuyu NPP and then transferred to the disposal facility, in accordance with the Law No. 7381.

3.

Nuclear Legal and Regulatory Framework of Türkiye

Türkiye established its first nuclear regulatory body, the Atomic Energy Commission (AEC), on August 27, 1956, with Law No. 6821. It pursued this effort to benefit from international experience in the area and became one of the founding members of the International Atomic Energy Agency (IAEA) in 1957. The AEC was replaced by the Turkish Atomic Energy Authority (TAEA) in 1982 under Law No. 2690.⁶ The regulations of all activities in the field of peaceful uses of nuclear energy, including issuing regulations, conducting safety reviews and assessments, granting permissions and licenses, conducting inspections, and applying enforcement actions, were among the authorities and responsibilities of TAEA. Additionally, TAEA had responsibilities as the operator of facilities requiring regulatory control, including a research reactor and a radioactive waste storage facility.

The Convention on Nuclear Safety, with its seventh and eighth articles, stipulates that the Parties shall have a legal and regulatory framework in the field of nuclear safety, and the establishment or designation of a Regulatory Authority tasked with the implementation of the said legal and regulatory framework.⁷ Similarly, Article 19 of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management states that, 'Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of spent fuel and radioactive waste management'.⁸ Within this scope, in 2018, Türkiye established a new national framework, and the regulatory and supervisory authorities were separated from operational duties. NRA was established to perform only regulatory duties. In addition, TENMAK was established in 2020 with Presidential Decree No. 4 and 57. It has its research and development functions, and the responsibility for the management of all national radioactive waste, including disposal activities.

The Turkish legal framework comprises the Constitution, law, regulation, and other regulatory decisions. In addition, it has non-mandatory guides. The norm pyramid in the field of nuclear law is illustrated in Figure 1. The main domestic

6 Turkish National Report for the Joint 8th and 9th Review Meeting, 2022.

7 Convention on Nuclear Safety, 1994.

8 Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (1997).

sources of law in hierarchical order are the Constitution, laws and international treaties, presidential decrees, regulations, and guides.

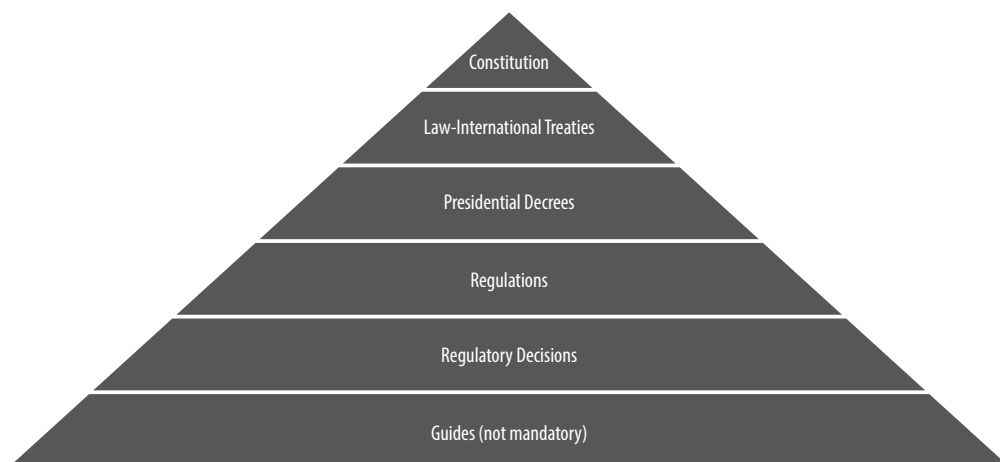


Figure 1. Turkish norm pyramid

The main legal framework for the spent fuel and radioactive waste management is defined by the Nuclear Regulation Law No.7381. Moreover, secondary legislation and guidelines have been prepared for the implementation of the law. Additionally, a National Radioactive Waste Management Plan has been prepared for the 2021-2025 period by TENMAK, and determined by the Ministry of Energy and National Resources by taking the opinion of the NRA as a basis for establishing the national policy and strategy for the management of radioactive waste and spent fuel.

The objective of the Nuclear Regulation Law is to determine, based on the peaceful use principle, the fundamental principles and rules to be applied for the protection of workers, the public, the environment, and future generations from the possible harmful effects of radiation during activities regarding the utilisation of nuclear energy and ionising radiation, and to determine the responsibilities of the parties. Further, along with the definition of the organisation, duties, and authorities of the NRA, it also defines its regulatory control over these activities.⁹ Essentially, the Nuclear Regulation Law contains provisions and requirements on general principles of radiation protection, safety, security, and safeguards; authorisations and inspections; administrative and criminal sanctions; coordination of activities between different governmental bodies regarding interfaces between them while regulating nuclear and radiation facilities and activities; roles and responsibilities

9 Nuclear Regulation Law, 2022.

for decommissioning and the management of spent fuel and radioactive waste; third-party liability for nuclear damage arising from nuclear incidents; establishment of an independent nuclear regulatory body, NRA, and establishment of the Nuclear Technical Support Joint Stock Company (NUTED A.Ş.), the technical support organisation. Besides this law, Presidential Decree No. 95 regulates the NRA's functions and organisational structure.

The duties and responsibilities of the NRA are defined in Presidential Decree No. 95, dated 8 March 2022. NRA is composed of a Nuclear Regulatory Board (Board) and a Presidency. NRA is independent in terms of its regulatory decisions. The Board is its decision-making organ.

Furthermore, some additional important legislation affect the radioactive waste and spent fuel management facilities, such as Environment Law No. 2872, which regulates the environmental impact of radioactive waste and spent fuel management facilities. However, other institutions or organisations may have the authority to regulate in the relevant areas. According to Article 3, paragraphs 6 and 7 of the Nuclear Regulation Law, administrative actions and measures by other organisations that regulate or oversee activities outside the scope of the Law in the field of nuclear energy and radiation cannot compromise safety, security, and nuclear safeguards. Additionally, provisions of other regulations that do not meet the requirements for safety, security, and nuclear safeguards will not apply to activities within the scope of Nuclear Regulation Law.

3.1. International Agreements

The last paragraph of Article 90 of the Constitution stipulates that 'international agreements duly put into effect have the force of law'.¹⁰ Therefore, the international treaties are situated on the same level as laws in the Turkish norm hierarchy. The agreements to which Türkiye is a party with respect to nuclear energy and ionising radiation are outlined in Table 1.

10 Constitution of the Republic of Türkiye No. 2709, 1982.

Table 1. International agreements signed/ratified by the Republic of Türkiye¹¹

International Agreement	In Force
Convention on Third Party Liability in the Field of Nuclear Energy (the Paris Convention)	01.04.1968
1964 Protocol to Amend the Paris Convention	05.04.1968
1982 Protocol to Amend the Paris Convention	07.10.1988
2004 Protocol to Amend the Paris Convention	04.01.2022
Treaty on the Non-Proliferation of Nuclear Weapons (NPT)	17.04.1980
Convention on the Physical Protection of Nuclear Material (CPPNM)	08.02.1987
Amendment to the Convention on the Physical Protection of Nuclear Material (CPPNM/A)	08.05.2016
Convention on Early Notification of a Nuclear Accident	03.02.1991
Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	03.02.1991
Convention on Nuclear Safety	24.10.1996
Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention	26.06.2007
International Convention for the Suppression of Acts of Nuclear Terrorism	24.09.2012
Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management	21.05.2023

The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management officially entered into force on May 21, 2023, in Türkiye. Its aim is to ensure spent fuel and radioactive waste management in a safe, secure, and sustainable manner in line with internationally recognised principles and good practices related to nuclear and radiation safety. After the ratification of the Joint Convention and officially becoming a Contracting Party, Türkiye presented its first national report for the 8th Review Meeting of the Joint Convention held in March 2025.

3.2. Secondary Legislation about Spent Fuel and Radioactive Waste

Two main regulations govern spent fuel and radioactive waste: Regulation on Authorizations and Safety Principles Regarding Radioactive Waste Facilities; and Regulation on Radioactive Waste and Spent Fuel Management.

11 Nuclear Regulatory Authority: International Treaties.

According to the Nuclear Regulation Law, safety means establishing and maintaining proper conditions to ensure the protection of workers, the public, the environment, and future generations from radiation during the conduct of activities related to nuclear energy and ionising radiation, and preventing accidents or mitigating the consequences of accidents. Further, as per the Law, activities related to nuclear energy and ionising radiation, and persons, facilities, devices, and materials related to these activities are subject to regulatory control in terms of safety, security, and nuclear safeguards. According to the Nuclear Regulation Law, NRA determines the activities that require notification or authorisation based on safety and security principles.

NRA prepared the Regulation on Authorizations and Safety Principles Regarding Radioactive Waste Facilities, enacted in 2022, to determine the procedures and principles pertaining to the authorisation of activities and the safety principles to be followed in these facilities, and to confirm that the activities associated with radioactive waste facilities are conducted in accordance with the principles of radiation protection, safety, and security.¹²

Next, the Regulation on Radioactive Waste and Spent Fuel Management was enacted in 2023 to define the procedures and principles regarding the safe management of radioactive waste and spent fuel. The responsibilities of the authorised person for the safety of spent fuel or radioactive waste management are prescribed in the Nuclear Regulation Law, and Regulation on Radioactive Waste and Spent Fuel Management. Article 5 of the Regulation, titled 'Protection of workers, public, environment and future generations', says that 'radioactive waste cannot be released into the environment'. Paragraph 2 states that necessary precautions are taken by the authorised person to ensure that the effects of radioactive waste and spent fuels on workers, public, environment, and future generations do not exceed acceptable levels. Paragraph 3 says that 'relevant legislative provisions are applied in matters regarding the protection of workers, public and environment from radiation in activities related to radioactive 'waste and spent fuel management'. Additionally, paragraph 5 states that 'in the management of radioactive wastes and spent fuels, the possible effects of radioactive wastes and spent fuels on the public and the environment beyond the country's borders are taken into account'. According to the Regulation, the person authorised to conduct activities that result in the generation of radioactive waste or its management shall take necessary measures, including reuse and recycling, to minimise the quantity, volume, and radioactivity of such waste to the lowest possible and reasonable extent. In addition, the Regulation states that the processing of radioactive waste comprises pretreatment, treatment, and conditioning processes. The treatment process shall be carried out in such a way that as small a volume

12 Regulation on Authorizations and Safety Principles Regarding Radioactive Waste Facilities, 2022.

of radioactive waste as possible is delivered to subsequent radioactive waste management.¹³

According to the Regulation on Clearance and Release of Radioactive Materials, 2023, methods such as decontamination or radioactive decay may be implemented with the aim of decreasing the activity of radioactive materials below the clearance limit.¹⁴

In addition, the Regulation on Safe Transport of Radioactive Material; Regulation on Safeguards; Regulation on Management System in Nuclear Facilities, Radiation Facilities and Radioactive Waste Facilities; Regulation on Authorizations Regarding Radiation Facilities and Radiation Practices; Regulation on the Authorization of Environmental Remediation Activities of Radioactively Contaminated Areas; Regulation on Management of Radiation Emergencies; Regulation on Clearance and Release of Radioactive Materials; Regulation on National Radiation Monitoring and Radiation Control; Regulation on Security of Nuclear Facilities and Nuclear Materials; Regulation on Radioactive Waste Management Special Account, and Decommissioning Special Account and the Accounts Management Board have some provisions that affect the radioactive waste management system.

3.2.1. Inspection

The Regulation on Inspections and On-site Examinations Regarding Nuclear Energy and Ionizing Radiation was published in 2023.¹⁵ This regulation outlines the inspection process in accordance with the provisions of Nuclear Regulation Law.

In accordance with Nuclear Regulation Law and Presidential Decree No. 95, the NRA has the following responsibilities regarding inspection:¹⁶

- To inspect or examine the activities and authorised persons on-site before or after the authorisation,
- To prepare annual inspection programs regarding inspection activities in coordination with the relevant departments,
- To carry out the works and procedures related to the implementation of administrative sanctions in matters falling within its scope of duty and authority, in coordination with the relevant service units,
- To receive technical support services from specialised public institutions and organisations, private law legal entities, and real persons, within the scope of the inspection and on-site examination to conduct the examination,

13 Regulation on Radioactive Waste and Spent Fuel Management, 2023.

14 Regulation on Clearance and Release of Radioactive Materials, 2023.

15 Regulation on Inspections and On-site Examinations Regarding Nuclear Energy and Ionizing Radiation, 2023.

16 Nuclear Regulation Law, 2022; Presidential Decree No. 95, 2022.

research, determination, and reporting in a way that will not be binding on the Authority in terms of results, and

- To inform the authorised person about the findings determined as a result of the inspection activities, follow up the works and procedures of the authorised person regarding the findings, report findings that have not been satisfactorily resolved, and carry out the works and procedures stipulated in the relevant legislation in coordination.

Additionally, inspectors and other NRA personnel assigned to accompany the inspection have the authority to enter relevant places or facilities for inspection purposes to supervise the activities and inspect them on the spot; meet with the people they deem necessary and conduct examinations, research, and investigations on the issues they deem necessary; request, examine, retain, or take copies of all kinds of information, documents, and records; take, remove, retain, properly dispose of, or have any material or sample; make or perform measurement, analysis, inspection, and testing using any device; and keep visual, audio, or written records.

For the documentation and reporting, the Nuclear Regulation Law gives responsibility to the authorised person to keep records, make notifications, and report as defined in legislation and its management system. Additionally, the Regulation on Management System in Nuclear Facilities, Radiation Facilities and Radioactive Waste Facilities includes requirements regarding records to be kept according to the management system of the facilities and their reporting. Regarding radioactive waste and spent fuel management, the Regulation on Radioactive Waste and Spent Fuel Management regulates the records and reporting in detail.

3.2.2. Enforcement

The Nuclear Regulation Law provides provisions for the enforcement of applicable regulations and terms of licenses. As a general principle, as stated in Article 3, paragraph 3, activities related to nuclear energy and radiation and persons, facilities, devices, and materials related to these activities are subject to regulatory control in terms of safety, security, and nuclear safeguards.

According to the Nuclear Regulation Law, nuclear enforcement system comprises criminal sanctions and administrative sanctions. Article 24 regulates the criminal sanctions and implementation of these sanctions that are not part of the regulatory functions of NRA. It falls within the jurisdiction of the criminal courts. Article 25 regulates administrative sanctions, which comprise cancellation, suspension, restriction of authorisation, and administrative fines. The Nuclear Regulatory Board is authorised to decide on administrative sanctions. The NRA could apply

administrative sanctions together or separately. In cases where safety or security is endangered or may be compromised, the NRA may decide to suspend or restrict the authorisation in addition to the administrative fine.¹⁷

Law No. 7381, Article 25, paragraph 2, states that besides the administrative fines applied pursuant to the first paragraph, an appropriate time is given to the person concerned by the NRA to rectify the violations. If the violations are not remedied within the given time, administrative fines are applied in the amount of twice the previous penalty each time. If it is determined that a false document or misleading information has been submitted, or a change in the authorisation conditions, which are the basis for the authorisation, has occurred and that it is not possible to correct it, the authorisation may be suspended, restricted, or cancelled, in addition to applying the administrative fine. The administrative sanctions to be applied by the NRA are determined with a graded approach. This approach is based on the type and characteristics of the activity, risk of exposure, and the magnitude of the radiation exposed, together with the presence and magnitude of the damage.

For the implementation of administrative sanctions, a regulation has been issued to clarify the procedural issues in 2023: the Regulation on Administrative Sanctions of the Nuclear Regulatory Authority. The enforcement process begins with the identification of a violation. Violations are graded on four levels depending on the consequences of the violations. Further, a calculation table and formula have been provided to determine the influence of the criteria given in the Regulation on the administrative sanction to be applied.¹⁸

Crimes, penalties, and administrative sanctions are defined in Nuclear Regulation Law such that they are compatible with the international instruments' provisions. Additionally, the Turkish Criminal Law No. 5237 defines some nuclear and radiological related crimes and penalties.

4. Basic Provisions about Spent Fuel and Radioactive Waste Management

According to the Nuclear Regulation Law, basic provisions about spent fuel and radioactive waste management are defined as follows¹⁹:

¹⁷ Nuclear Regulation Law, 2022.

¹⁸ Regulation on Administrative Sanctions of Nuclear Regulatory Authority, 2023.

¹⁹ Nuclear Regulation Law, 2022.

- Spent fuel and radioactive waste must be managed in a safe, secure, sustainable, and responsible manner within the framework of intergovernmental agreements and well-accepted standards.
- Necessary precautions shall be taken to ensure that the effects of spent fuels and radioactive wastes on workers, the public, the environment, and future generations do not exceed acceptable levels. In activities related to spent fuel and radioactive waste management, relevant legislative requirements shall be applied in matters regarding the protection of workers, the public, and the environment from radiation.
- Non-radiological hazards, and occupational health and safety issues shall be also considered in the management of spent fuel and radioactive waste.
- In the management of spent fuel and radioactive waste, the possible effects of spent fuel and radioactive waste on the public and the environment beyond the country's borders shall be considered.
- It is prohibited to import radioactive waste generated from activities conducted outside the jurisdiction area of the Republic of Türkiye. This requirement does not apply to radiation sources produced within Türkiye's borders that are exported under the condition of being returned when their usage period expires, nor to the transit passage of radioactive wastes or imports of materials contaminated with naturally occurring radioactive materials.
- Disused sealed sources shall be returned to the country of origin or, if that is not possible, to a radioactive waste facility.
- Radioactive waste shall not be released or left to the environment.
- The authorised person that generates radioactive waste shall take the necessary measures to keep the waste at the lowest possible and reasonable levels in terms of quantity, volume, and radioactivity.
- The spent fuel generated in NPPs shall be stored at the NPP site throughout the operational life of the NPP.
- NRA is responsible for establishing regulations concerning the safe management of spent fuel and radioactive waste, the release, and the clearance of radioactive materials and orphan radioactive materials.
- TENMAK is responsible for the disposal of radioactive waste generated as a result of activities carried out in the sovereignty area of the Republic of Türkiye and the management of orphan radioactive materials.
- TENMAK must prepare the draft National Radioactive Waste Management Plan as a basis for establishing the national radioactive waste policy and strategy for the management of radioactive waste and spent fuel. The draft Plan shall be approved by the Ministry of Energy and National Resources, considering the comments of the NRA, and shall be updated every five years.

- All responsibility for the management of the spent fuel or radioactive waste excluding their disposal belongs to the person authorised for the activity.
- The authorised person who produces spent fuel or radioactive waste is responsible for all kinds of transportation of such material inside or outside the facility.
- All kinds of responsibility for the radioactive waste that arise during the decommissioning activities belong to the authorised person.
- The Ministry of Energy and National Resources is responsible for establishing the radioactive waste management special and decommissioning special accounts. These accounts must be opened with the central accounting unit of the Ministry. Any revenue collected on behalf of these special accounts must be used for the intended purpose only.
- The Accounts Management Board is responsible for determining the contributions to the special accounts. For nuclear power plants, the contributions shall be based on the electricity produced per kilowatt-hour and the guarantees shall be based on per megawatt of installed power. For other facilities, contributions and guarantees shall be set according to the facility type, application, and waste characteristics. These contributions and guarantees shall be reviewed annually and shall be updated to cover anticipated expenses by the Accounts Management Board.
- Authorised persons who generate radioactive waste during activities subject to authorisation are responsible for making a contribution payment to the radioactive waste management special account in the amount determined by the Accounts Management Board in accordance with relevant legislation.
- Persons authorised to operate nuclear facilities, radiation facilities, and radioactive waste facilities are responsible for making a contribution payment to the decommissioning special account in the amount determined by the Accounts Management Board in accordance with relevant legislation.
- Payments shall be made to TENMAK from the radioactive waste management special account for:
 - I) Determination of areas for establishing a radioactive waste disposal facility and related siting studies.
 - II) Design, authorisation, construction, operation, maintenance, closure, and release of the radioactive waste disposal facility from regulatory control.
 - III) Research and development activities for the specified purposes.
- Payments shall be made to the authorised person from the decommissioning special account to carry out:

- I) Decommissioning of nuclear, radiation, and radioactive waste facilities, including the costs of disposal of radioactive wastes generated during decommissioning, and
- II) Remediation of the site compatible with the conditions for the end state of the facility site.
- It is a condition of authorisation for the operation of a facility that the Accounts Management Board shall report to the NRA that the guarantee is adequate to cover the necessary costs for radioactive waste management and decommissioning in the event of early decommissioning of the facility.
- If the balance in the special accounts for radioactive waste and decommissioning proves insufficient to cover expenses associated with decommissioning or radioactive waste management, including early decommissioning, the costs shall be covered by the guarantee provided by the authorised person. If the guarantee is deemed inadequate, the authorised person is responsible for covering the remaining amount.
- Persons applying for authorisation to operate the facilities are required to submit a cost plan for decommissioning and radioactive waste management to the Ministry of Energy and National Resources. Each facility shall have its own decommissioning special account.

4.1. Authorisation of Radioactive Waste Facility

According to Nuclear Regulation Law and secondary legislation, radioactive waste facilities are defined as the facilities where radioactive waste is processed, stored, or disposed of. The Regulation on Authorizations and Safety Principles Regarding Radioactive Waste Facilities²⁰ includes provisions for authorisation of radioactive waste processing, storage, and disposal facilities. The site of any radioactive waste facility must be approved by the NRA. The regulation specifies that the following activities require authorisation from the NRA:

- Construction,
- Commissioning,
- Operation,
- Modifications affecting safety and security at the facility, and
- Decommissioning or closure of the facility.

20 Regulation on Authorizations and Safety Principles Regarding Radioactive Waste Facilities, 2023.

According to the regulation, the organisation shall apply the graded approach principle according to the type and nature of the facility in which the activities are carried out within the scope of ensuring radiation protection, safety, and security at the radioactive waste facility. Furthermore, the NRA shall apply the graded approach principle according to the type and nature of the facility in the review and assessment processes of authorisation applications for radioactive waste facilities.

To establish a radioactive waste facility, the organisation must first submit a notice of intent to the NRA containing detailed information about the organisation and the proposed facility. This information includes contact details, administrative structure, management system certificates, technical experience, and an anticipated project schedule. The NRA then registers the organisation and initiates the preparation of the Regulatory Documents List, which serves as the basis for licensing and includes national and international standards and guidelines. The Regulatory Documents List is periodically reviewed and updated as necessary to ensure compliance with safety and regulatory requirements.

For radioactive waste facilities, first, a site approval must be obtained from the NRA, which involves submitting a comprehensive site report and conducting detailed site studies to ensure that the site is suitable. The organisation must then apply for a construction permit, which involves submitting safety analysis reports and environmental monitoring programs. Once construction is complete, a commissioning permit is required, which involves testing and verifying that the facility is operating as designed. Following the commissioning permit, the organisation must apply for an operating license. After obtaining an operating license, the organisation must comply with the safety and security regulations, conduct periodic reviews, and obtain a permit for any significant modifications. Finally, the decommissioning process requires a separate permit to ensure that all activities meet regulatory standards until the site is released from regulatory control.

The authorised person for the activity shall bear full responsibility for the effective and efficient management of radioactive wastes and spent fuels within the site, or alternatively, for the management of radioactive wastes at designated locations where radiation application or other related activities are being conducted according to the Regulation on Radioactive Waste and Spent Fuel Management. Furthermore, the authorised person has the prime responsibility to ensure safety and security in an activity or at a facility. To comply with the terms and conditions of a granted authorisation and related legislation, or to be under regulatory control, delegation or contracting to outsource its responsibilities shall not reduce or remove the responsibility of the authorised person.

According to the Nuclear Regulation Law, and the Regulation on Radioactive Waste and Spent Fuel Management, the authorised person for the activity shall bear

the full responsibility for all kinds of transportation of radioactive waste and spent fuel inside or outside the facility.

4.2. Radioactive Waste Classification

In Türkiye, the radioactive waste classification scheme is defined in the Regulation on Radioactive Waste and Spent Fuel Management. The radioactive waste classification scheme is based on the IAEA General Safety Guide on Classification of Radioactive Waste, GSG-1, with minor differences.²¹

According to the regulation, radioactive waste is classified according to its radioactivity concentrations and the half-lives of the radionuclides it contains into very short-lived, very low-level, low and intermediate level, and high-level radioactive waste.

Table 2. The radioactive waste classification scheme²²

Radioactive Waste Class	Limits on Half-life or Radioactivity Concentration	Final Route
Very Short-lived Radioactive Waste	Half-life of less than about 100 days	Clearance or release
Very Low-level Radioactive Waste	Radioactivity concentrations below one hundred times the clearance limits and not classified as very short-lived radioactive waste	Near surface, intermediate depth, or deep disposal facility
Low and Intermediate Level Radioactive Waste	- Radionuclides with half-lives less than 31 years. - For long lived alpha emitting radionuclides: Radioactivity concentration below 400 Bq/g on average for all radioactive waste packages and below 4,000 Bq/g for individual packages. - For long lived beta and gamma emitting radionuclides: Radioactivity concentration below approximately 10 kBq/g.	Near surface, intermediate depth, or deep disposal facility
	- For long lived alpha emitting radionuclides: Radioactivity concentration above 400 Bq/g on average for all radioactive waste packages and above 4,000 Bq/g for individual packages. - For long lived beta and gamma emitting radionuclides: Radioactivity concentration above 10 kBq/g.	Intermediate depth or deep disposal facility
High Level Radioactive Waste	- Spent fuels that have been recognised as radioactive waste. - Radioactive waste resulting from reprocessing and containing fission products and actinides with a total radioactivity concentration of more than about 108 Bq/g. - Radioactive waste containing around 108 Bq/g of radioactivity concentration.	Deep disposal facility

21 International Atomic Energy Agency General Safety Guide on Classification of Radioactive Waste, GSG-1, 2009.

22 Regulation on Radioactive Waste and Spent Fuel Management; Turkish National Report for the Joint Convention Meeting, 2024.

4.3. Disused Sealed Sources

All activities with radioactive sources including the use, manufacture, and possession of radioactive sources, are subject to obtaining a license from the NRA. According to Nuclear Regulation Law, the operations to be carried out at all stages, from the manufacture or supply of the sealed radioactive source to its export, return to the origin, delivery to the radioactive waste facility, sale, or transfer, shall be carried out by the authorised persons. Authorisation stages, the application procedure, and radiation protection, safety, and security principles for radiation facilities and radiation practices, which cover the use, manufacture, and possession of radioactive sources, are described in the Regulation on Authorizations Regarding Radiation Facilities and Radiation Practices. According to the regulation, activities must be justified based on societal benefits and must comply with dose limits specified by the NRA.

According to the Regulation on Authorizations Regarding Radiation Facilities and Radiation Practices.²³

- The authorised person must regularly review the radioactive source inventory to identify disused sealed sources, and ensure their continuous safety and security.
- One of the following appropriate actions shall be taken by the authorised person with respect to the disused sealed sources:
 - a) In case of a request for reuse of disused sealed sources for another purpose, the NRA shall be notified with the necessary information and documents. Disused sealed sources may be reused only with the consent of the NRA and within the scope of the provisions of this Regulation.
 - b) For transfer requests of the disused sealed sources, the transfer of the disused sealed source shall be conducted only if the authorised person notifies the NRA and the licence application made by the transferee is approved by the NRA.
 - c9 If disused sealed sources are not reused or transferred, the disused sealed sources shall be returned to the country of origin or, if that is not possible, shall be delivered to the radioactive waste facility operated by TENMAK.
- Disused sealed sources cannot be left in the environment or stored indefinitely by the authorised person.

Bringing radioactive waste generated by an activity implemented outside the area of jurisdiction of the Republic of Türkiye into the territory of the Republic of Türkiye is forbidden by the Nuclear Regulation Law except for the radiation sources produced within the borders of the Republic of Türkiye and exported with the condition of being

23 Regulation on Authorizations Regarding Radiation Facilities and Radiation Practices, 2023.

returned to the country of origin when their usage period expires and the transit passage of radioactive wastes, and the importation of materials contaminated with natural radioactive materials.

4.3.1. Orphan Radioactive Materials

In accordance with Article 14 of the Regulation on Radioactive Waste Management and Spent Fuel Management, TENMAK shall designate the required procedures for the control of orphan radioactive materials, take or have taken the necessary measures in cooperation with the relevant institutions and organisations when necessary, and perform the necessary works and procedures including disposal. Costs that may arise due to orphan sources shall be compensated by the last owner, if any, as identified by the NRA. To minimise the harmful effects of orphan radioactive materials, radiation measurement systems including fixed-portal detectors have been installed at the entrances of facilities importing scrap metal, ports, and customs.

Additionally, Article 24 (1)(b) of the Nuclear Regulation Law states that, 'Persons who leave the place or facility where the activity is carried out, nuclear material, radioactive source or radioactive waste without an owner, before their obligations regarding the activity expire, are subject to imprisonment from three years to eight years and a judicial fine of five thousand days'.²⁴

4.4. Decommissioning

According to the Regulation on Authorizations for Radioactive Waste Facilities and Safety Principles, radioactive waste processing and storage facilities are subject to a decommissioning permit. The organisation operating such a facility is obliged to decommission the facility. The decommissioning process is undertaken in accordance with the conditions for the decommissioning or closure permit, and in accordance with the documents in the Regulatory Documents List determined by the NRA, provided that it is demonstrated that the site will be made compliant with the re-use conditions. Within this scope, the organisation operating the facility shall prepare and implement reports, plans, and programs for all decommissioning activities aimed at removing radioactive materials from the site and removing radioactive contamination, together with the dismantling and environmental harmonisation of the site. For the decommissioning process, in addition to the aforementioned conditions, the

24 Nuclear Regulation Law, 2022; Regulation on Radioactive Waste Management and Spent Fuel Management, 2023.

organisation shall submit the radioactive waste management, radioactive release, environmental radiological monitoring, and personal dose and radiation measurement reports to the NRA every year starting from the date permission is granted for decommissioning. The content of these reports is determined by the NRA. The operating organisation also immediately notifies the NRA of any extraordinary event and reports the planned measures to be taken.²⁵

The application file for the decommissioning permit shall include the Safety Analysis Report prepared for decommissioning, the quality assurance document of the decommissioning process, radiation emergency plan, safety plan regarding the decommissioning process, environmental radiological monitoring program, radiation protection program, and design information questionnaire for radioactive waste facilities with nuclear material, including a nuclear material counting and control system. These documents submitted with the application shall be evaluated by the NRA in terms of their adequacy and compliance with the requirements of the documents in the Regulatory Documents List.

The organisation shall make the decision on the closure of the disposal facility and notify the NRA. Then, it shall make plans to start and complete the closure activities as soon as possible and apply to the NRA for a closure permit. In this scope, the organisation shall take the decision on the decommissioning of the radioactive waste facility and notify it to the NRA. It shall make plans to start and complete the decommissioning activities as soon as possible and apply to the NRA for a decommissioning permit.

Within the scope of the decommissioning process, first, the authorised organisation shall perform all activities included in the quality assurance document of the decommissioning process of the radioactive waste facility. Next, it shall submit the radioactive waste management, radioactive release, environmental radiological monitoring, and personal dose and radiation measurement reports, with the contents determined by the NRA, to the NRA every year starting from the date permission is granted for decommissioning.

5. Closure

Requirements concerning the post-closure period of a disposal facility are also stated in the Regulation on Authorizations and Safety Principles Regarding Radioactive Waste Facilities. As per this regulation, the organisation shall take measures to maintain radiation protection, safety, and security in the radioactive waste facility that it has decided to close and fulfil its responsibilities regarding nuclear safety, if any.

25 Regulation on Authorizations for Radioactive Waste Facilities and Safety Principles, 2022.

For the closure, the organisation shall implement active and passive safety measures on and around the site during the control period after the closure of the facility. The organisation reports the results of radiological environmental monitoring activities, and maintenance and repair activities to the NRA every year, starting from the date of the closure permit, during the post-closure active control period until it is released from regulatory control.

The organisation shall be responsible for the removal of such facilities from regulatory control. In the application file for such removal, the organisation shall apply to the NRA with a report demonstrating that the conditions necessary for the removal have been met. The release of the disposal facilities from regulatory control occurs following a post-closure period of active control and only limited use of the site. Monitoring and control studies shall be conducted to ensure the monitoring and maintenance of the integrity of the barriers throughout the active control period after the closure.²⁶

6.

Conclusion

Türkiye has appropriate infrastructure for spent fuel and radioactive waste management with its latest regulatory and legal framework developments. Nuclear Regulation Law and secondary legislation related to it outline the fundamental principles of the organisational system which can support the safe management of radioactive waste and spent fuel.

In particular, a very important development is the entry into force of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management before the nuclear power plant project is commissioned. The legal framework regarding radioactive waste, which is already in a good state, should be completed once the necessary determinations related to the process of special accounts are made and put into operation.

²⁶ Ibid.

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