2020

National Report

as referred to by the
Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management

ATOMIC ENERGY COUNCIL

National Report as referred to by the

Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management

Republic of China

Atomic Energy Council

2021

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LIST OF ACRONYMS AND ABBREVIATIONS

ABWR	Advanced Boiling Water Reactor
AEC	Atomic Energy Council
ALARA	As Low As Reasonable Achievable
ASME	American Society of Mechanical Engineers
BWR	Boiling Water Reactor
EPA	Environmental Protection Agency
FCMA	Fuel Cycle and Materials Administration
FSS	Final Site Survey
GTCC	Greater-Than-Class-C Radioactive Waste
HLW	High-Level Radioactive Waste
IAEA	International Atomic Energy Agency
INER	Institute of Nuclear Energy Research
ISO	International Organization for Standardization
LLW	Low-Level Radioactive Waste
MOEA	Ministry of Economic Affairs
MOI	Ministry of Interior
MOL	Ministry of Labor
NORM	Naturally Occurring Radioactive Materials
NPP	Nuclear Power Plant
NTHU	National Tsing Hua University
OSHA	Occupational Safety and Health Administration
PWR	Pressurized Water Reactors
SSCs	Structures, Systems and Components
SURW	Small User Radioactive Waste
THAR	Tsing Hua Argonaut Reactor
THOR	Tsing Hua Open-pool Reactor
THMER	Tsing Hua Mobile Educational Reactor

TPC	Taiwan Power Company
TRR	Taiwan Research Reactor
TRU	Transuranic Waste
USDOE	U.S. Department of Energy
USNRC	U.S. Nuclear Regulatory Commission
VRC	Volume Reduction Center
WBR	Water Boiler Reactor
ZPRL	Zero Power Reactor at Lungtan

A. INTRODUCTION

A.1. Purpose and Structure

The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management of the IAEA (the International Atomic Energy Agency) was opened for signature on September 29, 1997, and entered into force on June 18, 2001. The Convention contributes significantly to encourage the Contracting Parties to commit to the safety of spent fuel and radioactive waste management, and to fulfill the following objectives:

(1) To achieve and maintain a high level of safety worldwide in spent fuel and radioactive waste management.

(2) To ensure that there are effective defenses against potential hazards so that individuals, society and the environment are protected from harmful effects of ionizing radiation, now and in the future.

(3) To prevent accidents with radiological consequences and to mitigate their consequences should they occur.

Therefore, Article 32 of the Convention requires that each Contracting Party shall submit a national report to each review meeting of Contracting Parties, to address the measures taken to implement each of the obligations of the Convention, and the achievements.

Though Taiwan, the Republic of China (R.O.C.), is not a Contracting Party of the Convention, shall commit to following the requirements set forth in the relevant international conventions, in accordance with the provisions of Article 17 of the domestic law, “Nuclear Materials and Radioactive Waste Management Act;” hence, a national report has been prepared to fulfill the obligations of the Convention, with the form and structure as provided in IAEA INFCIRC/604/Rev.3.

Table A-1 provides a cross reference between the sections in this report and the specific reporting requirements in the Convention. The data presented

in this report had been updated to December 31, 2020, unless otherwise specified.

Table A-1. Cross Reference between the National Report and the Convention

National Report Section	Joint Convention Section
A. Introduction	
B. Policies and Practices	Article 32, Paragraph 1
C. Scope of Application	Article 3
D. Inventories and Lists	Article 32, Paragraph 2
E. Legislative and Regulatory System	Articles 18~20
F. Other General Safety Provisions	Articles 21~26
G. Safety of Spent Fuel Management	Articles 4~10
H. Safety of Radioactive Waste Management	Articles 11~17
I. Transboundary Movement	Article 27
J. Disused Sealed Sources	Article 28
K. General Efforts to Improve Safety	
L. Annexes	

The regulatory authority overseeing the utilization of nuclear energy and ionizing radiation in Taiwan is the Atomic Energy Council (AEC); and the Fuel Cycle and Materials Administration (FCMA) affiliated to the AEC, is in charge of safety regulation and inspection of affairs related to radioactive materials. The AEC is responsible for the compilation of this national report, and the report had been reviewed by the relevant organizations and the exports.

A.2. Overview

There are 4 nuclear power plants (NPPs) which are owned and operated by Taiwan Power Company (TPC), a state-owned enterprise. Chinshan NPP, Kuosheng NPP, and Lungmen NPP are located in northern Taiwan, as Maanshan NPP is located in southern Taiwan (Figure A-1). Chinshan NPP (under decommissioning) and Kuosheng NPP each consists of 2 boiling water reactors (BWRs), while Maanshan NPP consists of 2 pressurized water reactors (PWRs); besides, there are 2 advanced boiling water reactors (ABWRs) in Lungmen NPP, which are under mothballing at present (Table A-2).

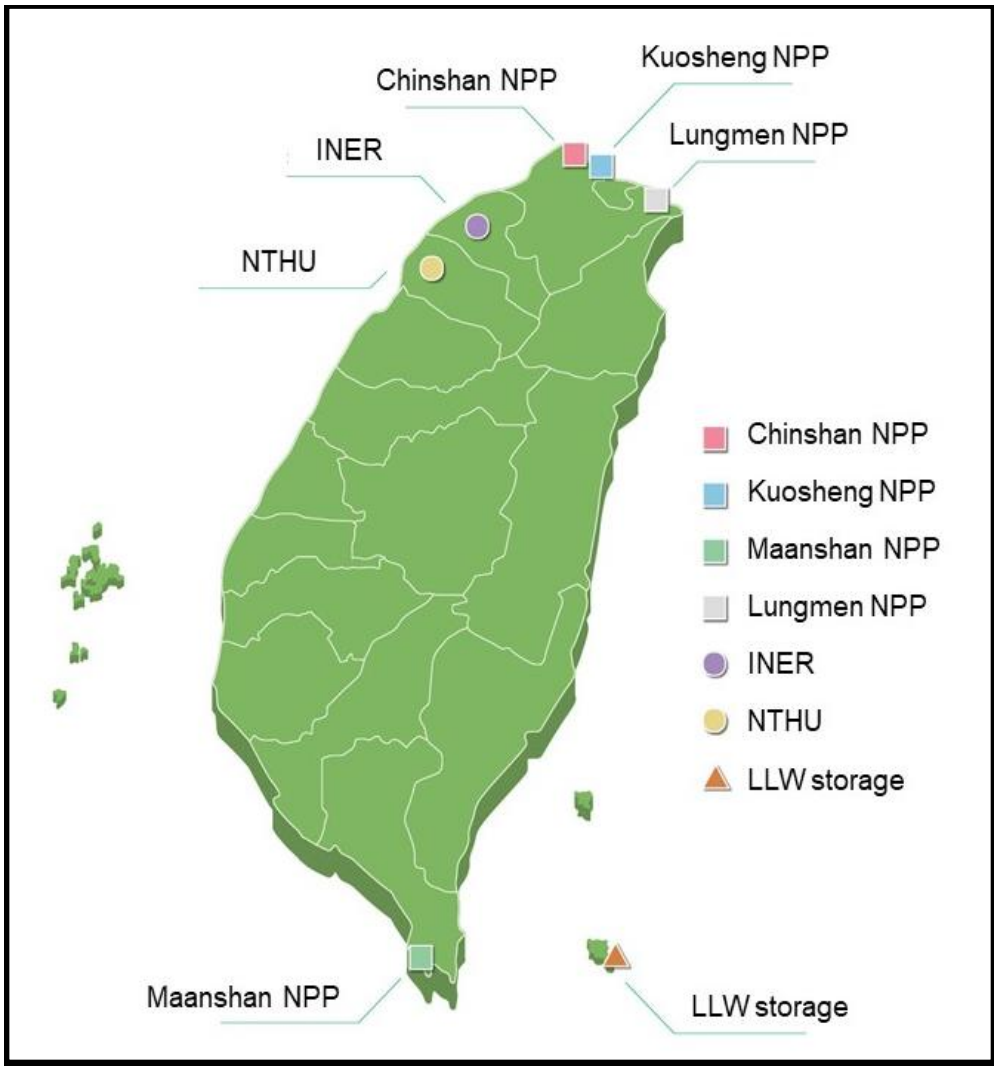


Figure A-1. Nuclear Facilities in Taiwan

Table A-2. Commercial NPPs of Taiwan

NPP	Unit	Reactor Type	Capacity (MWe)	Commission Year	Status
Chinshan	Unit 1	BWR	636	1978	Decommissioning
	Unit 2	BWR	636	1979	Decommissioning
Kuosheng	Unit 1	BWR	985	1981	Operating
	Unit 2	BWR	985	1983	Operating
Maanshan	Unit 1	PWR	951	1984	Operating
	Unit 2	PWR	951	1985	Operating
Lungmen	Unit 1	ABWR	1,350	-	Mothballing
	Unit 2	ABWR	1,350	-	Mothballing

There are 6 research and educational reactors in Taiwan, 5 of them are under decommissioning or decommissioned, only 1 is still operating. The research and educational reactors in Taiwan are as follows (Table A-3):

- Zero Power Reactor at Lungtan (ZPRL): owned by INER, under decommissioning.
- Taiwan Research Reactor (TRR): owned by the Institute of Nuclear Energy Research (INER), under decommissioning.
- Water Boiler Reactor (WBR): owned by INER, decommissioned.
- Tsing Hua Argonaut Reactor (THAR): owned by National Tsing Hua University (NTHU), decommissioned.
- Tsing Hua Mobile Educational Reactor (THMER): owned by NTHU, decommissioned.
- Tsing Hua Open pool Reactor (THOR): owned by NTHU, operating.

Table A-3. Research and Educational Reactors of Taiwan

Owner	Reactor	Basic Information	Operating Year	Status
INER	Zero Power Reactor at Lungtan (ZPRL)	· Light water moderator. · Power capacity 10 kW originally, upgraded to 30 kW. · Material Test Reactor (MTR) type fuel.	1971~2009	Decommissioning
	Taiwan Research Reactor (TRR)	· Heavy water moderator. · Power capacity 40 MW. · Natural Uranium fuel.	1973~1988	Decommissioning
	Water Boiler Reactor (WBR)	· Light water moderator. · Power capacity 100 kW. · Uranium oxide sulfate liquid fuel.	1983~1991	Decommissioned
NTHU	Tsing Hua Argonaut Reactor (THAR)	· Power level 10 kW. · Educational reactor.	1974~1991	Decommissioned
	Tsing Hua Mobile Educational Reactor (THMER)	· Power level 0.1 W. · Educational reactor. · Mobile type.	1975~1990	Decommissioned
	Tsing Hua Open pool Reactor (THOR)	· Light water moderator. · Power level 1 MW originally, upgraded to 2 MW.	1961~	Operating

The radioactive waste in Taiwan can be classified into two categories: high level radioactive waste (HLW) which includes the spent fuel for final disposal or the extraction residuals generated in reprocessing (not executed in Taiwan currently), and low level radioactive waste (LLW). It can also be divided into nuclear power-generated radioactive waste and small user radioactive waste (SURW, radioactive waste generated by medical treatment, industry, research, and purposes other than nuclear power generating). Please refer to Section B.4 for classification criteria.

There has been a thorough plan for the safety management of the spent fuel and radioactive waste in Taiwan (Figure A-2), Table A-4 presents a summary matrix with an overview of the safety management.

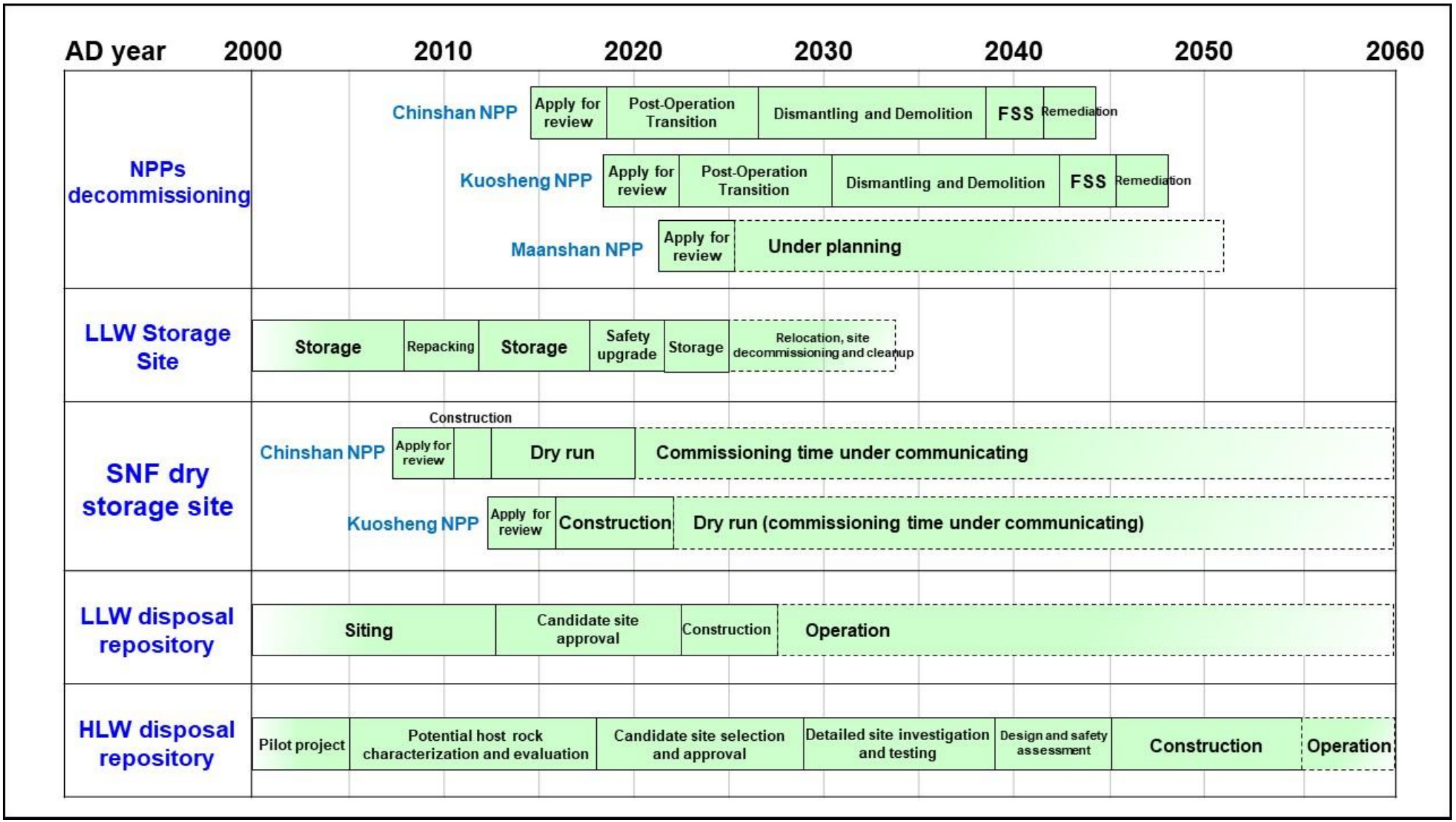


Figure A-2. Timeline of NPPs Decommissioning and Radioactive Waste Management

Table A-4. Overview of Spent Fuel and Radioactive Waste Management

Type of Liability	Long-term Management Policy	Funding of Liabilities	Current Practice / Facility	Future Facilities
Commercial NPPs – spent fuel	Final disposal; reprocessing as alternate.	Nuclear Backend Found	Construction licenses of dry storage of Chinshan and Kuosheng NPP are approved.	Deep geological repository
Commercial NPPs – radioactive waste	Intermediate depth final disposal (> 30 m). GTCC: under discussion.	Nuclear Backend Found	Stored in each NPPs. Early generation: stored in LLW Storage Site.	LLW final repository
Commercial NPPs – decommissioning	Complete decommissioning activities within 25 years after decommissioning permit is issued.	Nuclear Backend Found	Decommissioning permit of Chinshan NPP is approved; Decommissioning Plan of Kuosheng NPP is under review.	Remediation and reuse
Research and educational NPPs – spent fuel	Ship back to suppliers.	Government budget	Mostly have already been shipped back to suppliers.	NA
SURW – LLW	Disposed in LLW disposal with LLW from commercial NPPs.	Producer pays. Legacy: government budget.	Stored in INER.	LLW final repository
SURW – disused sealed sources	Ship back to suppliers. Reuse. Disposed in LLW disposal with LLW from commercial NPPs.	Producer pays. Legacy: government budget.	Stored in INER.	LLW final repository

A.3. What is New Since Last Report

The following section summarizes progress made in several important areas since the previous report.

(1) Legislative systems

A series of regulations have been promulgated, including the amendments to:

- Enforcement Rules for the Nuclear Materials and Radioactive Waste Management Act.
- Regulations on Treatment and Storage of Radioactive Waste and Safety Management of the Facilities.
- Guidelines for Restriction Areas of Low-level Radioactive Waste Final Disposal Facilities.
- Safety Analysis Report Guides for Spent Fuel Dry Storage Facility Application.
- Safety Analysis Report Guides for Low-level Radioactive Waste Storage Facilities.
- Regulations on Review of Application for Radioactive Materials Facilities Design Modification and Equipment Change.
- Regulations on Siting of Consolidated Interim Radioactive Waste Facilities.
- Regulations on Siting of High-level Radioactive Waste Final Disposal.

Two review guides have been established and promulgated as follows:

- Review Guides for Safety Analysis Reports of Spent Fuel Dry Storage Facilities.
- Review Guides for Re-evaluation Reports of Low-level Radioactive Waste Storage Facilities.

See sections E.2 and L.1 for additional information.

(2) Ensuring operation safety of facilities

The operators of spent fuel or radioactive waste operating facilities should submit statutory reports/plans for application for approval, and submit statutory reports/records periodically, in accordance with the relevant regulations (see sections E.2). The AEC is in charge of review, inspection, and field inspection of the facilities. All the relevant activities have been implemented accordingly without gross negligence. Major control measures and management activities, please refer to sections G and H.

As for LLW management in Taiwan, the AEC has requested TPC to carry it out according to the “LLW Storage Site (also known as Lanyu Storage Site) Relocation Plan Report” and the “Specific Implementation Measures of Low-level Radioactive Waste Final Disposal Alternative Plan” approved by the AEC in February 2017. Besides, the AEC also completed the inspection of the repacking preparedness project of LLW Storage Site, and approved TPC to commence the repacking activities in November 2019. All of the activities had been finished by February 2021. See sections H.2 and H.6 for more information.

(3) NPPs decommissioning

The operating licenses of Unit 1 and 2 of Chinshan NPP expired in December 2018 and July 2019 respectively, and have entered into the decommissioning phase thereafter. According to the provisions of “Nuclear Reactor Facilities Regulation Act,” the licensee (TPC) shall submit decommissioning plan and documents to apply for decommissioning permit 3 years prior to the scheduled permanent cessation of operation of the facilities (November 2015). The AEC had completed the review of the submitted documents in June 2017; following, the “Environmental Impact Assessment Report” was also approved by the Environmental Protection Administration (EPA) in July 2019. A decommissioning permit of Chinshan NPP was then issued by the AEC in July 2019. TPC has to complete decommissioning activities according to the “Enforcement Rules for the Implementation of Nuclear Reactor Facilities Regulation Act” in 25 years starting from the date of permit granted, aiming for remediation and reuse of the site. TPC had finished the demolition work of 2 towers in February 2020. See sections D.4 and E.6 for additional information.

For Kuosheng NPP, the operating licenses of Unit 1 and 2 are to be expired in December 2021 and March 2023 respectively. TPC had already submitted the Decommissioning Plan and documents to the AEC, to apply for a decommissioning permit; and the AEC had completed the review in October 2020.

As for Maanshan NPP, the operating licenses of Unit 1 and 2 will expire in July 2024 and May 2025. And TPC has to submit the Decommissioning Plan and documents by July 2021.

(4) Spent Fuel Dry Storage Facility

The 1st phase dry storage facility of Chinshan NPP had been constructed. The AEC has requested the Ministry of Economic Affairs (MOEA) and TPC to actively communicate and coordinate with the New Taipei City Government for the soil and water conservation completion certificate of the facility. The AEC has also ask TPC to perform self-integrated exercise at least once a year before the hot test of the 1st phase dry storage facility, in order to maintain the proficiency of the staff. For more detailed information, please refer to sections D.1 and G.2.

The construction permit of the 1st phase dry storage facility of Kuosheng NPP had been granted by the AEC on August 7, 2015, however, due to the run-off wastewater reduction plan for the construction site is not yet approved by the New Taipei City Government, the construction has not been commenced yet.

(5) Spent Fuel Final Disposal Project

TPC is developing spent fuel final disposal technologies according to the planning in “Spent Fuel Final Disposal Program Plan,” and submitted “Feasibility Assessment Report for the Spent Nuclear Fuel Final Disposal Technology in Taiwan" (SNFD 2017 Report) as an initial safety case of the 1st stage of the project, the “Potential Host Rock Characterization and Evaluation” stage (2005~2017). The report was subjected to international peer review in accordance with the AEC’s request, for the establishment of deep geological disposal technologies that is in line with international safety level. See also sections G.5 and G.7 for more information.

The project has entered the 2nd stage, the “Candidate Site Selection and Approval” stage, in 2018. The MOEA and TPC are responsible for the siting activities in this stage; the AEC is the regulatory authority for the safety, and will not hold any presumptions to the activities.

The “Spent Fuel Final Disposal Program Plan” has to be reviewed and revised every 4 years based on the “Enforcement Rules for the Nuclear Materials and Radioactive Waste Management Act.” The R&D planning of the project had lately been revised in 2018 (verified by the AEC in January 2020), and the scheduled operation commencement time of the disposal site is in 2055.

(6) LLW Final Disposal Project

The MOEA announced Daren Township (Taitung County) and Wuqiu Township (Kinmen County) are the recommended candidate sites in July 2012; however, they still have to be approved through local referendums in accordance with the “Act on Sites for Establishment of Low Level Radioactive Waste Final Disposal Facility,” and TPC is still communicating with the local governments and the public for the referendums to be held.

The AEC had verified the “Report on LLW Final Disposal Technical Evaluation” in September 2017, which is an initial safety analysis report of the two recommended candidate sites. This will also be used as a vehicle of communication with the stakeholders. (See section H.3).

Moreover, the MOEA and the AEC are undergoing the revise of the “Act on Sites for Establishment of Low Level Radioactive Waste Final Disposal Facility,” to revise the competent authority of the siting procedures from the AEC to the MOEA, so that this will be in line with the international trend.

B. POLICIES AND PRACTICES

Article 32, Reporting, Paragraph 1

In accordance with the provisions of Article 30, each Contracting Party shall submit a national report to each review meeting of Contracting Parties. This report shall address the measures taken to implement each of the obligations of the Convention. For each Contracting Party the report shall also address its:

(i) spent fuel management policy;

(ii) spent fuel management practices;

(iii) radioactive waste management policy;

(iv) radioactive waste management practices;

(v) criteria used to define and categorize radioactive waste.

B.1 Policies of Spent Fuel or Radioactive Waste Management

The policies on spent fuel or radioactive waste management can be referred to the “Radioactive Waste Management Policies” promulgated in 1997:

- The objectives of this policy are to ensure nationals safety, maintain environmental and ecological quality, and avoid undue impacts of radioactive waste to present and future generations.
- The management shall be based on presently available technologies, and continue to research and develop.
- The producers of the radioactive waste shall actively reduce the quantity and volume of the radioactive waste.
- The management of the radioactive waste shall be carried out by the producers themselves or commissioned to other organizations, and the producers shall bear the cost of all the related expenses.
- Management measures of radioactive waste shall take account of safety and environmental protection, and comply with relevant international conventions.

- Promotion of research and development, education and public communication shall be enhanced.
- Regulations, management systems and information systems shall be improved.
- The decommissioning of radioactive waste treatment and storage facilities shall adopt demolition in principle, so the sites can be reused.
- Seeking for the feasibility of reprocessing spent fuel abroad in compliance with international safeguards agreements.
- Seeking for the possibility of international cooperative disposal.

Besides, the radioactive waste management policies of Taiwan follow the related safety guides proposed by the IAEA, for instance “Fundamental Safety Principles” (IAEA Safety Standards Series No. SF-1) and “Predisposal Management of Radioactive Waste” (IAEA Safety Standards Series No. GSR Part 5), including concepts such as ensuring the protection of people and the environment, both now and in the future; the generation of radioactive waste must be kept to the minimum practicable level; the relationships between each steps of generating and management of radioactive waste has to be considered and properly arranged; the safety of the facility has to be considered to ensure that safety is optimized.

B.2 Practical Measures of Spent Fuel Management

(1) Spent Fuel of NPPs

When spent fuel has just been discharged from the reactors, they have to be stored in the spent fuel pools of the NPPs for decay before further managed, because of the high activity and heat they are generating. Present spent fuel management strategies of Taiwan are “storage in spent fuel pools for the short term; dry storage for the medium term; and final disposal for the long term.” These measures will be adjusted according to the influence of geopolitical situations.

Spent fuel will be stored in the spent fuel pools when removed from the reactors. The spent fuel pools of Chinshan, Kuosheng, and Maanshan NPPs have all been re-racked to increase their original storage capacity. TPC is now endeavoring to carry out the spent fuel dry storage plans of Chinshan and

Kuosheng NPPs, while the spent fuel pool of Maanshan NPP is capable of accommodating spent fuel generated during its' 40 years operation.

Dry storage facilities are essential to the decommissioning of NPPs in Taiwan. Spent fuel has to be moved from the reactor buildings to the dry storage facilities as soon as possible so that the decommissioning and dismantling activities can be carried out. The AEC has requested TPC to adopt indoor dry storage concept which is in line with the social consensus, and to commission the facility as fast as it can, so that the decommissioning of Chinshan NPP can be completed within 25 years as scheduled.

As for the final disposal of spent fuel, TPC submitted the "Spent Fuel Final Disposal Program Plan" to the AEC based on the "Enforcement Rules for the Nuclear Materials and Radioactive Waste Management Act." There are 5 stages included in the final disposal project: "Potential Host Rock Characterization and Evaluation," "Candidate Site Selection and Approval," "Detailed Site Investigation and Testing," "Repository Design and Safety Assessment," and "Repository Construction." The repository is scheduled to start operating in 2055. Currently, the project has entered the 2nd stage, "Candidate Site Selection and Approval" stage (2018~2028).

(2) Spent Fuel of Research and Educational Reactors

The management policy for spent fuel removed from the research and educational reactors (both INER and NTHU) is to ship back to where it was manufactured.

B.3 Practical Measures of Radioactive Waste Management

(1) Radioactive Waste from NPPs

Practical measures of radioactive waste from NPPs include source control of liquid radioactive waste, control of chemical, reduction of dry radioactive waste, solidification of sludge from liquid radioactive waste and reactor water, volume reduction of combustible and compactable radioactive waste, maintenance of incinerator and compactor, and operation of LLW storage facilities, and so on.

Radioactive waste can be divided into two categories according to their properties: wet radioactive waste and dry radioactive waste. Wet radioactive waste mainly includes concentrated sludge, filtered sludge, and spent resin. Those (besides spent resin) are usually cement solidified, and packaged in 55-gallon galvanized steel drums. Spent bead resin, on the other hand, is dewatered without cement solidification, and temporarily stored in 55-gallon galvanized steel drums with HDPE (High Density Polyethylene) liners. Dry radioactive waste mainly includes paper, clothes, plastic, wood, and metal. Those combustible are incinerated, those compactable are compacted, so the volume of the waste can be reduced, and then packaged in 55-gallon galvanized steel drums.

Radioactive waste generated by NPPs is stored in the storage facilities of each NPP respectively, besides those stored in LLW Storage Site before 1996.

TPC has the responsibility to plan and construct radioactive waste final disposal facility in compliance with “The Nuclear Materials and Radioactive Waste Management Act,” and is now endeavoring to carry out the LLW final disposal plan.

(2) Radioactive Waste from Small Users

INER is responsible for collecting, treatment, and storage of radioactive waste from medical, industrial, and research activities. The policies of radioactive waste management of INER include improving radioactive waste treatment and storage technologies (such as volume reduction of radioactive waste, integration of management process, development of radioactive waste container, and reduction of secondary waste), and improving operational safety of the facilities (such as modernization of the storage facilities, improvement in the operation management, and seismic-resistance evaluation of the facilities and related improvement).

The treatment measures of SURW are: liquid radioactive waste is cement solidified after being condensed by evaporator, or absorbed and ion exchanged by fluidized bed; contaminated metal is melted by furnace after decontaminated by chemical/mechanical decontamination equipment; compactible or combustible radioactive waste is compacted by compactor or incinerated by incinerator. The treated radioactive waste is packaged into 55-gallon galvanized steel drums, and stored in the storage facilities.

The quantity, nuclides, and activity of radioactive waste generated by THOR are relatively smaller and simpler than those of commercial NPPs. The radioactive wastes generated by THOR can be classified into three types: gas, liquid, and solid waste, are all properly treated and controlled according to relevant regulations. The radioactive gas is collected by induced draft fan system, and released to the atmosphere after compliance with the regulations is verified. The liquid radioactive waste is temporarily stored for 50~60 days before transferring to liquid radioactive waste storage plant, and will be discharged after compliance with the regulations is verified. For those cannot be discharged, will be collected to INER for treatment. Solid radioactive waste (ion exchange resin, chemical sludge, and irradiated and contaminated items) is packaged and temporarily stored in radioactive waste storage room, then it will be transferred to INER for further treatment.

B.4 Criteria for Definition and Classification of Radioactive Waste

The “The Nuclear Materials and Radioactive Waste Management Act” defines "radioactive waste" as the discarded material that is radioactive or is contaminated by radioactive substance, including the spent fuel ready for final disposal. The “Enforcement Rules for the Nuclear Materials and Radioactive Waste Management Act” classifies radioactive waste into high level radioactive waste and low level radioactive waste.

(1) High level radioactive waste (HLW): the spent fuel for final disposal or the extraction residuals generated in reprocessing.
(2) Low level radioactive waste (LLW): the radioactive waste other than described above.

Reprocessing of spent fuel is not excluded from the policies of spent fuel management of Taiwan, but it has not been implemented so far; therefore, in Taiwan, high level waste is referred to spent fuel.

Practically, low level radioactive waste can be classified under various principles. Based on the origins of radioactive waste, it can be divided into radioactive waste from NPPs and radioactive waste from small users. Based

on the treatment measures, radioactive waste from NPPs can be further divided into wet radioactive waste and dry radioactive waste, and radioactive waste from small users can be further divided into liquid radioactive waste, solidified radioactive waste, combustible radioactive waste, compactable radioactive waste, and others. Based on the management criteria of the regulatory authority, it can be divided into solidified radioactive waste, dewatered resin, combustible radioactive waste, compactable radioactive waste, and others. Based on transportation requirements, it can be divided into excepted, industrial, type A, type B, type C, fissile, and UF_6 packages according to limits of activity and materials of the packages ("Regulations for the Safe Transport of Radioactive Material," IAEA Safety Requirements No. TS-R-1).

The classification criteria regarding final disposal of LLW are stated in the "Regulations on Final Disposal of Low Level Radioactive Waste and Safety Management of the Facilities." According to the limits of radionuclide concentrations, it can be divided into class A, class B, class C, and greater than class C (GTCC). Solidification should be applied to class B and C radioactive waste. Besides solidification, reinforcement of the engineering design of the final disposal area of class C radioactive waste should also be considered. As for GTCC radioactive waste, it cannot be disposed in LLW final disposal facility unless approved by the regulatory authority.

Radioactive waste with activity or specific activity below certain values has almost no influences on public health and environment. The AEC has proposed "Regulations on Clearance Level for Radioactive Waste Management" referred to the IAEA and other countries, for the release of such radioactive waste. When radioactive waste decays to a certain level that the activity meet the release criteria in the regulations (such as effective doses to individual members of the public due to releases shall not exceed 0.01 mSv/a, and annual collective dose shall not exceed 1 person-Sv), the radioactive waste can released after the radiation evaluation report and the radioactive waste release plan are approved by the AEC.

C. SCOPE OF APPLICATION

Article 3 Scope of Application

1. This Convention shall apply to the safety of spent fuel management when the spent fuel results from the operation of civilian nuclear reactors. Spent fuel held at reprocessing facilities as part of a reprocessing activity is not covered in the scope of this Convention unless the Contracting Party declares reprocessing to be part of spent fuel management.
2. This Convention shall also apply to the safety of radioactive waste management when the radioactive waste results from civilian applications. However, this Convention shall not apply to waste that contains only naturally occurring radioactive materials and that does not originate from the nuclear fuel cycle, unless it constitutes a disused sealed source or it is declared as radioactive waste for the purposes of this Convention by the Contracting Party.
3. This Convention shall not apply to the safety of management of spent fuel or radioactive waste within military or defence programmes, unless declared as spent fuel or radioactive waste for the purposes of this Convention by the Contracting Party. However, this Convention shall apply to the safety of management of spent fuel and radioactive waste from military or defence programmes if and when such materials are transferred permanently to and managed within exclusively civilian programmes.
4. This Convention shall also apply to discharges as provided for in Articles 4, 7, 11, 14, 24 and 26.

This National Report applies to spent fuel and radioactive waste generated from all nuclear and civilian applications (including NPPs and other small users).

(1) Reprocessing of Spent Fuel

This National Report does not apply to radioactive waste management derived from reprocessing of spent fuel, because reprocessing of spent fuel has not been implemented in Taiwan so far.

(2) Naturally Occurring Radioactive Materials (NORM)

This National Report does not apply to management of NORM and statutory exemption of radioactive waste.

(3) Spent Fuel and/or Radioactive Waste within Military or Defence Programs

Currently, there is no nuclear fuel within the military or defense programs of Taiwan (either fresh or spent). Radiation protection and control of radioactive materials, equipment capable of producing radiation, and associated practices held by military authorities shall be prescribed with other regulations by the regulatory authority (AEC) in conjunction with the Ministry of Defense (MOD), in accordance with provisions of Article 54 of the “Ionizing Radiation Protection Act;” and the “Regulations on Radiation Protection and Control for Military Authorities” was therefore proposed on February 26, 2003. The management of radioactive waste within military or defence programs follows the regulations stated above, and is not included in this National Report.

(4) Discharge of Radioactive Waste

This National Report applies to gas and liquid waste discharged from spent fuel or radioactive waste facilities.

D. INVENTORIES AND LISTS

Article 32 Reporting, Paragraph 2

This report shall also include:

(i) a list of the spent fuel management facilities subject to this Convention, their locations , main purposes , and essential features;

(ii) an inventory of spent fuel that is subject to this Convention and that is being held in storage and of that which has been disposed of. This inventory shall contain a description of the material and, if available, give information on its mass and its total activity;

(iii) a list of the radioactive waste management facilities subject to this Convention, their locations , main purposes , and essential features;

(iv) an inventory of radioactive waste that is subject to this Convention that:

(a) is being held in storage at radioactive waste management and nuclear fuel cycle facilities;

(b) has already been disposed of; or

(c) has resulted from past practices.

This inventory shall contain a description of the material and other appropriate information available, such as volume or mass, activity, and specific radionuclides;

(v) a list of nuclear facilities in the process of being decommissioned and the status of decommissioning activities at those facilities.

D.1 Lists of Spent Fuel Management Facilities and Inventories

(1) NPPs

The spent fuel generated from commercial NPPs is presently stored in spent fuel pools. Spent fuel pools of NPPs and spent fuel inventories are listed in Table D-1.

Table D-1. Spent Fuel Pools of NPPs and Spent Fuel Inventories

Facility Name	Unit	Storage Capacity (Bundle)	Currently Stored (Bundle)	Total Uranium Weight (kg)
Chinshan NPP (BWR)	Unit 1	3,083	3,074	528,166.2
	Unit 2	3,083	3,076	528,567.1
Kuosheng NPP (BWR)	Unit 1	4,838	4,808	807,970.7
	Unit 2	4,838	4,684	787,108.1
Maanshan NPP (PWR)	Unit 1	2,160	1,581	631,396.7
	Unit 2	2,160	1,593	636,079.3
Total		20,162	18,816	3,919,288.1

1. Spent fuel in reactor cores is not included in this table.
2. Updated to the end of December 2020.

Chinshan NPP has entered into the decommissioning phase in 2018; Kuosheng NPP will enter into the decommissioning phase in 2021. The key of decommissioning is to remove spent fuel from the reactor cores; and therefore, dry storage facilities are needed for the decommissioning projects. After evaluation of technical feasibility, storage safety, and social, economic, and environmental impacts, TPC plans to build indoor spent fuel dry storage facilities both at Chinshan and Kuosheng NPP for the storage of spent fuel.

The construction of the 1st phase spent fuel dry storage facility of Chinshan NPP has been commissioned to INER by TPC. INER has taken NAC-UMS type storage cask system as a basis, and developed INER-HPS type storage cask system through technology transfer. Management system for design and manufacture of the storage casks has also been established. There will be 30 concrete casks installed in the dry storage facility of Chinshan NPP, each concrete cask is capable of storing 56 spent fuel assemblies. The planned storage capacity is 1,680 bundles of spent fuel. The 1st phase spent

fuel dry storage facility of Chinshan NPP is pending for hot test at present (Figure D-1).

(No spent fuel is loaded in the concrete cask).

Figure D-1. 1st Phase Spent Fuel Dry Storage Facility of Chinshan NPP

The construction of the 1st phase spent fuel dry storage facility of Kuosheng NPP has been jointly contracted to CTCI Machinery Corporation of Taiwan and NAC International by TPC. There will be 27 MAGNASTOR type concrete casks installed in the facility, each is capable of storing 87 spent fuel assemblies. The planned storage capacity is 2,349 bundles of spent fuel. The construction license has been approved by the AEC at present.

Please refer to Table D-2 for basic information of the dry storage facilities of Chinshan and Kuosheng NPPs.

Table D-2. Basic Information of the Dry Storage Facilities

Facility	Storage Cask Type	# of Storage Cask	Storage Capacity of the Cask (Bundle)	Total Storage Capacity (Bundle)	Current Status

Dry Storage Facility of Chinshan NPP	INER-HPS	30	56	1,680	Pending for hot test
Dry Storage Facility of Kuosheng NPP	MAGNASTOR	27	87	2,349	Construction license approved; under construction

(2) Small Users

Most of the spent fuel of TRR was shipped back to the U.S. A., and the rest is stored in the centralized warehouse of INER. Liquid spent fuel removed from WBR has been packaged in 20-L drums, and stored in the centralized warehouse of INER. As for the spent fuel removed from ZPRL was stored in the reactor pool previously, and had been shipped back the U.S. by July 19, 2009.

On the other hand, U-235 (enrichment 19.8%) spent fuel removed from THOR is stored in THOR spent fuel pool. See Table D-3 for more information.

Table D-3. Inventories of Nuclear Materials of Small Users

Facility	Inventory	Source	Storage Location
INER	· Natural uranium: 1,224.063 kgs · Depletion uranium: 92.591 kgs · Low-enriched uranium: 84.955 kgs	Uranium sludge in the TRR spent fuel pool, stabilized spent fuel, and test samples, etc.	Mainly stored in centralized warehouse, TRR related buildings, and hot cells.
NTHU	Low-enriched and High-enriched uranium: 0.003 tons	· Low-enriched uranium (enrichment 19.8%) · High-enriched uranium: high-enriched uranium fission chamber (HEU F.C.) for neutron detection.	THOR spent fuel pool

Updated to the end of December 2020.

D.2 Lists of Radioactive Waste Management Facilities and Inventories

(1) NPP Radioactive Waste Management Facilities

Gas radioactive waste, liquid radioactive waste, and solid radioactive waste treatment system are included in the radioactive waste treatment system of Chinshan NPP. Liquid radioactive waste treatment, demineralization, clarification of spent fuel pools, clarification of core water, and evaporation treatment of liquid radioactive waste are the main source of wet radioactive waste.

Currently, there are 2 LLW storage buildings in Chinshan NPP; in addition, a LLW trench is under decommissioning. Storage amount of Chinshan NPP is 46,135 drums (updated to the end of December 2020).

Liquid radioactive waste treatment system, solid radioactive waste treatment system, high volume-reduction solidification system, combustible radioactive waste incinerator (volume reduction center, VRC), and super compacter (VRC) are included in the radioactive waste treatment system of Kuosheng NPP.

Currently, there are 3 LLW storage buildings, a LLW temporary storage area, and a LLW trench in Kuosheng NPP. Storage amount of Kuosheng NPP is 57,426 drums (updated to the end of December 2020).

Gas radioactive waste, liquid radioactive waste, and solid radioactive waste treatment system, high volume-reduction solidification system, and LLW incinerator are included in the radioactive waste treatment system of Maanshan NPP.

Currently, there are 4 LLW storage areas and one LLW storage facility in Maanshan NPP. Storage amount of Maanshan NPP is 9,397 drums (updated to the end of December 2020).

The storage amount of LLW will be further reduced by volume reduction/ stabilization, and the storage capacity of each NPP is capable of storing LLW generated before the decommissioning of the NPPs.

LLW Storage Site (Figure D-2) is located in the southeastern part of Orchid Island. It is an off-site storage facility. There are 23 underground engineered trenches in LLW Storage Site. From 1982 to May 1996, LLW

Storage Site had received 97,672 drums of LLW (55 gallons each). Inspection and repacking activities of the LLW Storage Site had been taken place from December 2007 to June 2012. And the amount of LLW was reduced to 100,277 drums. In November 2019, the AEC approved TPC to start another repacking activity of LLW (Figure D-3) for the preparation of relocation. The repacking activities had been finished by February 2021.

Figure D-2. LLW Storage Site in Orchid Island

Figure D-3. Repacking Activities in the LLW Storage Site

Lists of TPC LLW storage facilities and inventories are shown in Table D-4.

Table D-4. LLW Storage Facilities and Inventories

	Storage Facility	Storage (Drum)	Overview	Total Amount (Drum)
Chinshan NPP	Storage Building #1	16,194	Spent bead resin and compactable radioactive waste mainly.	46,135
	Storage Building #2	29,941	Solidified, combustible, and other radioactive waste mainly.	
	Trench	0	Under decommissioning.	
Kuosheng NPP	Storage Building #1	2,879	Solidified and combustible radioactive waste mainly.	57,426
	Storage Building #2	32,645	Solidified radioactive waste, spent bead resin, insulation materials, and compressed discus mainly.	
	Storage Building #3	21,778	Solidified radioactive waste, insulation materials, and compressed discus mainly. Currently inspecting corrosion of the solidified drums.	
	Temporary storage area	124	Radioactive waste of all kinds.	
	Trench	0	Cleanup for decommissioning.	
Maanshan NPP	Storage Area #1	1,566	Dewatered resin, combustible radioactive waste, spent resin, and sludge.	9,397
	Storage Area #2	271	Solidified radioactive waste, dewatered resin, compactable radioactive waste, ash, spent resin, and sludge.	
	Storage Area #3	168	Dewatered resin.	

	Storage Area #4	0	None.	
	LLW Storage Building	7,392	Radioactive waste of all kinds.	
LLW Storage Site	Trench	100,277	Receiving LLW from 1982 to 1996. Radioactive waste generated from NPPs mainly, and 11,291 drums of LLW from small users.	100,277
Total				213,235

1. The capacity is estimated on the basis of 55-gallon drum.
2. Updated to the end of December 2020.

(2) Small User Radioactive Waste Management Facilities

There are 16 radioactive treatment and storage facilities in INER; 5 of them are treatment facilities and 11 of them are storage facilities (including 2 TRR temporary storage facilities). There is 1 LLW temporary storage facility in NTHU; and all of the LLW will be transferred to INER for further treatment and storage, for there is no solid radioactive waste treatment facility in NTHU. All of the SURW treatment and storage facilities are safely operating under safety regulation and environmental monitoring. Please refer to Table D-5 and Table D-6 for more information. Total of 17,216 drums of SURW and 13,475 sealed radioactive sources are in storage to the end of December 2020 (inventories will be different because of the treatment process).

Table D-5. SURW LLW Treatment Facilities and Inventories

Facility	Purpose	Current Status	Inventory
Liquid LLW Treatment Plant (Building 015B)	Treatment of liquid radioactive waste, including the storage of tritium-containing liquid radioactive waste.	Operating	833,263 L
Liquid LLW Treatment Plant (Building 064)	Treatment and storage of liquid radioactive waste.	Operating	500,100 L

Metal Scraps Melting Plant (Building 017)	Melting of LLW contaminated metal.	Operating	17,073 kg
Radioactive waste incinerator (Building 018)	Incinerating of combustible radioactive waste.	Operating	889 kg
Plasma furnace (Building 018)	Plasma melting of solid radioactive waste.	Improving	None

Updated to the end of December 2020.

Table D-6. SURW LLW Storage Facilities and Inventories

Facility	Purpose	Current Status	Capacity	Inventory	Note
INER					
Radioactive Waste Storage Facility #1 (Building 015V)	Storage of transuranic waste (TRU waste).	Operating	551 drums	487 drums	
Radioactive Waste Storage Facility #2 (Building 015K)	Storage of non-combustible solid radioactive waste.	Operating	5,868 drums	5,517 drums	Currently, 306 disused sources are also stored in the building.
Radioactive Waste Storage Facility #3 (Building 067)	Storage of solid radioactive waste and high-activity solid radioactive waste.	Operating	8,900 drums	6,366 drums	
Radioactive Waste Storage Facility #3 (Building 075)	1 F: storage of large and irregular non-combustible solid radioactive waste. 2 F: storage of combustible radioactive waste.	Operating	1,800 drums	629 drums	Combustible waste 278 drums. Currently, 12,872 disused sources are also stored in the building.
High-activity Radioactive Waste Underground Storage Facility (Building 015D)	Storage of high-activity radioactive waste and disused sources.	Operating	288 drums	32 drums	Currently, 297 disused sources are also stored in the building.

Combustible Radioactive Waste Temporary Storage Facility (Building 015F)	Storage of combustible radioactive waste.	Operating	780 drums	0 drums	
Very Low Contaminated Soil Underground Storage Facility (Building 066)	Storage of very low contaminated soil.	Operating	15,808 m^3	15,569 m^3	
Spent Fuel Cladding Underground Storage Facility	Storage of spent fuel cladding and stainless baskets from TRR.	Decommissioning	108 drums	None	Decommissioning Plan was reviewed in October 2019.
Spent Resin Underground Storage Facility	Storage of spent resin generated from TRR.	Decommissioned	36 drums	None	Decommissioned by April 2019.
TRR (Building 012)	Storage of TRR decommissioning waste.	Operating	3,414 drums	274 drums	
Retention sump (Building 012)	Storage of TRR decommissioning waste.	Operating	744 drums	526 drums	
NTHU					
Temporary storage facility	Temporary storage.	Operating	—	—	Transferred to INER in batches for management and storage.

1. The capacity is estimated on the basis of 55-gallon drum.
2. Updated to the end of December 2020.

D.3 Disposed Radioactive Waste and Past Practices

TPC is endeavoring to carry out the LLW final disposal plan presently. There is no LLW final disposal site in Taiwan currently, and there is no LLW that has been disposed.

No practical practices have been taken regarding the final disposal of LLW in Taiwan. All of the LLW is stored in the existing storage facilities, waiting for final disposal.

D.4 Lists of Decommissioned Facilities and Status of Decommissioning Activities

The decommissioning of NPPs is an important issue of Taiwan. The AEC has established a thorough laws and regulations system of NPP decommissioning activities, and has actively held/participate in international NPP decommissioning conferences, to keep relevant technologies and knowledge up to date. Relevant information is also published on the AEC's website, for information disclosure and better public participation.

The decommissioning activities of nuclear facilities in Taiwan are stated as follows:

(1) NPPs

The operating license of Chinshan NPP was expired in December 2018; Chinshan NPP has been permanently shut down since then. TPC submitted the "Decommissioning Plan of Chinshan NPP" to the AEC in compliance with Article 23 of the "Nuclear Reactor Facilities Regulation Act" in November 2015, and the plan was approved in June 2017; together with the "Environmental Impact Assessment Report" approved by EPA in July 2019, a decommissioning permit of Chinshan NPP was then issued by the AEC in July 2019, and Chinshan NPP has become the first commercial NPP that has entered the decommissioning phase.

TPC had submitted the "Decommissioning Plan of Kuosheng NPP" to the AEC in December 2018, and the according review was conducted from January 21, 2019 to October 20, 2020.

As for Maanshan NPP, the Decommissioning Plan is scheduled to be submitted by July 2021.

(2) SURW

(A) INER

TRR was shut down in January 1988. Since October 1988, unnecessary systems had been removed from the reactor, and the reactor was then sealed. The sealed reactor was removed to the dismantling building in November 2002, and has been monitored using radiation detectors, strain gauges, subsidence meters, inclinometers, and seismographs and so on. In April 2004, the AEC approved the

Decommissioning Plan of TRR, and the following decommissioning activities have been started. Decontamination of the spent fuel pool was completed in 2018; and relevant technologies had been established include decontamination of high-contaminated materials, dismantling of concrete structures of nuclear facilities, treatment of liquid radioactive waste, reduction of secondary waste, whole system decontamination of nuclear facilities, and management of the dismantling.

The Decommissioning Plan of WBR was approved and started implementing in May 1997. December 1997, system equipment was dismantled, and the reactor core and all of the contaminated systems and equipment in the reactor building were removed. December 2007, the remaining biological shielding was dismantled, and the decommissioning of WBR was completed.

The operation of ZPRL was temporarily stopped in December 2005. July 2009, all of the nuclear fuel was transferred to the U.S. January 2010, ZPRL was permanently shut down, and the Decommissioning Plan was approved in July 2013. Currently, ZPRL is under decommissioning.

Besides that, the Spent Resin Underground Storage Facility of INER had also completed decommissioning in April 2019. And the Spent Fuel Cladding Underground Storage Facility is under decommissioning at present.

(B) NTHU

THAR had completed decommissioning in 1993. The spent fuel and the generated radioactive waste were transferred to INER for storage; and the former was further shipped back to the U.S. in July 2009.

THMER had completed decommissioning in September 2003. The spent fuel was transferred to INER for storage, and the generated radioactive waste was currently stored on site.

E. LEGISLATIVE & REGULATORY SYSTEMS

Article 18 Implementing Measures

Each Contracting Party shall take, within the framework of its national laws, the legislative, regulatory and administrative measures and other steps necessary for implementing its obligations under this Convention.

E.1 Implementing Measures

Although Taiwan is not a Contracting Party of the Convention, Article 17 of the “Nuclear Materials and Radioactive Waste Management Act” explicitly stipulates that radioactive waste treatment, storage, and final disposal facilities shall comply with requirements set forth by the relevant international conventions. This implies that the government will take all the legislative, regulatory and administrative measures and other actions necessary to carry out its obligations under this Convention.

E.2 Legislative and Regulatory Framework

Article 19 Legislative and Regulatory Framework

1. Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of spent fuel and radioactive waste management.
2. This legislative and regulatory framework shall provide for:
   (i) the establishment of applicable national safety requirements and regulations for radiation safety;
   (ii) a system of licensing for spent fuel and radioactive waste management activities;
   (iii) a system of prohibition for the operation of a spent fuel or radioactive waste management facility without a license;

(iv) a system of appropriate institutional control, regulatory inspection and documentation and reporting;

(v) the enforcement of applicable regulations and of the terms of the license;

(vi) a clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and radioactive waste management.

3. When considering whether to regulate radioactive materials as radioactive waste, Contracting Parties shall take due account of the objectives of this Convention.

The legislative and regulatory framework of Taiwan can be divided into three tiers (Figure E-1): the first tier describes “Acts” that shall be passed by the Legislative Yuan then signed and promulgated by the President; the second tier regards “Legal Orders” which include Regulations and Standards laid down by Regulatory Bodies under the authorization of the aforementioned Acts; the third tier details the “Administrative Rules” written by Regulatory Bodies for the operation of the Regulatory Bodies based on their authority, those Administrative Rules include Guidelines, Points, and Policies and so on. The establishment of Legal Orders and Administrative Rules shall follow related requirements in compliance with the “Administrative Procedure Act” (Chapter IV). Legal Orders shall be approved by superior authorities and published in government gazettes or newspapers. Administrative Rules, on the other hand, shall be directed to lower units or subordinate officers. Administrative Rules are provisions of an interpretation nature and guidelines on the exercise of discretion in making consistent interpretation of laws and regulations, finding the facts, and exercising the power of discretion; they shall be signed by the head officers of the competent authorities, and released by publishing in government gazettes.

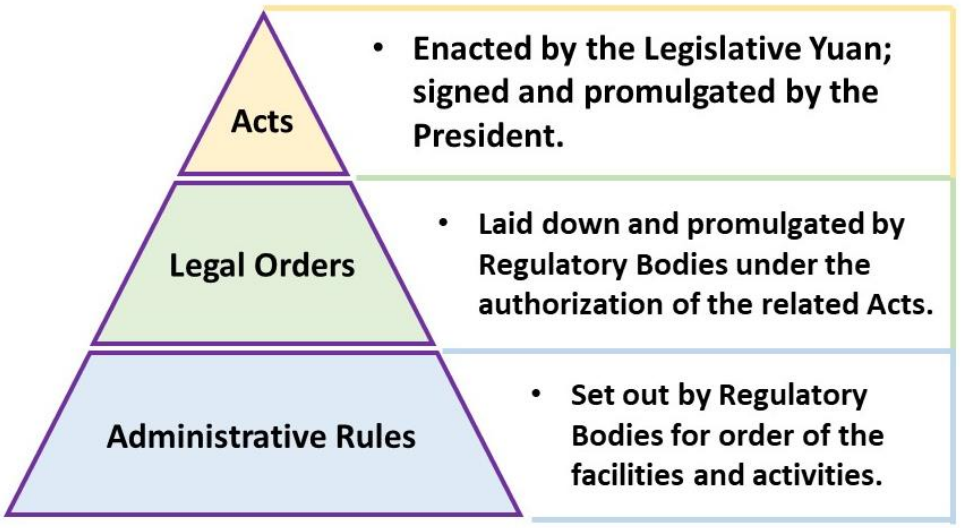


Figure E-1. Regulatory Framework of Taiwan

During drafting of Legal Orders, relevant authorities should be consulted; also, expert advices and opinions from conferences and public hearings should be taken into account, for the thoroughness and practicality of the Legal Orders. In practice, safety regulations proposed by the IAEA, Federal regulations of USNRC (U.S. Nuclear Regulatory Commission), and regulations from other countries are all important references to the establishment of the drafting of Legal Orders in Taiwan, regarding radioactive waste. Moreover, the AEC reviews the Legal Orders each year, to make sure that the regulatory system is advancing with the times.

(1) Safety Requirements and Regulations for Radiation Safety

"Nuclear Materials and Radioactive Waste Management Act," which is the competent legal of nuclear materials, nuclear fuel, and radioactive waste in Taiwan, was promulgated in 2002. The competent authority of the Act is the Atomic Energy Council (AEC). There are 5 chapters in the "Nuclear Materials and Radioactive Waste Management Act," the first chapter is the general rules, which states the legislative purpose of the act, and that is to manage radioactive waste properly in order to control its radioactive hazards and thereby ensure public safety; the second chapter is the regulatory requirements for nuclear materials and nuclear fuel; the third chapter is the regulatory requirements for radioactive waste; the fourth chapter is the penalties, which adopt both administrative penalty and administrative order

penalty as effective means to achieve the regulatory purposes; the fifth chapter is supplementary. The establishment of Legal Orders and Administrative Rules relating to this Act are authorized to the competent authority.

The AEC has established related Legal Orders regarding detailed regulatory requirements of production, treatment, storage, final disposal, and operation of radioactive materials and their corresponding facilities. Administrative Rules such as “Safety Analysis Report Guides for Radioactive Materials Facilities” are also proposed, for interpretation of laws and regulations, finding the facts, and exercising the power of discretion. For more information, please refer to Section L.1.

“Ionizing Radiation Protection Act,” which is the competent legal of radiation source regulation, was promulgated in 2002. The competent authority of the Act is also the Atomic Energy Council (AEC). In coordination with the regulatory system of radioactive waste, the permanent cessation of radioactive materials and equipment capable of producing ionizing radiation, and the permanent cessation of their production/manufacturing facilities, the facility operators shall file all materials or equipment to the regulatory authority, and return them to the original manufacturers or sellers, or transfer them to another owner, or dispose them as radioactive waste, or employ any handling methods specified by the regulatory authority (Article 35). Detailed regulatory requirements can be found in “Administrative Regulations for Radioactive Material and Equipment Capable of Producing Ionizing Radiation and Associated Practice.”

The AEC has made changes of the Legal Orders and Administrative Rules regarding the management of spent fuel or radioactive waste:

- Revision and promulgation of “Enforcement Rules for the Nuclear Materials and Radioactive Waste Management Act”: the Act proposes the application measures for decommissioning under 3 different situations. The Act also proposes procedures of deregulation after the decommissioning plan has been completed, and content of completion report of decommissioning activities which shall be submitted to the regulatory authority.
- Revision and promulgation of “Regulations on Treatment and Storage of Radioactive Waste and Safety Management of the Facilities”: it completes

the regulations of radioactive waste facility design, it amends LLW storage facilities as the objects of maintenance operation, and also amends the timing of storage facility re-evaluation.

- Revision and promulgation of “Range and Identification Standards of Low Radioactive Waste Final Disposal Restricted Area”: it amends that indigenous peoples’ regions are not allowed to be developed according to the laws, when selecting indigenous peoples’ regions as final disposal candidate sites, consent of the indigenous peoples shall be obtained.
- Revision and promulgation of “Safety Analysis Report Guides for Spent Fuel Dry Storage Facility Application”: it strengthens relevant design requirements in accordance with technological progress.
- Revision and promulgation of “Safety Analysis Report Guides for Low-level Radioactive Waste Storage Facilities”: it amends investigation requirements for side slope soil and water conservation and tsunamis, and also strengthens requirements of safety evaluation.
- Revision and promulgation of “Regulations on Siting of Consolidated Radioactive Waste Facilities”: it amends that the selection of site shall comply with “The Indigenous Peoples Basic Law,” and storage of radioactive waste in the indigenous peoples’ regions shall not against the will of the indigenous peoples.
- Revision and promulgation of “Regulations on Siting of High-level Radioactive Waste Final Disposal”: it amends that the selection of site shall comply with “The Indigenous Peoples Basic Law,” and storage of high-level radioactive waste in the indigenous peoples’ regions shall not against the will of the indigenous peoples.
- Promulgation of “Review Guides for Safety Analysis Reports of Spent Fuel Dry Storage Facilities.”
- Promulgation of “Review Guides for Re-evaluation Reports of Low-level Radioactive Waste Storage Facilities.”

(2) Lisencing

According to the requirements set forth in the “Nuclear Materials and Radioactive Waste Management Act,” approval of the regulatory authority (AEC) must be obtained before the construction, operation, permanent cessation, and decommissioning of spent fuel or radioactive waste facilities.

As stipulated in Article 17 of the “Nuclear Materials and Radioactive Waste Management Act,” an application for construction license of the construction of treatment, storage, and final disposal facilities of radioactive waste shall be filed to and reviewed by the regulatory authority.

As stipulated in Article 18 of the “Nuclear Materials and Radioactive Waste Management Act,” after the construction of a treatment, storage, or final disposal facilities of radioactive waste is completed, the facilities shall not be formally operated, until the regulatory authority has approved and issued operating licenses.

According to Article 27 of the “Enforcement Rules for the Nuclear Materials and Radioactive Waste Management Act,” the validity period of an operating license of a radioactive waste treatment or storage facility is up to 40 years, the validity period of an operating license of a radioactive waste final disposal facility is up to 60 years.

The AEC has issued a decommissioning permit for Chinshan NPP in July 2019. Furthermore, the AEC has granted the operating licenses of 2 radioactive waste storage facilities of INER (Building 012 and Retention Sump).

(3) Prohibition of Operation without License

According to Article 18 of the “Nuclear Materials and Radioactive Waste Management Act,” after the construction of a treatment, storage, or final disposal facilities of radioactive waste is completed, the facilities shall not be formally operated, until the regulatory authority has approved and issued operating licenses.

(4) Control, Regulatory Inspection, Documentation, and Reporting

The application, construction, and operation activities involving spent fuel or radioactive waste facilities shall be reviewed, inspected, and approved by the AEC in compliance with the “The Nuclear Materials and Radioactive Waste Management Act.” The legal portfolio of the AEC is set in the “Organization Act of Atomic Energy Council, Executive Yuan.”

According to Article 19 of the “Nuclear Materials and Radioactive Waste Management Act,” during construction or operation of treatment, storage, or final disposal facilities of radioactive waste, design amendment or equipment

change relating to significant safety items, shall not be made without approval from the regulatory authority.

As stipulated in Article 20 of the “Nuclear Materials and Radioactive Waste Management Act,” the operators of treatment, storage, or final disposal facilities of radioactive waste shall periodically submit reports regarding operation, radiation protection, environmental radiation monitoring, irregularity or emergency event, and other reports designated by the regulatory authority. Those reports shall be published by the regulatory authority.

As stipulated in Article 23 of the “Nuclear Materials and Radioactive Waste Management Act,” for permanent cessation of radioactive waste treatment or storage facilities, the operators shall prepare decommissioning plan, and implement accordingly after the plan is approved by the regulatory authority. For the closure of radioactive waste final disposal facilities, the operators shall prepare closure plan and control plan, and implement accordingly after the plans are approved by the regulatory authority.

As stipulated in Article 25 of the “Nuclear Materials and Radioactive Waste Management Act,” the importation, exportation, transition, transshipment, transportation, discard, or assignment shall not be implemented unless the regulatory authority has approved.

The AEC has a mandate to carry out inspection during the operation of the facilities. Through the inspection, safety requirements are ensured to be fulfilled, and public confidence can be further enhanced. The operators of spent fuel or radioactive waste management facilities should follow relevant requirements, and keep adapting new technologies, improving management procedures, and conducting crisis management, to ensure operation safety of the facilities. And the operation information shall be submitted to the regulatory authority.

The AEC has approved the following decommissioning activities:

- The decommissioning permit of Chinshan NPP was granted in July 2019.
- The Decommissioning Plan of Spent Fuel Cladding Underground Storage Facility of INER was reviewed and approved in October 2019.
- The Decommissioning Completion Report of Spent Resin Underground Storage Facility of INER was reviewed and approved in February 2020.

(5) Enforcement

The AEC acts on the “Nuclear Materials and Radioactive Waste Management Act,” and enforces control of spent fuel and radioactive waste. The enforcement is in response to non-compliance with specified requirements, including warnings, penalties, and revocation of licenses. In addition, the operators shall remedy the non-compliance, and the regulatory authority will ensure the progress of the remediation; furthermore, necessary measures will be taken to prevent recurrence.

(6) Allocation of Responsibilities

In accordance with Article 2 of the “Nuclear Materials and Radioactive Waste Management Act,” the AEC is in charge of supervision of activities regarding spent fuel and radioactive waste management.

According to Article 28 of the “Nuclear Materials and Radioactive Waste Management Act,” the producer of spent fuel or radioactive waste shall bear the necessary expenses for treatment, transportation, storage, and final disposal of spent fuel or radioactive waste, and also the necessary expenses for decommissioning of the facilities.

According to Article 29 of the “Nuclear Materials and Radioactive Waste Management Act,” the producer of spent fuel or radioactive waste shall be responsible for treatment, transportation, storage, and final disposal of spent fuel or radioactive waste.

TPC is responsible for implementation and necessary expenses for radioactive waste generated from NPPs currently, including medium term storage and final disposal of spent fuel, management, storage, and final disposal of LLW, and decommissioning of NPPs and so on.

On the other hand, INER is responsible for receiving radioactive waste generated from small users. Proper fees will be collected by INER.

As stipulated in Article 30 of the “Nuclear Materials and Radioactive Waste Management Act,” the development of a radioactive waste final disposal is a national mission. Such final disposal facility is expected to receive radioactive waste from both TPC and INER.

For NPPs of TPC are the main source of spent fuel and radioactive waste in Taiwan (more than 90% of spent fuel and radioactive waste are generated from NPPs), in accordance with “Act on Sites for Establishment of Low Level

Radioactive Waste Final Disposal Facility," the MOEA is the implementing authority of LLW final disposal; and in accordance with Article 89 of "The Electricity Act," TPC appropriates funds to "Nuclear Backend Fund" for the expenses of nuclear backend operation. The responsibility of management of "Nuclear Backend Fund" lies with the MOEA.

E.3 Regulatory Body

Article 20 Regulatory Body

1. Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 19, and provided with adequate authority, competence and financial and human resources to fulfill its assigned responsibilities.
2. Each Contracting Party, in accordance with its legislative and regulatory framework, shall take the appropriate steps to ensure the effective independence of the regulatory functions from other functions where organizations are involved in both spent fuel or radioactive waste management and in their regulation.

(1) The Regulatory Body and its Duties

(A) The Atomic Energy Council (AEC)

The Atomic Energy Council was founded according to "The Atomic Energy Law" promulgated in 1968, and became subordinate to the Executive Yuan (at ministerial level) in accordance with the "Organization Act of the Atomic Energy Council of the Executive Yuan" promulgated in 1970. The AEC is in charge of safety regulation of nuclear energy and radiation, nuclear emergency preparedness, environmental radiation monitoring, and management of radioactive waste including administrative oversights, environmental radiation monitoring, and R&D of safety regulation technologies of nuclear and radioactive waste.

The AEC consists of 14 commissioners (year 2020) who are mainly representatives of relevant ministries or agencies within the Executive Yuan, and scholars and experts from academia. The Chairman (Minister)

presides over the Council and oversees the Council's affairs with the assistance of 2 Vice-Chairmen (Deputy Ministers) and a Secretary General. There are 5 departments, 3 offices, and 12 interior committees in the headquarter of the AEC, and also 3 other affiliated agencies. The 5 departments include the Department of Planning, the Department of Nuclear Regulation, the Department of Radiation Protection, the Department of Nuclear Technology, and the Department of General Administration. The 3 offices are the Office of Personnel, the Office of Accounting, and the Office of Civil Service Ethics. The 12 interior committees include the Management Committee on Nuclear Accident Emergency Preparedness Funds, the Review Committee on Atomic Energy Science Research and Development Achievements, the Advisory Committee on Nuclear Facility Safety, the Advisory Committee on Safety of Ionizing Radiation, the Advisory Committee on Safety of Radioactive Materials, the Supervising Committee on Nuclear Safety of Lungmen NPP, the Committee on State Compensation Cases, the Committee on Nuclear Legislation, the Committee on Gender Equality, the Committee on Sexual Harassment Complaints, the Evaluation Committee on Nuclear Accident (non-permanent committee), the Review Committee on Petitions and Appeals (non-permanent committee). And the 3 affiliated agencies are the Institute of Nuclear Energy Research (INER), the Fuel Cycle and Materials Administration (FCMA), and the Radiation Monitoring Center (RMC).(Figure E-2).

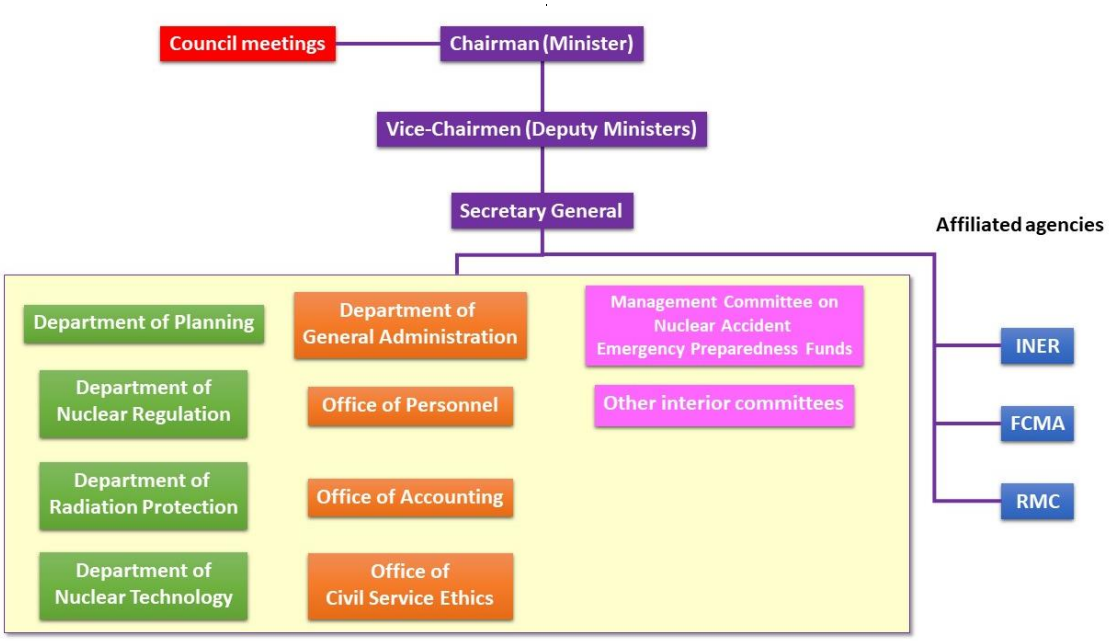


Figure E-2. Organization of the AEC

Among the aforementioned departments, the Department of Planning is in charge of nuclear safeguards; the Department of Nuclear Regulation is in charge of regulation of nuclear fuel in operating reactors and spent fuel in spent fuel pools; the Department of Radiation Protection is in charge of radiation protection of public health and the environment; the Department of Nuclear Technology is in charge of investigation and evaluation of abnormal events of nuclear reactors; and the Department of General Administration is in charge of file management.

The Advisory Committee on Safety of Radioactive Materials is found to improve regulation of radioactive materials, prevent radioactive hazards, and ensure environmental quality and public health. Experts of environmental protection, public policy, laws, nuclear engineering, geology, radioactive waste, radiation protection, economy, and energy are invited to participate in the Committee; to offer suggestions about the strategies, policies, laws, safety regulation, review, and R&D with regard to radioactive materials.

The administrative objectives of the AEC in 2020 are:

(a) to oversee the safety of NPPs

- Through safety inspection of NPPs, the AEC oversees the compliance of activities of NPPs with quality and safety requirements.
- Through inspection of nuclear security and emergency preparedness of NPPs, ensure the thoroughness of the preparedness work.

(b) to strengthen the regulation on NPPs decommissioning activities

- Through inspection of decommissioning activities of NPPs, ensure the compliance of quality of the decommissioning activities with the requirements.
- Through development of regulation technologies of decommissioning activities of NPPs, improve the ability of nuclear safety regulation.
- Through improvement in technologies of personnel and environmental radiation evaluation during decommissioning, ensure radiation safety during this period.

(c) to safely manage radioactive waste

- Through improvement in safety regulation and relevant technologies of radioactive materials of nuclear facilities and radioactive waste from decommissioning, reduce the amount of radioactive waste.
- Through strict regulation of construction and operation activities of spent fuel dry storage facilities, ensure the safety of these facilities.
- Supervise the implementation of radioactive waste final disposal plan and alternative plan, and strictly oversee the safety upgrade program of LLW storage facilities.
- Through improvement in radioactive materials regulations, and integration of R&D and practical needs, implement the regulation of radioactive materials.

(d) to carry out information disclosure and increase public trust

- Real time publication of important regulation information of NPPs.
- Adopt public meeting into the regulation system.

- Involve public participation and public communication in the regulation policies.

(e) to better manage radiation protection

- Through strict supervision of the radiation safety of operation and decommissioning of NPPs, and inspection and regulation of the NPPs, ensure radiation safety of the public.
- Inspect availability of medical exposure quality assurance equipment at the rate of 25% a year, and implement medical exposure quality assurance inspecting and guiding project for medical institutions nationwide. For those do not qualify and do not improve within deadline should be suspended or scrapped, to ensure the safety and quality of radiological diagnosis and radiation therapy.
- Through inspection and guiding project for radiation safety of workplace, ensure the availability of high-intensity or high-risk radiation sources. For those do not qualify and do not improve within deadline should be suspended or scrapped, to ensure the safety and quality of radiation workplace, personnel, and environment.
- Improve management system and R&D of radiation hazards for better emergency preparedness.

(f) to improve the environmental monitoring system

- Implement national environmental radiation monitoring and nuclear facility environmental monitoring plans, establish offshore sea area radiation database of Taiwan, and investigate radiation doses of the nationals.
- Through integration of radiation monitoring stands in reservoir and industrial areas and wireless communication network, establish environmental radiation safety monitoring and warning system and database. In addition, establish integrated monitoring information platform that offers real time monitoring information through the AEC website and the AEC application software.

- Improve radiation detection technologies, implement technical and information exchange internationally, and establish rapid analysis method of difficult to measure nuclides.

(g) to carry out basic research on application in everyday lives

- Develop atomic energy science research with the participation of academic institutions.
- Cultivate interdisciplinary human resources between atomic energy science and Innovative industry.
- Develop research on application of atomic energy science in policies, regulation, and everyday lives.

(h) to integrate engineering interdisciplinary technologies

- Ensure the development of safety technologies before NPP decommissioning.
- Develop nuclear facility decommissioning and radioactive waste treatment technologies.
- Develop nuclear medicine and medical materials applications.
- Develop plasma energy-saving technologies, and upgrade the energy-saving industry.

(i) to develop green energy technologies

- Develop key technologies and industrial applications such as energy saving and carbon reduction, alternative energy, wind power generation, and so on.
- Develop autonomous zonal grid regulation technologies and high-efficiency power management system.

(j) to allocate resources and improve budget implementation efficiency

- Improve budget implementation efficiency and assets benefits.
- Budget projects based on execution ability, and allocate resources properly in the light of Zero Base Budgeting principle.

The staff number in the headquarter of the AEC is 194 (updated to December 2020), and the staff number in the 3 affiliated agencies is 1,144. The business expenditures of the AEC headquarter of year 2020 is about 32.56 million NTDs.

(B) The Fuel Cycle and Materials Administration (FCMA)

The Fuel Cycle and Materials Administration (Figure E-3) is affiliated to the AEC in compliance with Article 15 of the "Organization Act of Atomic Energy Council, Executive Yuan." It is in charge of safety evaluation review of radioactive waste treatment, storage, and final disposal facilities, regulation and inspection of operation and final disposal of radioactive waste, drafting of regulations and guides regarding radioactive materials, policy announcement, public communication, and so forth. The duties of FCMA are as follows:

- 1st Division: to draft regulations, public communicate, internationally collaborate, treat and store SURW, review and inspect transportation, and supervision.
- 2nd Division: to review, inspect, and oversee the reduction, storage, and transportation of radioactive waste in nuclear facilities.
- 3rd Division: to regulate nuclear materials and nuclear fuel, and to review and oversee the storage and disposal of spent fuel.
- Secretary room: to implement public communication and other administrative work.
- Personnel administrator and accountant.

There are 42 employees in the FCMA, including 35 specialists and 7 administrators (updated to December 2020). For competence improvement of personnel, 40 hours of "Radioactive Materials Management Inspector Training Course," including core course (laws and regulations, and inspection skills), experience sharing, and preparation for inspection, is hold every year, lectured by experienced inspectors and experts; and senior inspector and inspector qualification certificates will be issued in accordance with the "Operation Procedures for Radiation Management Inspector Certification." In addition, professional training such as non-destructive testing is taken by the staff, and international conferences on decommissioning, dry storage, and final disposal are hold to improve professional skills of the staff.

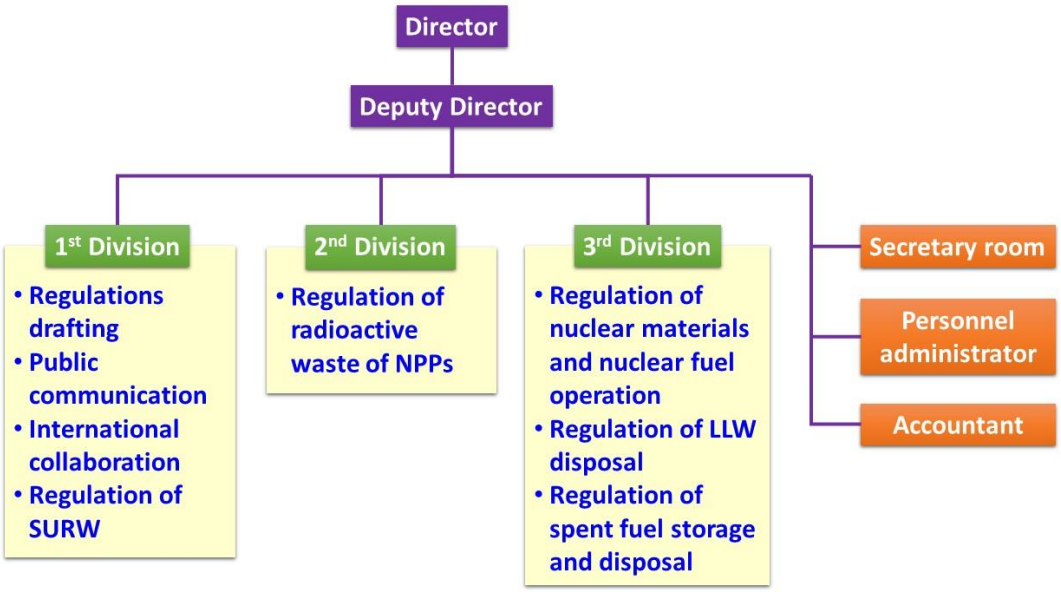


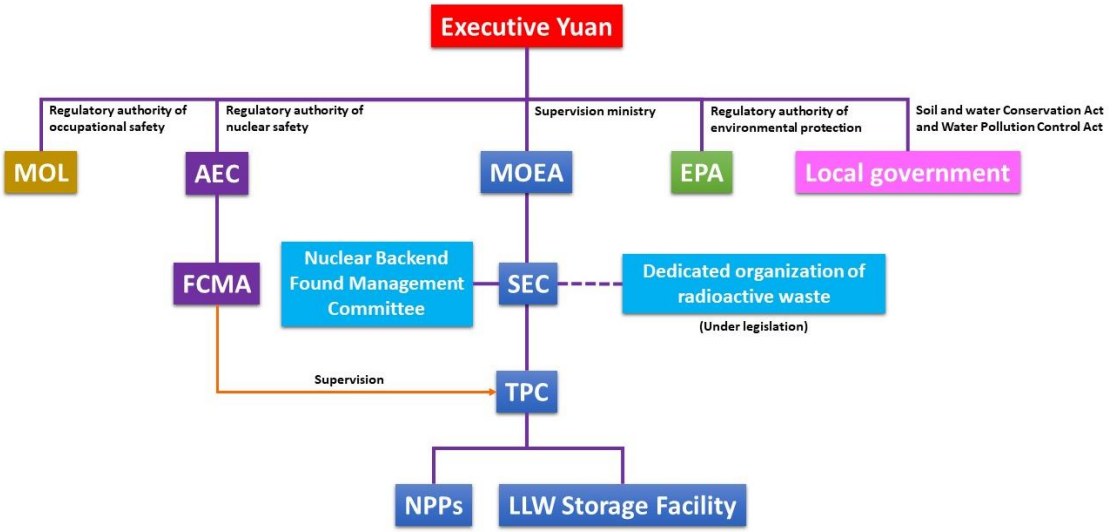
Figure E-3. Organization of the FCMA

(C) Other relevant competent authorities

The management and regulation system of radioactive waste in Taiwan is shown as Figure E-4. The Executive Yuan is the country's highest administration department. Under its jurisdiction, there are the Ministry of Economic Affairs (MOEA), the Environmental Protection Administration (EPA), the Atomic Energy Council (AEC), the Ministry of Labor (MOL), and so on. Among the aforementioned ministries, the MOEA is the supervision ministry of TPC (the owner of the NPPs) and is in charge of the management of spent fuel and radioactive waste; the EPA is in charge of the regulation of environmental evaluation and protection regarding spent fuel and radioactive waste facilities; the AEC, as mentioned, is in charge of the supervision and regulation of operation safety of spent fuel and radioactive waste; the MOL is in charge of occupational safety and health. Besides those, the Ministry of the Interior (MOI) is in charge of supervision of construction, and fire management and suppression of a facility. Also, the local government has jurisdiction over measures related to soil and water conservation and water pollution control of a facility, in accordance with the “Soil and Water Conservation Act” and “Water Pollution Control Act.”

The AEC has actively coordinated inter-ministerial cooperation in supervision and management as follows:

- Cooperation with the Occupational Safety and Health Administration (OSHA) of the MOL for labor health rights and measures regarding ionizing radiation activities.
- Integration of regulation resources with the OSHA. Stepwise exchange and inspect regulation data online: manual comparison for the 1st step, and integration of inter-ministerial system interface for the 2nd step.
- Establish labor health management cooperation system of ionizing radiation activities with the OSHA. Follow notification from the OSHA, the AEC will follow up the management of labor health.
- Establish notification system of occupational injury and illness due to ionizing radiation with the Ministry of Health and Welfare (MHW) and the MOL; and establish personnel dose reconstruction and verification methods with the Bureau of Labor Insurance (BLI) of MOL.



EPA: Environmental Protection Administration
MOL: Ministry of Labor
SEC: State-owned Enterprise Commission

Figure E-4. The Management and Regulation System of Radioactive Waste

(2) Independence of Regulatory Functions

The AEC and its affiliated agency, the Fuel Cycle and Materials Administration (FCMA), exercise the authority and operate independently in accordance with “The Nuclear Materials and Radioactive Waste Management Act.” Unless otherwise provided by law, the AEC and the FCMA are not subject to the commands and supervision of other authorities, and are in charge of safety regulation in regard to spent fuel and radioactive waste nationwide.

F. OTHER GENERAL SAFETY PROVISIONS

Article 21 Responsibility of the License Holder

1. Each Contracting Party shall ensure that prime responsibility for the safety of spent fuel or radioactive waste management rests with the holder of the relevant license and shall take the appropriate steps to ensure that each such license holder meets its responsibility.
2. If there is no such license holder or other responsibility party, the responsibility rests with the Contracting Party which has jurisdiction over the spent fuel or over the radioactive waste.

F.1 Responsibility of the License Holder

(1) License holder

(A) Primary Responsibility Resting with the License Holder

The prime responsibility of management of spent fuel or radioactive waste rests with the operators of the facilities (the license holders) according to current regulatory framework. The operators shall construct spent fuel or radioactive waste facilities according to plans approved by the regulatory authority, and ensure that the operation of the facility meets with the requirements. The operators shall ensure that the facility can be properly decommissioned or closed, and shall demonstrate the compliance with the requirements proposed by the regulatory authority. Moreover, the operators shall make all possible efforts to improve the safety and reliability of the facilities.

(B) Measures to Ensure that the License Holders Meeting its Responsibility

The AEC, in accordance with the “Nuclear Materials and Radioactive Waste Management Act,” ensures that the license holders of spent fuel or radioactive waste facilities perform activities (siting, design, construction, commissioning, operation, decommissioning and/or closure of the facility) in compliance with relevant regulations and the license conditions through

inspection. No construction shall be undertaken unless a construction license is granted by the AEC. And during construction, the AEC will request the license holders to take corrective and remedial measures to ensure the safety of the facilities if any violations occur. After completion of the construction, the facilities shall not be operated unless operating licenses have been granted by the AEC. An operating license is granted when commissioning inspection has been taken by the AEC and that safely operation of the facility can be assured. Afterwards, the facilities shall be inspected periodically by the AEC for compliance with relevant regulations and technical standards prescribed in relevant provisions. If operation activities fail to meet the license conditions, the AEC will either ask for corrective and remedial measures or order a penalty (including license revocation or operation suspension).

(2) Absence of License Holder

According to Articles 17 and 18 of "The Nuclear Materials and Radioactive Management Act," the construction and operation of a spent fuel or radioactive waste management facility require a license from the regulatory authority. The regulatory authority can order penalties, fine, suspension, and demolition if there are any violations, depending on the severity. In addition, according to Articles 6 of the Act, the licenses shall not be assigned, leased, lent, pledged, or mortgaged unless permitted by the regulatory authority, to prevent shifting of the responsibility. Regulations have been proposed to prevent lack of license holders of the facilities.

F.2 Human and Financial Resources

Article 22 Human and Financial Resources
Each Contracting Party shall take the appropriate steps to ensure that:
(i) qualified staff are available as needed for safety related activities during the operating lifetime of a spent fuel and a radioactive waste management facility;
(ii) adequate financial resources are available to support the safety of facilities for spent fuel and radioactive waste management during their

operating lifetime and for decommissioning;

(iii) financial provision is made which will enable the appropriate institutional controls and monitoring arrangements to be continued for the period deemed necessary following the closure of a disposal facility.

(1) Qualified Personnel

According to Article 17 of “The Nuclear Materials and Radioactive Waste Management Act,” technical and management abilities, as well as financial bases of the construction license applicants for treatment, storage, or final disposal facilities of radioactive waste, shall be competent to operate the facilities. This requirement ensures qualified personnel are available during the operation period.

And according to Article 27 of “The Nuclear Materials and Radioactive Waste Management Act,” spent fuel or radioactive waste treatment facilities shall be operated by qualified personnel. The qualification of the personnel shall follow the provisions of the “Regulations on Qualifications of Personnel Operating Radioactive Waste Treatment Facilities,” and qualification certificates will be issued after training and examination are taken by the personnel.

Moreover, for improvement in professional quality of operators and management staff, the AEC holds “Examination for Operators of Radioactive Waste Treatment Facilities” and issues senior operator and operator licenses correspondingly, in accordance with the “Regulations on Qualifications of Personnel Operating Radioactive Waste Treatment Facilities.”

There are 79 senior operators and 330 operators in Taiwan, 409 qualified personnel in total, up to December 2020.

(2) Financial Resources during Operating Lifetime and Decommissioning

According to Article 28 of “The Nuclear Materials and Radioactive Waste Management Act,” the producers of spent fuel or radioactive waste shall afford its necessary expenses for treatment, storage, transportation, final disposal, and decommissioning of the facilities. In addition, according to Article 3 of the “Regulations for the Review and Approval of Application for Construction License of Radioactive Wastes Treatment, Storage and Final Disposal Facilities,” the applicants for the construction license of radioactive waste

treatment, storage or final disposal facilities shall submit application forms enclosed with safety analysis reports and financial guarantee statements to the competent authority for review. And budget sources and financial planning of the expenses for construction, operation, and decommissioning of the facilities shall be included in the financial guarantee statements in accordance with Article 6 of the Regulations.

In compliance with the above regulations, Nuclear Backend Fund has been established since 1987. The fund was managed by TPC until 1998 and then redefined as a non-operational fund. The management right was also shifted to Nuclear Backend Fund Management Committee under the MOEA's supervision. There are 8 to 14 members in the Committee, and the chairman is designated by the MOEA.

Main purposes of the Nuclear Backend Fund are as follows:

- Independent volume reduction, treatment, packaging, transportation, interim storage, and final disposal of LLW generated by NPPs.
- Reprocessing of the spent fuel.
- Packaging, transportation, interim storage, and final disposal of spent fuel or radioactive waste arising from reprocessing.
- Decommissioning of NPPs, and treatment, packaging, transportation, interim storage, and final disposal of the relevant radioactive waste.
- Special tasks approved by the Executive Yuan for improving nuclear backend management.

There are NT$370.250 billion dollars in the Nuclear Backend Fund (updated to the end of December 2020). The expenses for management of the spent fuel or radioactive waste generated from operation are covered by the operation costs of the NPPs.

(3) Financial Provisions following Closure of a Disposal Site

According to Article 28 of “The Nuclear Materials and Radioactive Waste Management Act,” the producers of spent fuel or radioactive waste shall afford its necessary expenses for treatment, storage, transportation, final disposal, and decommissioning of the facilities. If there is any shortages, TPC is responsible for make it up. On the other hand, TPC is also responsible for the closure of radioactive waste and spent fuel disposal sites, and implements institutional control in accordance with institutional control plans approved by

the regulatory authority. The expenses for the closure and institutional control are covered by the Nuclear Backend Fund, along with all other expenses regarding the final disposal of the radioactive waste.

F.3 Quality Assurance

Article 23 Quality Assurance Each Contracting Party shall take the necessary steps to ensure that appropriate quality assurance programs concerning the safety of spent fuel and radioactive management are established and implemented.

Quality assurance (QA) program shall be incorporated in the safety analysis report of construction license application of spent fuel or radioactive waste facilities, in accordance with Article 4 of the “Regulations for the Review and Approval of Application for Construction License of Radioactive Wastes Treatment, Storage and Final Disposal Facilities.” The “Regulations on Quality Assurance of Nuclear Reactor Facilities” are the only existing regulations regarding quality assurance of nuclear facilities in Taiwan, and are applied to nuclear reactor facilities, and all other spent fuel or radioactive waste facilities (including spent fuel pools, radioactive waste treatment facilities, on-site storage facilities, and so on). Based on experience, quality assurance programs of structures, systems, and components (SSCs) that are important to safety, can refer to U.S.NRC 10 CFR 50 Appendix B and ASME NQA-1; for quality assurance programs of SSCs that are not important to safety, can refer to 10 CFR 50 Appendix B and ISO 9000 series.

Quality assurance programs shall be included in safety analysis reports for the application for construction and operating licenses according to current regulations. For there are no specific criteria specialized for quality assurance programs of spent fuel management facilities, “Regulations on Quality Assurance of Nuclear Reactor Facilities” are practically applied to all activities related to spent fuel management facilities.

F.4 Operational Radiation Protection

Article 24 Operational Radiation Protection

1. Each Contracting Party shall take the appropriate steps to ensure that during the operating lifetime of a spent fuel or radioactive waste management facility:
   (i) the radiation exposure of workers and the public caused by the facility shall be kept as low as is reasonably achievable, economic and social factors being taken into account;
   (ii) no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection; and
   (iii) measures are taken to prevent unplanned and uncontrolled releases of radioactive materials into the environment.
2. Each Contracting Party shall take appropriate steps to ensure that discharges shall be limited:
   (i) to keep exposure to radiation as low as is reasonably achievable, economic and social factors being taken into account; and
   (ii) so that no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection.
3. Each Contracting Party shall take appropriate steps to ensure that during the operating lifetime of a regulated nuclear facility, in the event that an unplanned or uncontrolled release of radioactive materials into the environment occurs, appropriate corrective measures are implemented to control the release and mitigate its effects.

(1) Protection from Radiation Exposures

(A) ALARA

Article 1 of the “Ionizing Radiation Protection Act” proposes that ALARA (as low as reasonably achievable) is the primary principle of radiation protection. Therefore, radiation exposure of workers and the

public caused by spent fuel or radioactive waste facilities shall be kept as low as reasonably achievable. Along with other economic and social factors, radiation exposure could be kept well under dose limits in the regulations.

(B) Dose Limits

(a) Dose limits to the Workers

Article 7 of the “Safety Standards for Protection against Ionizing Radiation” specifies that the dose limits of occupational exposure for radiation workers are:

- The effective dose shall not exceed 100 mSv over a cycle of five consecutive years started from January 1, 2003, and shall not exceed 50 mSv in any single year.
- The equivalent dose to the lens of the eye shall not exceed 150 mSv in one year.
- The equivalent dose to skin or extremities shall not exceed 500 mSv in one year.

(b) Dose Limits to the General Public

Article 12 of the “Safety Standards for Protection against Ionizing Radiation” specifies that the annual dose limits to the public due to the radiation practices are:

- The effective dose shall not exceed 1 mSv.
- The equivalent dose to the lens of the eye shall not exceed 15 mSv.
- The equivalent dose to skin shall not exceed 50 mSv.
- The design of radiation protection shall ensure that the annual effective dose to individual members of the general public from a spent fuel or radioactive waste facility shall not exceed 0.25 mSv.

(2) Control of Discharge

(A) ALARA

Article 1 of the “Ionizing Radiation Protection Act” stipulates that in order to protect against the detriment of ionizing radiation and to maintain health and safety of our citizens, all radiation activities shall be implemented in accordance with the ALARA principle; i.e. the same principle shall be applied to control of discharge. Furthermore, the

operators of the facilities shall not discharge any radioactive gas or liquid waste until radiation safety evaluation is carried out and approved by the regulatory authority in accordance with Article 9.1 of the Act.

(B) Control Limits

Col. 4 to 6 of Schedule IV-2 in the “Safety Standards for Protection against Ionizing Radiation” list the control limits of released radionuclides in air, water, and effluent. The operators of the facilities shall demonstrate that the releases meet the aforementioned control limits.

(C) Measures to Prevent Unplanned and Uncontrolled Releases

For the prevention of unplanned and uncontrolled releases, Article 9.1 of the “Ionizing Radiation Protection Act” stipulates that the operators of the facilities which discharge radioactive gas or liquid waste shall perform radiation safety evaluation, and the aforementioned activities can only be implemented after the evaluation has been approved by the regulatory authority. Moreover, releases of radioactive gas or liquid waste without prior approval will be fined and ordered to rectify before deadlines in accordance with Article 41 of the Act. For those do not rectify before deadlines, there will be consecutive penalties or even suspension of practice. If deemed necessary, permission, permits or registration may be revoked.

(D) Corrective Measures Following Unplanned or Uncontrolled Releases

Unplanned or uncontrolled discharge of radioactive gas or liquid waste is prohibited in accordance with Article 9 of the “Ionizing Radiation Protection Act.” However, if accidents result in radiation intensity off-site or concentration of radioactive materials in water, air, or effluent exceeding the limits in the “Safety Standards for Protection against Ionizing Radiation,” the operators shall take necessary protection and clean up measures, and report to the regulatory authority immediately. In addition, investigation, analysis, and record shall be carried out, and reported to the regulatory authority within a limited period of time.

(3) Environmental Radiation Monitoring

For the improvement in environmental radiation monitoring in Taiwan, “Setup Guidelines for Environmental Radiation Monitoring Facilities” was

promulgated on January 2018. There are 3 types of monitoring facilities in the Guidelines, including basic, standard, and enhanced, depending on their objectives. Basic type refers to real-time environmental radiation monitoring posts which are suitable for monitoring environmental background radiation in Taiwan; standard type refers to not only real-time environmental radiation monitoring posts but also aerosol suction machines and fallout collectors that are capable of detecting radiation levels in airborne particulate and fallout, which are suitable for monitoring environmental radiation near nuclear facilities; enhanced type refers to not only the equipment mentioned above but also high-volume aerosol suction machines that can collect more than 500 L air per minute, which are suitable for early detecting radioactive fallout from abroad. Currently, there are 61 environmental radiation monitoring posts nationwide that monitor environmental radiation changes 24/7, for radiation safety of the public.

Furthermore, the Radiation Monitor Center of the AEC carries out radiation monitoring activities around NPPs, research nuclear facilities, and LLW Storage Site periodically, including direct monitoring of dose rates and radioactive analyses of samples from air, grass, rivers, groundwater, ponds, lakes, mountain spring water, seawater, milk, chickens, rice, vegetables, fish, seaweed, shells, biological indicators, soil, shore sand, sludge, and so on. The results are within background.

F.5 Emergency Preparedness

Article 25 Emergency Preparedness

1. Each Contracting Party shall ensure that before and during operation of a spent fuel or radioactive waste management facility there are appropriate on site and, if necessary, off site emergency plans. Such emergency plans should be tested with appropriate frequency.
2. Each Contracting Party shall take the appropriate steps for the preparation and testing of emergency plans for its territory insofar as it is likely to be affected in the event of a radiological emergency at a spent fuel or radioactive waste management facility in the vicinity of its territory.

(1) Emergency Plans

1. NPPs

Except for LLW Storage Site, currently all spent fuel or radioactive waste management facilities are located in NPP sites; therefore, the emergency plans are incorporated in the emergency plans of the NPPs, and are regulated by the “Nuclear Emergency Response Act” and the “Enforcement Rules for the Implementation of the Nuclear Emergency Response Act.”

LLW Storage Site has stopped receiving LLW since April 1996. Presently, all the LLW is stored in solidified form in steel drums in LLW Storage Site. And off-site emergency plan is not needed for LLW Storage Site.

2. Small Users

The “Regulations on Emergency Response of Research Reactor Facilities” amended on June 4, 2009 is the basis of regulation of emergency response of research reactor facilities. For the 3 research reactors in INER have permanently ceased operation, currently there are no emergency plans for research reactors. Presently, accident response plans or relevant plans incorporated in the Safety Analysis Report (SAR) of spent nuclear or radioactive waste management facilities in INER are submitted to the regulatory authority for review and approval in accordance with Article 8 and 26 of the “Enforcement Rules for the Nuclear Materials and Radioactive Waste Management Act.”

On the other hand, the emergency plans of THOR had been reviewed on 2017.

(2) Emergency Exercises

The emergency exercises of spent fuel or radioactive waste facilities in NPPs are covered by the emergency exercises of NPPs. Based on Article 15 of the “Nuclear Emergency Response Act,” the AEC will select an emergency planning zone (EPZ) periodically to conduct emergency exercises in accordance with the approved emergency response plan. The above exercises also applied to other nuclear reactor facilities.

The AEC has conducted emergency exercises once a year since 2001 to review response ability of NPPs and the relevant units. The central and local

government, and the operators of nuclear reactor facilities have all participated in the exercises. The emergency exercises include unit recovery drill, radiation detection, dose evaluation, sheltering in place, evacuation and shelter placement, iodine tablets distribution, medical treatment for radiation injuries, decontamination, and so on.

(3) Improve Emergency Preparedness Regulations

Radiation disaster is deemed one of the statutory disasters in the “Disaster Prevention and Protection Act” revised on April 2016. Based on this Act, the AEC has proposed the following regulations to improve radiation disaster preparedness. First of all, “Classification, Content, Models, Methods and Announcement Timing of Alarm Signals during Nuclear Emergency Response” and “Regulations on the Disclosure of Information about Potential Radiation Disasters” were revised on 2017.

Then written notification of nuclear accidents, frequency of emergency exercises, and appropriation amount of the Nuclear Accident Emergency Preparedness Funds stipulated in the “Enforcement Rules for the Implementation of the Nuclear Emergency Response Act” were revised on October 2017. Meanwhile, “Regulations on Assessment of Nuclear Accident Emergency Preparedness Funds” and “Guidelines for Establishment and Operation of the Management Committee on Nuclear Accident Emergency Preparedness Funds” were also revised for better management of the Nuclear Accident Emergency Preparedness Funds. Moreover, for the improvement in the “Nuclear Emergency Response Act,” the AEC refers to relevant regulations and practical methods of the U.S., Japan, and IAEA, and has incorporated post-Fukushima re-examination of NPPs and experience from emergency exercises conducted every year into the amendment of the Act.

Also, for better efficiency of emergency response, the AEC has integrated disaster prevention and relief resources from TPC and the MOEA, and has expanded emergency preparedness area according to degree of risk assessment.

Finally, the “Response and Decision Making Reference Guides for Public Protective Actions in Nuclear Accidents” was issued on May 2018 for the National Nuclear Emergency Response Center to follow while nuclear accidents happen; and the “Radiological Disaster Relief Operation Plan” was

reviewed on December 2018 for more thorough nuclear emergency preparedness.

(4) Nuclear Security, Nuclear Safeguards, and Emergency Response Measures

For the improvement of radioactivity analysis in emergency response, the AEC has established 2 backup laboratories in National Yang-Ming University and National Pingtung University of Science and Technology individually. The 2 laboratories had set up the equipment and software needed by 2018, and have been certified by the Taiwan Accreditation Foundation (TAF).

The AEC had also completed the review of the renewal of the nuclear security plan in 2018. The plan was renewed according to the newest international nuclear security regulations and regulation requirements of the AEC, to strengthen the nuclear security of NPPs in Taiwan.

For the timeliness of emergency mobilization organizations of NPPs and TPC, the AEC has proposed “Plan for Unannounced Emergency Mobilization Drill or Communication Tests of NPPs (2018),” and conducted an unannounced communication Test of Maanshan NPP and an unannounced emergency mobilization drill of Chinshan NPP. The test results showed that the communication and emergency mobilization have met the test criteria.

Moreover, in order to improve radiation disaster response and preparedness of local governments, radiation disaster prevention and protection knowledge of the first responders has been strengthened through guidance, training, and exercises. Local governments have also been incorporated into the radiation disaster prevention activities to strengthen the radiation disaster response system.

- Guidance: The AEC has guided the radiation disaster preparedness of local governments through participating in the review of local government disaster prevention and protection plan and the “All-Out Defense Mobilization Plan” implemented by the Executive Yuan. The AEC has also counseled local governments on the preparedness of radiological disaster relief operation plan.
- Training: The AEC had organized 4 sessions of “Local Government Radiation Disaster Prevention and Protection Forums” to improve first responders’ understanding of the radiation disaster prevention and

protection mechanism and measures. There were 206 people participating in the forums. Through lectures and table-top exercises, first responders were taught to understand the main points of radiation disaster response, and became acquainted with the process of the radiation disaster response. Other training courses and forums were also held to strengthen the ability of the first responders of the local governments. In 2019, a total of 47 training courses were held, and 2,310 people participated.

- Exercise: Radiation disaster prevention and protection drills have been conducted with the New Taipei City Government, the Tainan City Government, the Yunlin County Government, and the Hsinchu City Government. The AEC has designed the drill scenario and provided consultation in the drills. Besides, Radiation Response Team of the AEC has also been assigned to participate to improve the cooperation of central and local governments in radiation disaster prevention and protection.

In order to improve professional competence of the Radiation Response Team and understanding of the overall disaster prevention and protection mechanism, “Disaster Prevention Specialist Training” was held by the AEC. In 2019, 31 participants of the AEC were certificated with disaster prevention specialist. In addition, “Counter-Radiological Dispersal Devices (RDDs) Training” was also held in December 2019. Experts from the U.S. were invited to lecture on the arrangement of response activities and main points of communication when encountering RDDs. In total, there were 33 members participating in the training. The Radiation Response Team was also sent to the 2019 Jin Hua Exercise conducted by the Executive Yuan for the radiation detection.

According to the “Cyber Security Management Act,” information security management system (ISMS) has been introduced since 2017 for the confidentiality, usability, and integrity of information asset. And the system has been certified with ISO 27001. Relevant information security documents fit for each department can be established in the ISMS through process review, establishment of information security policies, asset inventory and risk assessment. Information security management can also be improved, through

information security campaigns, information security trainings, and review of internal audit and emergency reporting.

F.6 Decommissioning

Article 26 Decommissioning
Each Contracting Party shall take the 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.

The regulatory provisions regarding decommissioning of nuclear reactor facilities are stipulated in the “Nuclear Reactor Facilities Regulation Act;” deadlines for decommissioning activities of nuclear reactor facilities, radiation dose limits for decommissioned sites, scope of changes in a decommissioning plan involving important regulatory events, and what should be included in environmental radiation monitoring reports of decommissioned sites are specified in the “Enforcement Rules for the Implementation of Nuclear Reactor Facilities Regulation Act;” and documents required for application for decommissioning permits, review procedures of the documents, and other requirements are stipulated in the “Regulations on the Permit Application and the Management for Decommissioning of Nuclear Reactor Facilities.”

In accordance with the “Nuclear Reactor Facilities Regulation Act,” TPC shall submit decommissioning plans 3 years prior to the scheduled permanent cessation of operation of NPPs. The AEC will review the plan and issue a decommissioning permit if the plan is bonded to the provisions. The decommissioning activities shall be completed within 25 years.

(1) Qualified Staff and Adequate Financial Resources

Decommissioning plans shall include planning of organizations and personnel training, in accordance with Article 3 of the “Regulations on the

Permit Application and the Management for Decommissioning of Nuclear Reactor Facilities." This can ensure that there are sufficient qualified personnel to implement the decommissioning activities.

Article 2 of the "Regulations on the Permit Application and the Management for Decommissioning of Nuclear Reactor Facilities" requires that applicants for decommissioning of nuclear reactor facilities shall file an application with decommissioning plans and financial statements; these shall be reviewed and approved by the regulatory authority. Also, Article 4 of the above-mentioned Regulations requires that financial planning and resources needed for decommissioning activities and management of the generated radioactive waste shall be included in the financial statements. Currently, the financial resources for the decommissioning are supported by the Nuclear Backend Fund.

(2) Radiation Protection

Article 3 of the "Regulations on the Permit Application and the Management for Decommissioning of Nuclear Reactor Facilities" stipulates that dose evaluation and radiation protection measures shall be included in decommissioning plans. The above-mentioned radiation protection shall comprise the protection of radiation workers and general public, in accordance with the "Safety Standards for Protection against Ionizing Radiation." Moreover, in accordance with Article 17 of the "Enforcement Rules for the Implementation of Nuclear Reactor Facilities Regulation Act," if the decommissioned sites are released for restricted use, annual effective dose to individual members of the general public shall not exceed 1 mSv; and if the sites are released for non-restricted use, annual effective dose to individual members of the general public shall not exceed 0.25 mSv.

(3) Control of Waste Release

Article 31 of the "The Nuclear Materials and Radioactive Waste Management Act" and the "Regulations on Clearance Level for Radioactive Waste Management" are the regulatory basis of the release of radioactive waste generated from decommissioning of nuclear facilities. Radioactive waste meets the control limits can be exempted from control, and then recycled, reused, incinerated, or buried according to the approved release plans after properly monitored.

On the other hand, radiation sources will be regulated based on Article 53 of the “Ionizing Radiation Protection Act” and “Exemption Standards for Radiation Sources;” for those with radiation activity under the exemption standards can be exempted from control.

(4) Emergency Preparedness

Emergency preparedness plan shall be included in the decommissioning plan in accordance with Article 3 of the “Regulations on the Permit Application and the Management for Decommissioning of Nuclear Reactor Facilities,” and the plan shall be reviewed and approved by the regulatory authority before implementation.

(5) Record Keeping for Information Important to Decommissioning

Article 3 of the “Regulations on the Permit Application and the Management for Decommissioning of Nuclear Reactor Facilities” requires that quality assurance programs describing information record keeping shall be included in decommissioning plans. Therefore, the operators shall be responsible of record keeping of important information during decommissioning.

(6) Regulations Amendment

The AEC conducted a comprehensive review on purposes of the legislation stipulated in the decommissioning regulations, application and review procedures for decommissioning permits, transition between expiration of operating licenses and issuance of decommissioning permits, safety regulation of onsite decommissioning activities, and site deregulation after decommissioning, and amended the “Enforcement Rules for the Implementation of Nuclear Reactor Facilities Regulation Act,” the “Regulations on the Permit Application and the Management for Decommissioning of Nuclear Reactor Facilities” and the “Standards of Fees for Regulatory Services under the Nuclear Reactor Facilities Regulation Act.” Moreover, “Guides for Nuclear Reactor Facilities Decommissioning Plan” and “Review Guides for Nuclear Reactor Facilities Decommissioning Plan” were also amended for safety regulation of the activities during decommissioning period. These amendments were based on real practices of NPPs regulation in Taiwan. The provisions specify that the decommissioning period of a nuclear reactor facility starts from the next day of the operating license expiration date. In addition, the

provisions also specify regulation measures such as required documents for application for decommissioning permits and the deadlines for submission, content that shall be included in the decommissioning plans, and nuclear fuel safety/environmental radiation safety/releases of radioactive gas and liquid radioactive waste/management of radioactive waste during decommissioning period.

Beside the amendments mentioned above, for the improvement in quality of decommissioning activities of nuclear facilities and effective management of radioactive waste generated from decommissioning, the “Enforcement Rules for the Nuclear Materials and Radioactive Waste Management Act” was amended in 2019. In order to secure sufficient time for the operators to plan decommissioning activities and to ensure environmental and public safety, deadlines for the decommissioning plans were clearly specified. Meanwhile, procedures for deregulation were included for the operators to follow when releasing sites after decommissioning.

(7) Review of Decommissioning Plans

A task force, consisted of experts from nuclear safety fields and specialists from the AEC, was organized by the AEC to review the Decommissioning Plan of Chinshan NPP, in accordance with Article 23 of the “Nuclear Reactor Facilities Regulation Act” and the relevant provisions. A web page dedicated to pertinent information has also been set up for information disclosure, and public meetings were held for public participation and opinion collection.

The “Decommissioning Plan of Chinshan NPP” and the “Report on Technical and Management Ability and Financial Assurance of Chinshan NPP” were approved by the AEC in June 2017. The review has confirmed that the Decommissioning Plan complies with the regulations, and that the health and safety of the public will be well protected during decommissioning; also, that the technical competence, the management competence, and financial status are capable of implementing decommissioning activities. After the environmental impact assessment (EIA) report was approved by the EPA in July 2019, the AEC issued the decommissioning permit (the first one in Taiwan) of Chinshan NPP on July 12, 2019.

The progress of NPP decommissioning in Taiwan can be divided into four phases: transitional phase, dismantling phase, final site survey phase, and site remediation phase. Currently, the spent fuel of Chinshan NPP still remains in the reactors. For safety, the AEC follows the regulation measures in outage to regulate the decommissioning activities of Chinshan NPP, and Pre-Defueled Safety Analysis Report (PDSAR) and Technical Specification (PDTS) were asked to be submitted as the safety baseline during decommissioning. The former documents were submitted by TPC in December 2017, and the AEC organized a review team comprising specialists from the AEC and experts from academia thereafter. TPC modified the documents in 2 sessions of Q&A and 3 review meetings, and the documents were approved in November 2018. The AEC has supervised TPC to follow the requirements in the documents and maintain the functions of safety related systems and equipment, so that the safety of nuclear fuel in the reactors can be assured.

As for Kuosheng NPP, TPC submitted the “Decommissioning Plan of Kuosheng NPP” to apply for decommissioning permit on December 27, 2018. The abovementioned plan was approved on October 20, 2020. And TPC will start the decommissioning activities once the decommissioning permit is issued.

The AEC also requires TPC to submit a decommissioning plan for Maanshan NPP by 2021 for decommissioning of Maanshan NPP in the near future.

(8) Regulation of Decommissioning Activities

A task force on safety regulation of NPP decommissioning was established in June 2017 for regulation of NPP decommissioning, and assurance of public safety and environmental quality. The AEC will oversee and inspect that TPC implements dismantling, radiation protection, management of spent fuel and radioactive waste, environmental radiation monitoring, engineering management, and other activities during decommissioning follows the approved decommissioning plan. To ensure that the decommissioning activities are consistent with the approved decommissioning plan, TPC should file an application with dismantling plan prior to dismantling any buildings or facilities. According to the aforementioned

regulation measures, the AEC reviewed the dismantling plan of towers (with only power output function) located between the main transformer and the switchyard of Chinshan NPP based on its classification and evaluation result of radiation impacts, dismantling methods, response actions, and housekeeping, and conducted onsite inspection, to ensure that the dismantling activities would be consistent with the approved plan. The plan was approved in November 2019, and TPC started to dismantle the towers thereafter.

Besides, the AEC completed the review of the “Decommissioning Plan of Waste Trench in Chinshan NPP” in 2019. Inspectors will visit on a monthly basis during implementation of the plan, to ensure personnel and public safety. The location of waste trench will be used as the 2nd phase spent fuel dry storage facility (an indoor facility) of Chinshan NPP for the purpose of decommissioning.

Chinshan NPP is currently under decommissioning; however, treatment systems for volume reduction should be maintained for volume reduction of LLW generated during decommissioning. The AEC has requested TPC to complete safety evaluation of these systems according to the principles of 10 years periodic reassessment.

In order to strengthen the ability of treatment and storage during decommissioning, two meetings regarding the management technologies of radioactive waste during decommissioning were hold in 2019. LLW incinerator, ultra-high pressure compactor, and LLW storage facility newly constructed during decommissioning, and the development of LLW container were discussed in the meetings.

(9) Development of Decommissioning Technologies

INER has been proactively participating in the planning and license application for decommissioning of Chinshan NPP since 2013 in line with the national policies. The following key technologies have been developed ever since: (A) Schedule planning of decommissioning activities of NPPs: Chinshan NPP is required to be dismantled when decommissioning in accordance with the regulations. And all the decommissioning activities shall be completed within 25 years after the decommissioning permit is issued by the regulatory authority. The timeline of the whole decommissioning can be mainly divided into four phases: post-operation transition phase (8 years), dismantling and

demolition phase (12 years), final site survey phase (3 years), and remediation phase (2 years). (B) 3D engineering simulation and visual aids: 3D engineering simulation of the systems, structures, and components required for NPP decommissioning. Also, radiation measurement data and application of visual aids are also incorporated in the simulation. The first NPP digital model database and decommissioning information management system in Taiwan was then established for decontamination, dismantling and demolition, management of radioactive waste, and personnel training during decommissioning.

(10) Decommissioning of Facilities Generating SURW

For permanent cessation of nuclear materials production or storage facilities, nuclear fuel treatment or storage facilities, and final disposal facilities of radioactive waste, the operators shall submit decommissioning plans to the regulatory authority for review and approval in accordance with Article 14 and 23 of the “The Nuclear Materials and Radioactive Waste Management Act.”

Article 20 of the “Enforcement Rules for the Nuclear Materials and Radioactive Waste Management Act” stipulates that the decommissioning plans shall include the following, such as personnel training, dose evaluation, radiation protection measures, accident response plans and so on.

Decommissioning plans of many of the non-reactor facilities in INER have been approved by the AEC. Among those, Fuel Assembly Recycle Plant (Building 017B), Fuel Assembly Waste Warehouse (Building 040), UO_2 Fuel Manufacturing Lab (Building 021), Radiochemistry Lab (Building 016), and Decontamination Lab and Quality Testing Lab for Solidified Waste (Building 039) have been decommissioned or cleaned up.

G. SAFETY OF SPENT FUEL MANAGEMENT

Article 4 General Safety Requirements

Each Contracting Party shall take the appropriate steps to ensure that at all stages of spent fuel management, individuals, society and the environment are adequately protected against radiological hazards.

In so doing, each Contracting Party shall take the appropriate steps to:

(i) ensure that criticality and removal of residual heat generated during spent fuel management are adequately addressed;

(ii) ensure that the generation of radioactive waste associated with spent fuel management is kept to the minimum practicable, consistent with the type of fuel cycle policy adopted;

(iii) take into account interdependencies among the different steps in spent fuel management;

(iv) provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the frame work of its national legislation which has due regard to internationally endorsed criteria and standards;

(v) take into account the biological, chemical and other hazards that may be associated with spent fuel management;

(vi) strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation;

(vii) aim to avoid imposing undue burdens on future generations.

G.1 General Safety Requirements

(1) Subcriticality and Residual Heat Removal of Spent Fuel Management

In accordance with Article 13 of the “Regulations on Treatment and Storage of Radioactive Waste and Safety Management of the Facilities,” the design of spent fuel storage facilities shall be able to ensure that the safety requirements for residual heat removal and subcriticality are met.

(2) Minimizing Radioactive Waste Generated from Management of Spent Fuel

Currently, there are no spent fuel management facilities or final disposal sites in Taiwan. All of the spent fuel is stored in the spent fuel pools. Dry storage facilities of Chinshan NPP and Kuosheng NPP are both ongoing. And the operation of spent fuel storage facilities can barely produce any radioactive waste. Nevertheless, the AEC has asked TPC to minimize radioactive waste produced from operation of wet and dry storage facilities and from decommissioning.

(3) Interdependencies among Different Steps in Spent Fuel Management

According to the policies at present, spent fuel removed from the cores will be temporarily stored in the spent fuel pools for dry storage. The spent fuel can be transferred to dry storage facilities once the facilities start to operate, and finally it will be disposed in final disposal site. Moreover, the design, construction, and operation of all the spent fuel management facilities shall maintain retrievability of spent fuel.

(4) Regulations for Radiation Protection

The radiation protection programs of spent fuel pools are governed by the regulations for radiation protection program because spent fuel pool is part of nuclear reactor facility.

Under the planning of radiation protection programs of the dry storage facilities in Chinshan NPP and Kuosheng NPP, annual effective doses to individual members of the general public shall not exceed 0.25 mSv, and the doses shall be kept ALARA.

(5) Consideration for Biological, Chemical and Other Hazards

In the design, construction, operation, decommissioning, and closure process, the operators shall evaluate all potential biological, chemical and other hazards that may adversely impact on the safety of spent fuel management facilities. Since reprocessing of spent fuel is not adopted currently, impact from potential biological, chemical and other hazards are very limited.

(6) Consideration for Impacts on Future Generations

The safety standards also apply to future generations; in addition, government and the operators shall evaluate influence on future generations

from management of spent fuel based on regulations of the “Fundamental Safety Principles” (IAEA Safety Standards Series No. SF-1), and provide proper design and proper protective measures.

(7) Consideration for Burdens on Future Generations

For ethical reasons and follow the “Fundamental Safety Principles” (IAEA Safety Standards Series No. SF-1), the management of spent fuel shall not cause undue burdens on future generations. Under the government’s policies, the operators of NPPs shall be responsible for the management of spent fuel generated from operation of NPPs. Whether it is the design, construction, operation, decommissioning, closure or funding should all comply with these policies.

G.2 Existing Facilities

Article 5 Existing Facilities Each Contracting Party shall take the appropriate steps to review the safety of any spent fuel management facility existing at the time the Convention enters into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a facility.

(1) Spent Fuel Wet Storage Facilities

The existing facilities related to spent fuel management are spent fuel pools, which are part of nuclear reactor facilities, in NPPs. The old storage racks of the spent fuel pools have been replaced with neutron poisoned high density racks to increase the storage capacity. Through review of re-racking work plan and ten-year re-evaluation, and also through routine inspection, safety of the spent fuel pools is confirmed by the AEC.

Due to insufficient storage space of spent fuel pool in Kuosheng NPP, TPC submitted a license amendment request (or design change request, DCR) to install spent fuel storage racks at cask loading pool (CLP). The AEC had reviewed this amendment on April 6, 2017, and a formal approval had been issued on May 19, 2017, after holding a public meeting. Kuosheng NPP is allowed to transfer spent fuel to the cask loading pool of unit 1, and unit 1 has

restarted operation since June 9, 2017. The relevant safety analysis reports are published on the AEC website.

(2) Spent Fuel Dry Storage Facilities

The construction and performance test of 1st phase spent fuel dry storage facility of Chinshan NPP has been completed, and the AEC approved TPC to carry out hot test of the facility. However, the New Taipei City Government has not issued soil and water conservation certificate yet, and hot test of the facility is not yet to be carried out.

The AEC issued the construction license for spent fuel dry storage facility of Kuosheng NPP in August 2015; however, the construction has not been started, due to the “Plan for Reduction of Runoff Wastewater at Construction Site” has not yet been approved by the New Taipei City Government.

The AEC asked the New Taipei City Government to actively review the soil and water conservation of the 1st phase spent fuel dry storage facility of Chinshan NPP in September 2017, and has also asked the MOEA and TPC to communicate and coordinate with the New Taipei City Government, so the spent fuel can be removed from the reactor cores as soon as possible. The AEC also asked the MOEA to actively implement the dry storage construction plans of Chinshan NPP and Kuosheng NPP in September 2017 and July 2019.

The AEC has invited TPC to dry storage facility regulation meetings once a month since January 2019, so the progress of dry storage facilities can be kept track of. In the meetings, the AEC has requested TPC to carry out integrated exercise before hot test of the dry storage facility in Chinshan NPP at least once a year, and keep improving the preparation work of personnel and equipment for the safety of the hot test. In addition, TPC should request for experienced experts from the U.S. vendors to participate in the hot test for better safety and emergency preparedness.

For social consensus and public acceptance, and for the implementation of decommissioning plan, the AEC has asked TPC to plan the 2nd phase spent fuel dry storage facility of Chinshan NPP to adopt indoor storage. The “Investment Feasibility Report of the 2nd Phase Indoor Spent Fuel Dry Storage Facility of Chinshan NPP” was approved by the Executive Yuan in August 2019, and the “Investment Feasibility Report of the 2nd Phase Indoor Spent Fuel Dry Storage Facility of Kuosheng NPP” is under review by the MOEA at present.

The AEC has regulated the implementation progress of the 2nd Phase Indoor Spent Fuel Dry Storage Facility of Chinshan NPP through monthly meetings, and has asked TPC to commence operation of the facility in the transitional phase, to facilitate the decommissioning activities.

For the regulation and safety review of indoor dry storage facilities, the AEC has amended the “Safety Analysis Report Guides for Spent Fuel Dry Storage Facility Application” and has promulgated the “Review Guides for Safety Analysis Reports of Spent Fuel Dry Storage Facilities” (January 2019).

(3) Research Reactor Facilities

The AEC has reviewed and inspected TRR spent fuel pool, ZPRL reactor pool, WBR spent fuel drums, Central Warehouse, and inspection facility (hot cell) in INER. The results show that all spent fuel facilities in INER are in compliance with the safety standards.

Five experts from IAEA, the U.S. National Nuclear Security Administration (NNSA), Los Alamos National Laboratory (LANL), and the Argonne National Laboratory (ANL) visited INER, to inspect WBR fuel and have discussion over follow-up stabilization procedures.

INER completed uranium powder stabilization of the fuel rods and TRR fuel pool in November 2019. All of the stabilized products (38 sets of storage containers) were transported to two temporarily storage boxes in Building 074. The 23 sets of storage containers of the first temporarily storage box have already been transported to Central Warehouse in Building 036A after approved by IAEA in March 2014. The remaining 15 sets of storage containers of the second temporarily storage box will also be transported to Central Warehouse in Building 036A after approved by IAEA.

The AEC has routinely reviewed and inspected the fuel pool of THOR in NTHU, and the results show that it is in compliance with the safety standards.

G.3 Siting of Proposed Facilities

Article 6 Siting of Proposed facilities

1. Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed spent fuel management facility:
   (i) to evaluate all relevant site related factors likely to affect the safety of such a facility during its operating lifetime;
   (ii) to evaluate the likely safety impact of such a facility on individuals, society and the environment;
   (iii) to make information on the safety of such a facility available to members of the public;
   (iv) to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.
2. In so doing, each Contracting Party shall take the appropriate steps to ensure that such facility shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 4.

Siting requirements of HLW disposal facilities have been proposed by the AEC. According to the “Regulations on the Final Disposal of High Level Radioactive Waste and Safety Management of the Facilities,” HLW disposal facilities shall not be located in the following areas: active fault or areas in which the geological conditions would affect the safety of the disposal facilities; areas with geochemical conditions not favorable for effectively controlling the spreading of pollution caused by radioactive nuclides and likely to affect the safety of the disposal facilities; areas with surficial or underground hydrographical conditions likely to affect the safety of the disposal facilities; areas with high population density; and other areas in which development is prohibited according to laws. In addition, Article 5 of the Regulations stipulate that a HLW disposal facilities shall be avoided to locate in the following areas:

where landslide, collapse and volcanic activities are likely to occur; where geological structure is likely to change obviously; where hydrographical conditions are prone to change; where parent rock for disposal is being deteriorated obviously; where lithosphere is ascending or eroding obviously. If disposal facilities are located in any of the above areas, the operators shall bring forward solutions to ensure the facilities meet the safety requirements.

For detailed site investigation, Article 6 of the “Regulations on the Final Disposal of High Level Radioactive Waste and Safety Management of the Facilities” stipulates that operators of disposal facilities shall submit plans for detailed site investigation, and start detailed investigation after the plans are approved by the competent authority. A detailed site investigation plan shall include the following contents: description of the location, conceptual design of the operating area of disposal facilities, planning of necessity of drilling or excavation and operation, planning of research and test, planning for investigating and controlling the factors likely to influence the capability of the location to isolate highly radioactive waste, planning of quality assurance, planning of restoration, financial description, and other contents specified by the competent authority.

TPC follows the “The Nuclear Materials and Radioactive Waste Management Act” and relevant regulations, carries out the siting and construction of spent fuel final disposal facility. According to the regulations, TPC shall revise “Spent Fuel Final Disposal Program Plan” every 4 years, and submit to the AEC for review. The Plan was revised in 2018; and according to its planning, 2018 to 2028 is the second stage of the project, the “Candidate Site Selection and Approval” stage. The AEC has asked TPC to carry out siting activities based on three principles: detached organization, public participation, and objective criteria. The AEC has also asked TPC to implement the siting activities in host rock areas in priority based on former results, regional geological data, siting factors, and verification and comparison with results from public work and academic research in large-scale investigation.

G.4 Design and Construction of Facilities

Article 7 Design and Construction of Facilities

Each Contracting Party shall take the appropriate steps to ensure that:

(i) the design and construction of a spent fuel management facility provide for suitable measures to limit possible radiological impacts on individuals, society and environment, including those from discharges or uncontrolled releases;

(ii) at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a spent fuel management facility are taken into account;

(iii) the technologies incorporated in the design and construction of a spent fuel management facility are supported by experience, testing or analysis.

(1) Limitation of Radiological Impact

As spent fuel pool is considered part of nuclear reactor facility, regulations related to nuclear reactor facilities are applied to design, construction, and operation of spent fuel pools. The radiation protection standards shall in compliance with the dose limitation of nuclear reactor facilities and the ALARA principle. As stipulated in Article 12 of the “Safety Standards for Protection against Ionizing Radiation,” effective doses to individual members of the public shall not exceed 1 mSv/a, equivalent dose to lens of eyes shall not exceed 15 mSv, and equivalent dose to skin shall not exceed 50 mSv. In addition, as stipulated in Article 10 of the “Enforcement Rules for the Implementation of Nuclear Reactor Facilities Regulation Act,” doses to individual members of the public off-site caused by external exposure shall not exceed 0.5 mSv/a, or shall not exceed 0.02 mSv/hr.

Spent fuel dry storage facilities are taken as independent spent fuel storage facilities, although they are located in the site of NPPs. The radiation protection plans need to ensure that effective doses to individual members of the public shall not exceed 0.25 mSv/a caused by a spent fuel dry storage facility.

As stipulated in Article 8 of the “Regulations on the Final Disposal of High Level Radioactive Waste and Safety Management of the Facilities,” multiple

barriers shall be adopted as the design concept of final disposal of HLW. Also, from Article 9, effective doses to individual members of the public caused by the facility shall not exceed 0.25 mSv/a. And from Article 10, risk to individual members of the critical group shall not exceed 10^{-6}/a.

(2) Planning and Technical Provisions for Decommissioning

There are plenty of international experiences regarding spent fuel pool decommissioning, proves that spent fuel pools can be decommissioned safely.

According to Article 4 of the “Regulations for the Review and Approval of Application for Construction License of Radioactive Wastes Treatment, Storage and Final Disposal Facilities,” conceptual plans and application of decommissioning of dry storage facilities shall be submitted with parts of safety analysis reports when applying for construction licenses.

(3) Technology Support from Experience, Testing and Analysis

The applicants should follow the technology support which is established from experience, testing, and analysis by the designers. This practice is anticipated to be continued in the future.

G.5 Safety Evaluation of Facilities

Article 8 Assessment of Safety of Facilities Each Contracting Party shall take the appropriate steps to ensure that: (i) before construction of a spent fuel management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out; (ii) before the operation of a spent fuel management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (I).

(1) Safety and Environmental Assessments before Construction

According to Article 17 of the “Nuclear Materials and Radioactive Waste Management Act,” systematic safety and environmental assessments shall be

carried out before the construction of spent fuel management facilities. The evaluation shall be able to demonstrate compliance with the following criteria:

- Compliance with the provisions from relevant international conventions;
- The structures, systems and components are sufficient to secure public health and safety;
- Impact on the environment complies with the provisions from relevant regulations;
- Technical and management abilities, and financial bases of the applicants are competent to operate the facilities.

The safety analysis reports of spent fuel dry storage facilities of Chinshan and Kuosheng NPPs were reviewed in 2009 and 2015 respectively.

The AEC asked TPC to submit a “Technical Feasibility Assessment Report on the Spent Nuclear Fuel Final Disposal (SNFD 2017 report)” by 2017 after complete the 1st stage “Potential Host Rock Characterization and Evaluation” of the final disposal project. The report is taken as a compilation of the R&D results in the stage, and it was reviewed by international peers to make sure that the development was in line with international standards.

The AEC invited experts and academics from engineering geology, earthquake engineering, civil engineering, nuclear engineering, radiation protection, materials science, and functional safety assessment, and so on, to review the feasibility of the project in accordance with the requirements in the “Regulations on the Final Disposal of High Level Radioactive Waste and Safety Management of the Facilities.” For the purpose of information disclosure, relevant reports have been made available online. Moreover, the AEC invited German, the U.S., and Japan experts in related fields to hold three technical conferences, to make sure that the results are in good quality. The report was finalized after five rounds of review, and the AEC has requested TPC to follow the instruction from the review to carry out the final disposal project.

(2) Updating Assessments before Operation of Facilities

According to Article 18 of the “Nuclear Materials and Radioactive Waste Management Act,” spent fuel management facilities shall not be formally operated until the competent authority has approved and issued operating licenses. Also, in accordance with Article 26 of the “Enforcement Rules for the

Nuclear Materials and Radioactive Waste Management Act," the applicants shall submit updated safety analysis reports to the competent authority for license application.

G.6 Operation of Facilities

Article 9 Operation of Facilities

Each Contracting Party shall take the appropriate steps to ensure that:

(i) the license to operate a spent fuel management facility is based upon appropriate assessment as specified in Article 8 and is conditional on the completion of a commissioning program demonstrating that the facility, as constructed, is consistent with design and safety requirements;

(ii) operational limits and conditions derived from tests, operational experience and the assessments, as specified in Article 8, are defined and revised as necessary;

(iii) operation, maintenance, monitoring, inspection and testing of a spent fuel management facility are conducted in accordance with established procedures;

(iv) engineering and technical support in all safety related fields are available throughout the operating lifetime of a spent fuel management facility;

(v) incidents significant to safety are reported in a timely manner by the holder of the license to the regulatory body;

(vi) programs to collect and analyze relevant operating experience are established and that the results are acted upon, where appropriate;

(vii) decommissioning plans for a spent fuel management facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body.

(1) Operating License

According to Article 26 of the "Enforcement Rules for the Nuclear Materials and Radioactive Waste Management Act," spent fuel management facilities shall not be operated until approved by the competent authority along with issuing of the operating licenses after the construction of the facilities. The applicants shall submit commissioning plans to the competent authority for dry

run before applying for operating licenses. After dry run, the applicants shall submit the following data for the application for operating licenses:

- Updated version of safety analysis reports;
- Operation technical specifications;
- Commissioning reports;
- Planning of accident response;
- Other documents designated by the competent authority.

The phase 1 construction of spent fuel dry storage facility of Chinshan NPP has completed but not yet operated. The dismantling activities of Chinshan NPP cannot be carried out if the spent fuel is not able to be removed from the reactors. Therefore, the AEC has requested TPC to adopt indoor dry storage concept which is in line with the social consensus for the 2nd phase spent fuel dry storage facility of Chinshan NPP, and to commission the facility as fast as it can for the decommissioning of Chinshan NPP. The AEC will follow early cases of the U.S., 20 years of operating license will be issued first, and TPC shall apply for license renewal 2 years before the license is expired.

(2) Operational Limits and Requirements

Operational limits and requirements derived from tests, operational experience and evaluation shall be incorporated into the Facility Operating Technical Specifications and submitted to the AEC according to regulations currently applied. In addition, any design modification or equipment change that may modify the Facility Operating Technical Specifications shall be approved by the competent authority prior to implementation in accordance with Article 19 of the “Nuclear Materials and Radioactive Waste Management Act.”

(3) Procedures for Operation, Maintenance, Monitoring, Inspection and Testing

Planning for quality assurance shall be included in the safety analysis reports for spent fuel management facility operating licenses according to regulations currently applied. At present, there are no specific regulations on quality assurance planning for spent fuel management facilities; therefore, regulations on quality assurance planning for nuclear reactor facilities are applied. In accordance with Article 9 of the “Regulations on Quality Assurance

of Nuclear Reactor Facilities," all activities related to quality shall follow appropriate procedures.

The AEC will apply relevant regulations and licensing/ inspection procedures on the construction, commissioning, and operation of spent fuel storage facilities.

Regarding the inspection of spent fuel management facilities, the AEC has proposed specific Inspection Guidance (IG-1) and Checklist of Inspection (IG-2) for each inspection items.

(4) Engineering and Technical Support in Safety Related Fields

Article 17 of the "Nuclear Materials and Radioactive Waste Management Act" stipulates that, for the application for construction licenses of spent fuel management facilities, the AEC will review the technical and management abilities, and financial bases of the applicants are competent to operate the facilities. The AEC will make sure that during operation, there will be sufficient engineering and technical support for safety related events.

(5) Reporting of Incidents

Reporting of incidents of spent fuel management facilities (including abnormal or emergency events) shall follow the following requirements in accordance with Article 30 of the "Enforcement Rules for the Nuclear Materials and Radioactive Waste Management Act."

- If the facility is located inside a nuclear reactor site, the reporting shall follow the requirements stipulated for nuclear reactor sites;
- If the facility is located outside a nuclear reactor site, the reporting shall be done within 2 hours since finding of the incident, and a paper report shall be submitted within 30 days since finding of the incident.

Article 7 of the "Enforcement Rules for the Implementation of Nuclear Reactor Facilities Regulation Act" stipulates that incidents in the nuclear reactor sites shall be reported within 1 hour since finding, and paper reports shall be submitted within 30 days since finding of the incidents.

(6) Collection and Analysis of Operating Experience

Article 20 of the "Nuclear Materials and Radioactive Waste Management Act" stipulates that, the operators of spent fuel treatment, storage and final disposal facilities shall report to the competent authority periodically on the operation, radiation protection, environmental radiation monitoring, abnormal

or emergency events, and other specified by the competent authority. Therefore, the operators have the responsibility to collect and analyze operational experience, and report to the competent authority.

(7) Decommissioning Plan

According to Article 23 of the “Nuclear Materials and Radioactive Waste Management Act,” the decommissioning of spent fuel management facilities shall be completed within 15 years since permanent cessation. And decommissioning plans shall be submitted to the competent authority for review and approval prior to the implementation of the decommissioning activities. According to Article 11 of the “Enforcement Rules for the Nuclear Materials and Radioactive Waste Management Act,” a decommissioning plan shall include the following content:

- Organization of the decommissioning executors;
- Description of the facilities to be decommissioned;
- Radiation evaluation of the facilities to be decommissioned;
- Classification and quantities of the radioactive waste;
- Manpower and technologies applied for each decommissioning phase;
- Work specifications and schedule of each decommissioning phase;
- Radiation evaluation and radiation protection measures; and
- Other specified by the competent authority.

G.7 Final Disposal of Spent Fuel

Article 10 Disposal of Spent Fuel If, pursuant to its own legislative and regulatory framework, a Contracting Party has designated spent fuel for disposal, the disposal of such spent fuel shall be in accordance with the obligations of Section C relating to the disposal of radioactive waste.

The “Spent Fuel Final Disposal Program Plan” was renewed and reviewed by the AEC in 2018; in addition, relevant information has been disclosed on the AEC’s website. Based on the results of the review, the AEC has asked TPC to fulfill the following requirements:

(1) Overall Planning

· Technology development of each year, siting activities, and public communication should be planned to fulfill the project.

· Seeking for international cooperation to keep the technologies applied up to date. The cooperation should be mission-oriented and fit for Taiwan. Also, cooperation projects on foreign underground research laboratory should be planned, to upgrade safety evaluation and engineering technologies regarding final disposal in Taiwan.

(2) Planning of Personnel and Funding

· Staffing in accordance with planning of siting activities and technology development, and refer to staffing of foreign dedicated organizations. Strengthen staff ability for plan implementation, management, and integration. Road map of technology development which indicates development items, objectives, progress, and achievement should also be planned.

· Research and technology development should be mission-oriented. Budgeting should be exact, and renewed at proper time.

(3) Improve Final Disposal Technologies

· Improve site characterization technologies and site long-term evolution research, for siting activities for final disposal site. Improvement in safety evaluation technologies should also be made including improvement in FEPs database and scenario development.

· Technologies regarding engineering barrier system, including disposal containers, buffer materials, and backfill materials, are insufficient comparing to other countries. Latest development of other countries should be paid attention to, and renew the project accordingly and periodically, to keep final disposal technologies up to date.

· “Preliminary Safety Case Report for the Spent Nuclear Fuel Final Disposal (SNFD2021)” and “Safety Case Report for the Spent Nuclear Fuel Final Disposal (SNFD2025)” based on characteristic data of the host rock obtained at the stage should be submitted by 2021 and 2025 respectively. The reports should be written according to the safety case guides from IAEA and opinions from the previous international peers and the AEC review. Also, SNFD2021 and SNFD2025 reports should be reviewed

domestically and internationally, to make sure that the relevant technologies are up to date, and that public safety and environmental quality are assured.

· According to requirements from IAEA SSR-5 and SSG-23, final disposal database should be established, which incorporates all the experiment and investigation data and major decision documentation. This system is built to reinforce quality assurance of relevant documentation and information, and to ensure the readability and traceability of the project.

(4) Siting Activities and Public Communication

· The key to this project at siting stage is public communication. Public communication strategies and objectives should be proposed based on the previous experience and international experience. Yearly public communication activities should be planned based on the aforementioned strategies and objectives, and information disclosure and public participation are encouraged, for the achievement of public approval.

· The siting activities at the “Candidate Site Selection and Approval (2018~2028)” stage should follow the principles of detached organization, public participation, and objective criteria, for investigation and evaluation of candidate sites and recommendation of sites for detailed investigation before 2028.

H. SAFETY OF RADIOACTIVE WASTE MANAGEMENT

Article 11 General Safety Requirements

Each Contracting Party shall take the appropriate steps to ensure that at all stages of radioactive waste management individuals, society and the environment are adequately protected against radiological and other hazards. In so doing, each Contracting Party shall take the appropriate steps to:

(i) ensure the criticality and removal of residual heat generated during radioactive waste management are adequately addressed;

(ii) ensure that the generation of radioactive waste is kept to the minimum practicable;

(iii) take into account interdependencies among the different steps in radioactive waste management;

(iv) provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards;

(v) take into account the biological, chemical and other hazards that may be associated with radioactive waste management;

(vi) strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation;

(vii) aim to avoid imposing undue burdens on future generations.

H.1 General Safety Requirements

According to the “Nuclear Materials and Radioactive Waste Management Act,” the construction, operation, decommissioning, closure, institutional control, and exemption from institutional control of radioactive waste

management facilities are reviewed and approved by the competent authority (AEC). The AEC inspects and oversees the facilities to ensure that the relevant regulations and commitments are complied with; moreover, appropriate measures are taken to ensure that adequate protection are provided against radiation and other hazards to any individuals, society and environment.

(1) Subcriticality and Residual Heat Removal

For there are no nuclear source material, nuclear fuel production facilities, and HLW produced from spent fuel reprocessing, criticality is normally not a concern in radioactive waste (except for spent fuel) management. The decay heat of LLW is very low, and the decay heat of HLW is relatively high.

(2) Minimization of Radioactive Waste Generation

The producers of radioactive waste shall be responsible for minimizing the quantity and volume of radioactive waste generation in accordance with Article 29 of the “Nuclear Materials and Radioactive Waste Management Act.” Also, it stipulates that the producers shall be responsible for the treatment, transportation, storage, and disposal of radioactive waste, or commissions to other capable entities.

TPC and small users have implemented radioactive waste volume reduction and other relevant measures in compliance with the requirements from the AEC.

(3) Interdependencies among Different Steps in Radioactive Waste Management

Regulations for each steps of radioactive waste management facilities, including treatment, transportation, storage, disposal, decommissioning, closure, and institutional control, have been promulgated; the AEC confirms that interdependencies among the design, construction, and operation of each steps are taken into account.

(4) Regulations for Radiation Protection

Articles 5 and 14 of the “Regulations on Treatment and Storage of Radioactive Waste and Safety Management of the Facilities” stipulate that the design of radiation protection of radioactive waste treatment and storage facilities shall ensure that the annual effective doses to individual members of the general public will not exceed 0.25 mSv, and the doses shall be kept ALARA.

Similarly, Article 8 of the “Regulations on Final Disposal of Low Level Radioactive Waste and Safety Management of the Facilities” stipulates that the design of radiation protection shall ensure that the annual effective doses to individual members of the general public will not exceed 0.25 mSv, and the doses shall be kept ALARA.

(5) Consideration for Biological, Chemical and Other Hazards

Operators shall evaluate all potential biological, chemical and other hazards that may have bad influence on the public in each steps of radioactive waste management in accordance with the current regulations.

(6) Consideration for Impacts on Future Generations

The safety standards are the same to current and future generations. However, “Fundamental Safety Principles” (IAEA Safety Standards Series No. SF-1) should also be followed by the government and the operators, and impacts to future generations should be evaluated to ensure that future generations are properly protected.

(7) Consideration for Burdens on Future Generations

The management of radioactive waste shall not impose an undue burden on future generations for ethical reasons and the requirements of “Fundamental Safety Principles” (IAEA Safety Standards Series No. SF-1). The policies in Taiwan are that the producers should be responsible for the management of radioactive waste; therefore, the design, construction, operation, decommissioning, closure, and funding of radioactive waste management facilities shall all comply with these policies.

H.2 Existing Facilities and Past Practices

Article 12 Existing Facilities and Past Practices
Each Contracting Party shall in due course take the appropriate steps to review:
(i) the safety of any radioactive waste management facility existing at the time the Convention enter into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a facility;

(ii) the results of past practices in order to determine whether any intervention is needed for reasons of radiation protection bearing in mind that the reduction in detriment resulting from the reduction in dose should be sufficient to justify the harm and the costs, including the social costs, of the intervention.

(1) Safety Review of Existing Radioactive Waste Management Facilities

(A) NPPs

The existing facilities related to NPPs and radioactive waste management are on-site treatment facilities, volume reduction centers (VRC), on-site storage facilities, and off-site LLW Storage Site. All of the abovementioned radioactive waste management facilities are operated normally from 2017 to 2019; the generation of solidified LLW is also reduced continuously. Moreover, management ability of the operating personnel is also effectively maintained.

The AEC has conducted project review, periodical and routine inspection, annual reports, and ten-year re-evaluation and relicensing to ensure that facility safety is in compliance with safety standards. In addition, Meetings of Radioactive Materials Regulation have been periodically held for better communication between the regulatory authority and the operators.

Regarding the regulation of LLW Storage Site, the “Implementation Plan for Enhancement of Operation Safety of LLW Storage Site” was approved by the AEC in August 2016. The plan has been started since August 2017, 55-gallon drums in the trench were repacked into 3×1 and 3 ×4 containers to prepare for relocation in the future. The AEC proposed “Inspection Project of Safety Enhancement of LLW Storage Site” in June 2017, and planned on-site inspectors for repacking activities.

(B) Small Users

The AEC had completed review of treatment and storage facilities in INER during 2017 to 2019, and made sure that everything was in compliance with the safety standards.

In addition, the AEC inspects regulation of nuclear fuel and nuclear materials facilities of INER every season; the inspection items include safety storage, material inventories, and nuclear safeguards.

The AEC has also reviewed and inspected temporary storage facility in NTHU, to make sure that it is in compliance with the safety standards.

The AEC inspects regulation of nuclear fuel and nuclear materials facilities of NTHU every year, the inspection items include safety storage, material inventories, and nuclear safeguards.

(2) Examination of Results from Past Practices

The AEC has reviewed past practices and concluded that there is no need of intervention. All radioactive waste arising from NPPs, as well as medical, agricultural, industrial and research activities is either stored on-site or off-site. There has no disposal of radioactive waste.

H.3 Siting of Proposed Facilities

Article 13 Siting of Proposed Facilities

1. Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed radioactive waste management facility:
   (i) to evaluate all relevant site related factors likely to affect the safety of such a facility during its operating lifetime as well as that of a disposal facility after closure;
   (ii) to evaluate the likely safety impact of such a facility on individuals, society and the environment, taking into account possible evolution of site conditions of disposal facilities after closure;
   (iii) to make information on the safety of such a facility available to members of the public;
   (iv) to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their

territory.

2. In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 11.

The only ongoing siting activities are the siting of LLW final disposal; relevant activities and results are compiled in this section.

(1) Overview of Siting

The “Act on Sites for Establishment of Low Level Radioactive Waste Final Disposal Facility” was promulgated in May 1996. The purposes of this Act are to propose responsibility and procedures of siting, and to achieve objectives of maintaining safety and protect environment. The points are summarized as follows: (A) responsibility and procedures of the regulatory authority and the host organization; (B) the main producers of radioactive waste are responsible for the siting, and siting groups will be organized by scholars and experts; (C) siting shall follow the principles of transparency, impartiality, openness, respectful feedback, communication, and collecting public opinions; (D) necessary requirements of time limit of siting and land acquisition.

Based on the Act, the MOEA is the host organization, and TPC is responsible for siting activities. The MOEA has organized a siting group through open selection, and announced Daren Township (Taitung County) and Wuqiu Township (Kinmen County) to be the recommended candidate sites in 2012. However, the local governments of these two places have refused to hold local referendums for approval. Although the AEC has urged the MOEA and TPC to propose specific plan for local referendum many times, the siting activities have been postponed ever since. On the other hand, the AEC has asked TPC to plan for centralized storage as the interim storage facility, so the decommissioning of NPPs and the relocation of the LLW Storage Site can be further carried out. This alternative plan was approved by the AEC in February 2017, and TPC has to commission the centralized storage facility in 8 years since March 2017. Nevertheless, TPC still needs to find a site for final disposal in 5 years since March 2017.

(2) Siting Criteria and Safety Evaluation

When siting of LLW final disposal site is implemented, safety evaluation should be done on possible impacts during operation and post-closure. According to Article 4 of the “Act on Sites for Establishment of Low Level Radioactive Waste Final Disposal Facility” and Article 7 of the “Regulations on Final Disposal of Low Level Radioactive Waste and Safety Management of the Facilities,” the siting of LLW final disposal site shall meet the following criteria:

- Shall not be located on active faults or in areas with geological characteristics that endanger the safety of the disposal facility.
- Shall not be located in areas with geochemical characteristics that are unfavorable for effectively suppressing the diffusion of radioactive nuclides, and are likely to endanger the safety of the disposal facility.
- Shall not be located in areas with hydrologic characteristics of surface water or groundwater are likely to endanger the safety of the disposal facility.
- Shall not be located in areas of high population density.
- Shall not be located in areas that cannot be developed according to the law.

The safety evaluation of final disposal facilities during operation and post-closure can follow the amended “Safety Analysis Report Guides for Radioactive Waste Final Disposal Facilities” (September 2016).

TPC had submitted the “LLW Final Disposal Technology Analysis Report” including safety evaluation at the end of 2016. The Report has been reviewed by international peers, and was reviewed by the AEC in September 2017.

(3) Evaluation of Impacts to Safety of Public, Society, and Environment

TPC shall submit the following reports regarding final disposal facilities of radioactive waste: (A) “Report on Selection of Recommended Candidate Sites” according to Article 9 of the “Act on Sites for Establishment of Low Level Radioactive Waste Final Disposal Facility,” (B) “Investment Feasibility Study Report” according to Article 6 of the “Editing Guidelines for Fixed Assets Investment Project Affiliated to the MOEA,” (C) “Environmental Impact Assessment Report” according to Article 30 of the “Standards for Determining Specific Items and Scope of Environmental Impact Assessments for Development Activities,” (D) “Safety Analysis Report” according to Article 3 of

the “Regulations for the Review and Approval of Application for Construction License of Radioactive Wastes Treatment, Storage and Final Disposal Facilities.” These documents should be able to demonstrate the siting procedures of LLW final disposal facilities, the results of investment feasibility study, the results of environmental impact assessment and safety evaluation; possible impacts of final disposal facilities on public, society, and environment now and in the future should also be included. The above documents should be reviewed by the regulatory authority, and taken as the basis for approving its construction.

(4) Availability of Information Disclosure

All information held or kept in custody by an administrative authority shall be made available to the public upon request in principle unless reasons for non-disclosure apply according to the “Administrative Procedure Act” amended on December 28, 2005.

Several regulations also require information related to safety of nuclear facilities to be made public, including the regulations that the MOEA referred to review the results of investment feasibility study, the regulations that the EPA referred to review the results of environmental impact assessment, and the regulations that the AEC referred to review the results of safety analysis report. Current policies are to disclose information to the public.

The AEC has set up a final disposal section on its official website to enhance availability of information and public participation.

(5) Influence on Other Contracting Parties

Taiwan is surrounded by ocean without any border with other countries; given the nature of LLW final disposal, the final disposal facilities will not have unacceptable impacts on other countries. If severe security incidents occurred, Taiwan will offer prompt and comprehensive information to the neighboring countries.

H.4 Design and Construction of Facilities

Article 14 Design and Construction of Facilities Each Contracting Party shall take the appropriate steps to ensure that:

(i) the design and construction of a radioactive waste management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases;
(ii) 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;
(iii) at the design stage, technical provisions for the closure of a disposal facility are prepared;
(iv) the technologies incorporated in the design and construction of a radioactive waste management facility are supported by experience, testing or analysis.

(1) Limitation of Radiological Impacts

The design and construction of radioactive waste management facilities shall comply with Article 5 of the “Regulations on Treatment and Storage of Radioactive Waste and Safety Management of the Facilities” and Article 7 of the “Safety Standards for Protection against Ionizing Radiation.” Effective doses to individual members of the public shall not exceed 0.25 mSv/a, effective doses to individual members of radiation workers shall not exceed 50 mSv in a single year, and doses shall be maintained ALARA.

(2) Decommissioning Planning and Technical Requirements

Currently, there is no need to propose relevant provisions regarding conceptual plan and technical requirements of decommissioning of the radioactive waste management facilities. There is plenty of international experience regarding the decommissioning of radioactive waste management facilities; through lessons learned from this experience, it can be known that safely decommission is feasible. Also, according to the “Regulations for the Review and Approval of Application for Construction License of Radioactive Wastes Treatment, Storage and Final Disposal Facilities,” if there is any new construction of radioactive waste management facility, preliminary decommission planning shall be proposed in the safety analysis report, which includes the conceptual plan and technical requirements of decommissioning of the facility.

(3) Technical Support of Closure of Final Disposal Facility

Planning for closure and institutional control of final disposal facilities shall be included in Chapter 11 of the safety analysis report in compliance with the “Safety Analysis Report Guides for LLW Final Disposal Facilities.” Hence, technical support of closure of final disposal facilities is prepared when designing the facilities.

(4) Technical Support by Experience, Testing, and Analysis

In order to facilitate license application, the applicants will follow the experience and technical support by testing and analysis done by the designers. This practice is anticipated to be continued in the future.

H.5 Safety and Environmental Assessments of Facilities

Article 15 Assessment of Safety of Facilities

Each Contracting Party shall take the appropriate steps to ensure that:

(i) before construction of a radioactive waste management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out;

(ii) in addition, before construction of a disposal facility, a systematic safety assessment and environment assessment for the period following closure shall be carried out and the results evaluated against the criteria established by the regulatory body;

(iii) before the operation of a radioactive waste management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (i).

(1) Safety and Environmental Assessments before Construction

Article 17 of the “Nuclear Materials and Radioactive Waste Management Act” stipulates that systematic safety and environmental assessments shall be

carried out, to ensure that the following criteria are met, before the construction of radioactive waste management facilities.

For the construction of radioactive waste treatment, storage, or final disposal facilities, the applicants shall file for construction licenses to the competent authority. The construction shall not be started until the application has been reviewed and approved to satisfy the following requirements, and construction licenses are issued.

- The construction is consistent with the provisions of relevant international conventions.
- The equipment and facilities are sufficient to secure public health and safety.
- The impacts on the environment comply with the provisions of relevant laws, statutes, and decrees.
- The technical and management abilities, financial bases, etc. of the applicants are competent to operate the facility.

(2) Post-Closure Safety and Environmental Assessments of Final Disposal Facilities before Construction

Post-closure safety and environmental assessments of final disposal facilities are required to be included in the safety analysis reports and the environmental impact assessments during construction license application.

(3) Updating Assessments before Operation of Facilities

According to Article 26 of the “Enforcement Rules for the Nuclear Materials and Radioactive Waste Management Act,” the applicants apply for operating licenses of radioactive waste management facilities shall submit commissioning plans to the competent authority for approval. After dry run, updated safety analysis reports and relevant documents shall be submitted to the competent authority for application for operating licenses.

H.6 Operation of Facilities

Article 16 Operation of Facility
Each Contracting Party shall take the appropriate steps to ensure that:
(i) the license to operate a radioactive waste management facility is based

upon appropriate assessments as specified in Article 15 and is conditional on the completion of a commissioning program demonstrating that the facility, as constructed, is consistent with design and safety requirements;

(ii) operational limits and conditions, derived from tests, operational experience and the assessments as specified in Article 15 are defined and revised as necessary;

(iii) operation, maintenance, monitoring, inspection and testing of a radioactive waste management facility are conducted in accordance with established procedure. For a disposal facility the results thus obtained shall be used to verify and to review the validity of assumptions made and to update the assessments as specified in Article 15 for the period after closure;

(iv) engineering and technical support in all safety related fields are available throughout the operating lifetime of a radioactive waste management facility;

(v) procedures for characterization and classification of radioactive waste are applied;

(vi) incidents significant to safety are reported in a timely manner by the holder of the license to the regulatory body;

(vii) programs to collect and analyze relevant operating experience are established and that the results are acted upon, where appropriate;

(viii) decommissioning plans for a radioactive waste management facility other than a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body;

(ix) plans for the closure of a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility and are reviewed by the regulatory body.

(1) Operating License

According to Article 26 of the “Enforcement Rules for the Nuclear Materials and Radioactive Waste Management Act,” the applicants shall submit commissioning plans to the competent authority for dry run before

applying for operating licenses. After dry run, the applicants shall submit the following data for the application for operating licenses:

- Updated version of safety analysis reports;
- Operation technical specifications;
- Commissioning reports;
- Planning of accident response;
- Other documents designated by the competent authority.

The facilities shall not be operated until approved by the competent authority along with issuing of the operating licenses.

(2) Operational Limits and Requirements

Operational limits and requirements shall be incorporated into the Facility Operating Technical Specifications, which is one of the references of operating licenses. Amendment of the Facility Operating Technical Specifications shall be reviewed and approved by the competent authority.

(3) Procedures of Operation of Final Disposal Facilities and Updating of Post-Closure Safety Assessment

Quality assurance program shall be included in the safety analysis reports required by the operating licenses of radioactive waste management facilities according to current regulations. For there are no specific regulations regulating the quality assurance program of radioactive waste management facilities, regulations for nuclear reactor facilities are referring to in current practice. According to Article 9 of the “Regulations on Quality Assurance of Nuclear Reactor Facilities,” all activities that could impact the quality shall be performed in compliance with appropriate procedures.

Article 17 of the “Regulations on Final Disposal of Low Level Radioactive Waste and Safety Management of the Facilities” stipulates that the operators of LLW final disposal facilities shall re-evaluate in every 10 years during operation. This renewal is to further verify the results of post closure safety assessment through reviewing of the operational data and validating assumption provided in the Safety Analysis Reports.

(4) Engineering and Technical Support in Safety Related Fields

Article 17 of the “Nuclear Materials and Radioactive Waste Management Act” stipulates that the AEC will review the technical and management abilities, and financial bases of the construction license applicants, to ensure that the

applicants are competent to operate radioactive waste management facilities. Through this measure, all activities related to safety during the operation of the facilities are ensured to have available engineering and technical support.

(5) Characteristics and Classification of Radioactive Waste

Different treatment procedures, different transportation packages, and different final disposal measures shall be applied according to the characteristics of the radioactive waste. The characteristics and classification of radioactive waste are stipulated in Articles 3 and 4 of the “Regulations on Final Disposal of Low Level Radioactive Waste and Safety Management of the Facilities.”

(6) Reporting of Incidents

According to Article 30 of the “Enforcement Rules for the Nuclear Materials and Radioactive Waste Management Act,” the reporting of incidents (abnormal or emergency events) in radioactive waste management facilities shall follow the following requirements:

- If the facility is located inside a nuclear reactor site, the reporting shall follow the requirements stipulated for nuclear reactor sites;
- If the facility is located outside a nuclear reactor site, the reporting shall be done within 2 hours since finding of the incident, and a paper report shall be submitted within 30 days since finding of the incident.

Article 7 of the “Enforcement Rules for the Implementation of Nuclear Reactor Facilities Regulation Act” stipulates that incidents in the nuclear reactor sites shall be reported within 1 hour since finding, and paper reports shall be submitted within 30 days since finding of the incidents.

(7) Collection and Analysis of Operating Experience

For properly collecting and analyzing operating experiences, Article 30 of the “Enforcement Rules for the Nuclear Materials and Radioactive Waste Management Act” stipulates that:

- Annual reports on operation, radiation protection, and environmental radiation monitoring shall be submitted within three months after the end of a year.
- Quarterly reports on environmental radiation monitoring shall be submitted within 60 days after the end of a season.

- Monthly reports on treatment, generation, and storage quantities of radioactive waste shall be submitted by the end of the following month.

In addition, Article 17 of the “Regulations on Treatment and Storage of Radioactive Waste and Safety Management of the Facilities” stipulates that, the operators shall re-evaluate the storage facilities every 10 years, and submit reports to the AEC for review and approval.

Also, Article 17 of the “Regulations on Final Disposal of Low Level Radioactive Waste and Safety Management of the Facilities” stipulates that, the operators shall re-evaluate the final disposal facilities every 10 years, and submit updated SAR to the AEC.

(8) Decommissioning Plan

Current regulations do not require submission of decommissioning plans of radioactive waste management facilities other than final disposal facilities before operation of the facilities. However, the operators shall submit decommissioning plans within the specified time in accordance with Article 19 of the “Enforcement Rules for the Nuclear Materials and Radioactive Waste Management Act,” for decommissioning activities when the facilities are permanently shut down. Article 20 of the “Enforcement Rules for the Nuclear Materials and Radioactive Waste Management Act” stipulates that, a decommissioning plan shall include the following items:

- An overview of the facility.
- Decommissioning objectives and schedule.
- Decontamination and methods and radioactive waste reduction measures.
- Classification, characteristics, quantities, treatment, transportation, and storage of the decommissioning waste.
- Dose evaluation and radiation protection measures.
- Environmental radiation monitoring.
- Personnel training.
- Material accounting management of nuclear source materials or nuclear fuel.
- Planning of re-utilization of the facilities or land.
- Quality assurance program.
- Planning of accident response.
- Other matters designated by the competent authorities.

In accordance with Article 14 of the “Nuclear Materials and Radioactive Waste Management Act,” the decommissioning of radioactive waste management facilities shall be completed within 15 years since permanent cessation. And the site shall not cause individual members of the public with effective doses exceeding 0.25 mSv/a.

(9) Closure Plans for Final Disposal Facilities

According to the “Safety Analysis Report Guides for LLW Final Disposal Facilities,” the closure and institutional control of radioactive waste final disposal facilities shall be included in chapter 11 of the safety analysis reports. And they shall be re-evaluated in every 10 years during operation of the facilities according to Article 17 of the “Regulations on Final Disposal of Low Level Radioactive Waste and Safety Management of the Facilities.”

(10) Relocation Project of the LLW Storage Site

In June 2016, the AEC had asked TPC to submit the “Implementation Plan for Relocation of LLW Storage Site,” and keep on communicating with the local people for support. Subsequently, the AEC had reviewed the “Planning Report on Relocation of LLW Storage Site” in February 2017, and asked TPC to prepare for the relocation. All of the reports mentioned above and relevant information are published on-line for the purpose of information disclosure.

The AEC has urged TPC to keep implementing the relocation of the LLW Storage Site based on the conclusions from “The Fifth Meeting of the Presidential Office Indigenous Historical Justice and Transitional Justice Committee” held in March 2018. The implementation status will be reported to the Nuclear-Free Homeland Task Force of the Executive Yuan periodically. The AEC had also asked the Task Force to prioritize the discussion over the relocation of the LLW Storage Site and centralized storage facility, to relocate the LLW as soon as possible.

For further improvement of the safety of LLW storage, the AEC has asked TPC to submit the “Implementation Plan for Enhancement of Operation Safety of LLW Storage Site” and implement accordingly. The 55-gallon drums in the trench were repacked into hot-dip galvanized 3×1 and 3×4 containers which could prevent corrosion in advance. The preparation work was reviewed by the AEC in October 2019, and TPC was approved to start the repacking activities.

During the repacking, the AEC inspected the safety on-site. TPC had completed the repacking activities by February 2021.

Before the LLW is moved out from Orchid Island, the AEC will continue supervising the management of LLW and monitoring the environmental radiation of Orchid Island, to ensure the radiation safety and environmental quality of the personnel and the local people.

H.7 Institutional Control after Closure

Article 17 Institutional Measures after Closure Each Contracting Party shall take the appropriate steps to ensure that after closure of a disposal facility: (i) records of the location, design and inventory of that facility required by the regulatory body are preserved; (ii) active or passive institutional controls such as monitoring or access restrictions are carried out, if required; and (iii) if, during any period of active institutional control, an unplanned release of radioactive materials into the environment is detected, intervention measures are implemented, if necessary.

Article 23 of the “Nuclear Materials and Radioactive Waste Management Act” stipulates that closure plan and institutional control plan shall be submitted and approved before the closure of the final disposal facilities, for the safety management of radioactive waste final disposal facilities after closure. And Article 33 of the “Enforcement Rules for the Nuclear Materials and Radioactive Waste Management Act” stipulates that the institutional control plan shall include the following:

- Organization of the executor.
- Site security.
- Environmental radiation monitoring.
- Quality assurance program.
- Management of records and archives.
- Other matters designated by the competent authorities.

Moreover, Article 24 of the “Nuclear Materials and Radioactive Waste Management Act” stipulates that for exemption from institutional control, the environmental impact assessment and radiation safety assessment shall be approved by the EPA and the AEC respectively. And from Article 34 of the “Enforcement Rules for the Nuclear Materials and Radioactive Waste Management Act,” a final disposal facility can only be exempted from institutional control, when the effective doses to individual members of the public caused by the facility are lower than 0.01 mSv/a. The same Article also stipulates that the radiation safety assessment shall include the following:

- Description of the final disposal facilities and the ambient areas.
- Environmental radiation monitoring data during the operation, closure, and institutional control period.
- Natural and human activities impacting the final disposal facilities and the adjacent areas during the operation, closure, and institutional control period.
- Land reutilization plan.
- Radiation safety evaluation for land reutilization.
- Other matters designated by the competent authorities.

(1) Record Keeping

Article 33 of the “Enforcement Rules for the Nuclear Materials and Radioactive Waste Management Act” stipulates that the operators shall submit institutional control plans to the AEC for review and approval before the closure of the final disposal facilities. Chapter of “Management of Records and Archives” shall be included in the institutional control plans.

(2) Active and Passive Institutional Control

Article 33 of the “Enforcement Rules for the Nuclear Materials and Radioactive Waste Management Act” stipulates that the operators shall submit institutional control plans to the AEC for review and approval before the closure of the final disposal facilities. The institutional control plans shall include chapters of active institutional control such as “Environmental Radiation Monitoring” and “Site Security” and passive institutional control such as “Management of Records and Archives.”

(3) Intervention Measures If Necessary

Although there are no specific regulations regarding intervention measures, if any incident should occur, the operators should take intervention measures, and the AEC will ensure that the intervention measures can be properly executed.

I. TRANSBOUNDARY MOVEMENT

Article 27 Transboundary Movement

1. Each Contracting Party involved in transboundary movement shall take the appropriate steps to ensure that such movement is undertaken in a manner consistent with the provisions of this Convention and relevant binding international instruments.

   In so doing:

   (i) a Contracting Party which is a State of origin shall take appropriate steps to ensure that transboundary movement is authorized and takes place only with the prior notification and consent of the State of destination;

   (ii) transboundary movement through States of transit shall be subject to those in ternational obligations which are relevant to the particular modes of transport utilized;

   (iii) a Contracting Party which is a State of destination shall consent to a transboundary movement only if it has the administrative and technical capacity, as well as the regulatory structure, needed to manage the spent fuel or the radioactive waste in a manner consistent with this Convention;

   (iv) a Contracting Party which is a State of origin shall authorize a transboundary movement only if it can satisfy itself in accordance with the consent of the State of destination that the requirements of subparagraph are met prior to transboundary

   (v) a Contracting Party which is a state of origin shall take the appropriate steps to permit re-entry into its territory, if a transboundary movement is not or cannot be completed in conformity with this Article, unless an alternative safe arrangement can be made.

2. A Contracting Party shall not license the shipment of its spent fuel or radioactive waste to a destination south of latitude 60 degrees South for storage or disposal.

3. Nothing in the Convention prejudices or affects:
   (i) the exercise, by ships and aircraft of all States, of maritime, river and air navigation rights and freedoms, as provided for in international law;
   (ii) rights of a Contracting Party to which radioactive waste is exported for processing to return, or provide for the return of, the radioactive waste and other products after treatment to the State of origin;
   (iii) the right of a Contracting Party to export its spent fuel for reprocessing;
   (iv) rights of a Contracting Party to which spent fuel are exported for reprocessing to return, or provide for the return of, radioactive waste and other products resulting from reprocessing operations to the State of origin.

I.1 General Requirements

The transboundary movement of radioactive waste is regulated by the "Regulations for the Nuclear Source Materials Operational Safety Management," and the transboundary movement of spent fuel is regulated by the "Regulations for the Nuclear Fuels Operational Safety Management." Moreover, they should all comply with the requirements in the "Regulations on Safely Transportation of Radioactive Materials."

(1) Notification and Consent of the Importing Country in Advance

Article 11 of the "Regulations for the Nuclear Fuels Operational Safety Management" and Article 11.1 of the "Regulations for the Nuclear Source Materials Operational Safety Management" stipulate that importation permits from the importing countries shall be submitted to the competent authority, to make sure that the transboundary movement of spent fuel or radioactive waste should only be authorized and done when the importing countries are notified and consenting to in advance.

(2) Transit Transportation

There are no practical needs of transit transportation of spent fuel or radioactive waste; therefore, currently there are no regulations regarding transit transportation. However, if there is transboundary movement requiring

transit transportation, international requirements regarding transit transportation will be followed.

(3) Requirements of Importing Countries' Consent of Transboundary Movement

Article 13 of the "Regulations for the Nuclear Source Materials Operational Safety Management" stipulates that, to apply for exporting of radioactive waste, application forms enclosed with transport plans and the following documents shall be submitted to the competent authority for review and approval:

- Photocopy of the import permits issued by the receiving countries, which shall be notarized by the overseas missions of Taiwan.
- The Chinese translation of the import permits referred to in the preceding subdivision, which shall be notarized by the overseas missions of Taiwan or by domestic public notaries.
- Photocopy of the certificates on the management capability of the receiving institutes.
- Evaluation documents conform to the related safety requirements set forth in the "Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management" issued by the IAEA.
- Photocopy and Chinese translation of the operation permits of the receiving facilities.
- Photocopy and Chinese translation of the written contracts signed by the applicants and the receiving institutes as well as other related documents.
- Relevant laws, regulations, inspect and examine requirements of the receiving countries on radioactive waste, and safety-related evaluation documents.

In accordance with the above regulations, radioactive waste will only be exported to countries having administrative and technical capacity, as well as regulatory structure needed to manage the radioactive waste in a manner consistent with the Convention.

According to the "Regulations for the Nuclear Fuels Operational Safety Management," to apply for exporting of spent fuel that is not going to be disposed, application forms enclosed with import permits granted by the receiving countries shall be submitted to the competent authority for review

and approval. In Taiwan, INER and NTHU have the experience of transporting spent fuel removed from research reactors back to the U.S.

(4) Requirements of Exporting Countries' Consent of Transboundary Movement

Article 11 of the "Regulations for the Nuclear Source Materials Operational Safety Management" stipulates that, to apply for importing of radioactive waste, application forms enclosed with transport plans and the following documents shall be submitted to the competent authority for review and approval:

- Photocopy of the export permits issued by the exporting countries, which shall be notarized by the overseas missions of Taiwan.
- Photocopy and Chinese translation of the written contracts signed by the applicants and the exporters as well as other related documents.
- Purposes and management of the importing radioactive waste.
- Types, characteristics, quantities, radionuclide activity, and the packaging of the radioactive waste.
- Photocopy of the receivers' facility operating license, estimation of the receivers' operating capacity and the secondary waste produced, and disposal plans for the secondary waste.

Transboundary movement will be consented by Taiwan if the exporting countries have the abovementioned technical and management abilities, as well as regulatory structure needed to manage the radioactive waste in a manner consistent with the Convention. So far, there is no experience of allowing importation of radioactive waste.

The regulation of the importation of spent fuel is regulated by the "Regulations for the Nuclear Fuels Operational Safety Management" and the "Regulations for the Nuclear Source Materials Operational Safety Management." Currently, Taiwan has no intention of allowing the importation of spent fuel.

(5) Re-entry in case of Non-Conformity

Re-entry of non-conforming spent fuel or radioactive waste has never been required in Taiwan, and currently there are no relevant regulations. International requirements will be followed if there is re-entry of non-conforming spent fuel or radioactive waste.

I.2 Transportation Beyond 60 Degrees Latitude South

The applicants for exportation of spent fuel or radioactive waste shall apply for export permits to the competent authority in accordance with the “Nuclear Materials and Radioactive Waste Management Act.” The abovementioned permit does not apply to transportation beyond 60 degrees latitude south (including the whole Antarctica). Although transportation beyond 60 degrees latitude south is not prohibited, practically the provision from Article 27 of the Convention will be followed, that the transportation will not be approved.

J. DISUSED SEALED SOURCES

Article 28 Disused Sealed Sources

1. Each Contracting Party shall, in the framework of its national law, take the appropriate steps to ensure that the possession, re-manufacturing or disposal of disused sealed sources takes place in a safe manner.
2. A Contracting Party shall allow for re-entry into its territory of disused sealed sources if, in the framework of its national law, it has accepted that they be returned to a manufacturer qualified to receive and possess the disused sealed sources.

J.1 Safety Regulation on Disused Sealed Sources

According to the provisions of the “Administrative Regulations for Radioactive Material and Equipment Capable of Producing Ionizing Radiation and Associated Practice,” the operators or the possessors of the sources shall fill out application forms for permanent cessation of use of sealed sources. Permission to cease from use will be granted by the AEC after the documents are reviewed and approved. The sealed sources possessed by TPC are solidified and stored in Chinshan NPP, Kuosheng NPP, and Maanshan NPP by region, along with the radioactive waste generated by the NPPs. Other disused sealed sources from small users shall be transported to INER for management and storage according to Article 37 of the “Administrative Regulations for Radioactive Material and Equipment Capable of Producing Ionizing Radiation and Associated Practice.”

Application forms and documents related to transportation shall be submitted to the competent authority when disused sealed sources from small users retracted by their suppliers. Export permits will be granted after the documents are reviewed and approved. Moreover, the operators shall cancel the original registration certificates or permits within 30 days after exportation, by submitting the photocopy of the export documents, the radiation workplace

monitoring certificate, and other relevant documents to the competent authority.

For the management of disused sealed sources, the AEC will review the abovementioned documents, and carry out on-site inspection. The disused sealed sources of TPC will be inspected along with routine inspection of NPPs, and the disused sealed sources stored in INER will be inspected along with routine inspection of INER. The AEC will implement on-site inspection for the storage management and radiation safety of the storage facilities if disused sealed sources possessed by civilian facilities are not delivered to INER within 3 months after the permission is granted by the AEC.

For improvement in border control, and better integration of online service and information in the cloud, the “Radiation Source Import/Export Customs Licensing System V.2” of the AEC has officially gone online since September 28, 2019. The system’s interface has been connected to the “CPT single window” (customs clearance and port affairs system) of the Customs Administration. The customs declaration forms (CA) and the import/export consent forms (AEC) can be reviewed together online. Law enforcement and smart monitoring applying technologies, simplification of application procedures, and integration of operation interface can be done through the establishment of the system; furthermore, information security, personal information security, and border control can be improved.

J.2 Management of Disused Sealed Sources

The disused sealed sources of TPC are currently stored in NPPs. There are 246 disused sealed sources in total stored in NPPs by the end of December 2020. Few of the disused sealed sources have been solidificated with sludge, and stored in the 55-gallon drums in the NPPs.

The AEC has appointed INER to receive and manage the disused sealed sources produced by small users. INER will review the documents submitted by the users, to double check the types and activity of the radionuclides before receiving the sources. Then the sources will be stored in the radioactive waste

storage facilities in INER with their original packages. Relevant information will be reported to the competent authority monthly.

The disused sealed sources produced by small users are transferred to INER for treatment and storage. By the end of December 2020, there are 13,475 disused sealed sources stored in INER.

J.3 Re-entry into the Territory

In Taiwan, INER is the only manufacturer producing sealed sources. However, the sources produced by INER are mainly provided to medical institutions in Taiwan and have not been exported. Therefore, re-entry into the territory is not an issue in Taiwan.

K. GENERAL EFFORTS TO IMPROVE SAFETY

Besides establishment of the laws and regulations, improvement in the management system, and practical measures of radioactive waste management, this chapter demonstrates activities done by the AEC and TPC for improvement in safety.

K.1 Organization Reformation and Establishment of Dedicated Organization

(1) Organization Reformation of the AEC and Revision of the Relevant Regulations

The AEC is planning to be re-organized into the Nuclear Safety Commission which is solely in charge of nuclear safety regulation. The re-organization is corresponding to the organization reformation policy of the Executive Yuan and the basic principles of international nuclear energy safety. The “Nuclear Materials and Radioactive Waste Management Act” is expected to be revised into “Nuclear Materials and Radioactive Waste Regulation Act;” technical regulatory requirements will also be revised properly if needed.

(2) Establishment of Dedicated Organization

Finland, Sweden, France, Japan, and South Korea are currently having dedicated organizations for management of radioactive waste and LLW final disposal sites operating; some of them are even constructing the HLW final disposal sites. The government is showing the resolution to manage the radioactive waste by planning to establish a dedicated organization for the management of radioactive waste. A draft of the “Act on Establishment of Public Body Radioactive Waste Management Center” was proposed by the MOEA in September 2018 to the Legislative Yuan for deliberation.

K.2 Improvement in Public Participation and Supervision

(1) Visits to the Facilities

The AEC has invited representatives from the New Taipei City Government, local communities, and environmental groups, and the village chief of Shimen District to visit the spent fuel dry storage facility and decommissioning activities in Chinshan NPP for more than 10 times since May 2011. Those visits include a visit to concrete cask transportation during the integrated exercise of spent fuel dry storage facility in Chinshan NPP in March 2018; a visit to upgrading the automated monitoring equipment of slope stabilization of dry storage facility in Chinshan NPP in May 2019; and two site visits to the 2nd phase dry storage facility site in Chinshan NPP. Briefing by the AEC and TPC and communication meetings were held in the visits, and the AEC follows the statuses of the activities. All relevant information regarding the visits is disclosed on the AEC's website.

(2) Environmental Radiation Parallel Monitoring Activity

The AEC conducted an environmental radiation parallel monitoring of LLW Storage Site in April 2020 for the tenth consecutive year for the purposes of information disclosure, public participation, and environmental radiation sampling and analysis by the third-party. Representatives from Orchid Island residents, Township Office, Township representative council, the Taitung County Government, and the Council of Indigenous Peoples were invited to the activity.

A briefing was held before the monitoring to demonstrate the sampling procedures. Three sets of samples comprising agricultural products, soil, water, and grass were taken individually in six tribes. The sampling locations were designated by the participants. The analyses were conducted by the Nuclear Science and Technology Development Center (NSTDC) affiliated to NTHU which is certificated by the Taiwan Accreditation Foundation (TAF), Radiation Monitoring Center affiliated to the AEC, and Radiation Laboratory affiliated to TPC for parallel verification. The results were sent to all the participants directly from the NSTDC, and disclosed on the AEC's website. Environmental radiation monitoring results have been close to the background since 2011.

K.3 Availability of Information and Communication with the Communities

(1) Availability of Information

The AEC has disclosed regulation information of radioactive materials of each nuclear facilities on the website (https://www.aec.gov.tw/) including safety evaluation reports on operation of liquid radioactive waste treatment facility, annual regulatory reports on radioactive waste, annual amount of solidified waste, progress of dry storage facilities, progress of final disposal program, and review reports and annual work plans of final disposal program.

Besides, the AEC has set up an exclusive official website for decommissioning of NPPs. On this website, memorabilia of decommissioning safety regulation, relevant regulations, Decommissioning Plans, review documents, briefing to the local communities, and other information related to public participation have been published, and public opinions are also collected to facilitate the decommissioning activities. Moreover, the AEC live stream most of the public hearings and forums related to atomic energy safety regulation, to increase chances of public participation and joint supervision.

The MOEA has set up a LLW final disposal official website (https://www.llwfd.org.tw/tc/index.aspx) for disclosure of relevant information. On the other hand, TPC has set up a nuclear backend official website (https://nbmi.taipower.com.tw/), including disclosure of information regarding dry storage, decommissioning of NPPs, LLW final disposal, HLW final disposal, and interim storage. The public can understand basic safety consideration in regard to nuclear backend operation and siting progress of LLW and HLW final disposal sites through these websites.

(2) Public Hearings

The AEC had organized a professional review team which consisted of experts and specialists from the AEC after receiving the “Decommissioning Plan of Kuosheng NPP” and relevant documents submitted by TPC in December 2018. These documents have been published on the official website of the AEC. Also, the AEC had invited the local government, legislators,

and citizen groups to the public hearings of review of the plan in March 2019, to take public opinions as references of the review work. In the hearing, TPC and the AEC had briefed on the planning of decommissioning and the progress of review respectively, and the participants had shared their thoughts and comments. Issues including dry storage, safety and schedule of radioactive waste final disposal, and compensation fee and employment were discussed in the hearing. Moreover, the AEC showed their regulation on the safety of decommissioning activities through replies in the hearing. Relevant documents and information have been published on the website. The AEC as the competent authority of the decommissioning of NPPs, will review the plan strictly, disclose relevant information, and improve public participation.

(3) Public Opinions Response

For the purpose of information disclosure, the AEC has updated pictures easy-to-understand to show their policies and regulation measures. In addition, the AEC grasps public opinions regarding nuclear safety policies and regulation measures immediately, and respond to them actively.

(4) Social Media Platforms

The AEC has been actively updating the official website and the Facebook page “Radiation Station;” news media and the public can obtain real-time information of nuclear safety and radiation safety through the website, and knowledge of atomic energy science can be acquired from the Facebook page. The Facebook page “Radiation Station” was even recognized as the “administrative agency with good performance” by the National Development Council in 2018.

In addition, application program “AEC of the public” has also been established to provide the public with real-time local radiation safety protection information. The application program was also demonstrated in the “Information Technology Month” exhibition to increase its visibility.

(5) Atomic Energy Science Exhibition

The AEC has participated in science fairs in counties and cities, science festivals, and so on with the National Taiwan Science Education Center, to create a high quality science learning environment so that these science resources can be shared with the public. Moreover, the AEC has also held and live streamed atomic energy science exhibitions filled with interactive games

and models. Teachers of elementary schools are encouraged to guide the students to link the atomic energy science with their life experience; summer vacation learning sheets of the students will also be selected and rewarded accordingly. Each atomic energy science exhibition has received public opinions of what they concern through communication and interaction, the effectiveness has been widely acknowledged by the public and covered by the media.

K.4 International Collaboration and Technical Information Exchange

Radioactive waste management technologies are advancing rapidly, in order to make the safety requirements and safety regulation technologies in line with international standards, the AEC has actively seeking for international collaboration and technical information exchange. In addition to annual meetings including the TECRO-AIT JSC Meeting on Civil Nuclear Cooperation, the AEC-NRA Nuclear Regulatory Information Exchange Meeting, and the Taiwan-Japan Nuclear Safety Conference, the AEC has invited international experienced experts to Taiwan to do technical information exchange and to share their experience, regarding decommissioning of NPPs, radioactive waste storage, and radioactive waste final disposal. Industry, government, academic, and the public are all welcomed to the meetings. The list of meetings held over the years is as follows:

- “Technical Meeting on the Implementation of Renewal Measures of Nuclear Safeguards” jointly held by the IAEA and the AEC in 2017.
- “Conference on the Safety Review and Regulation for Spent Fuel Indoor Dry Storage Facility of NPP” with experts from Germany in 2017.
- “Conference on Review and Regulation of Decommissioning Activities of NPP” with experts from the U.S. in 2017.
- “Conference on NPP Decommissioning Technology” with experts from Japan in 2017.
- “Conference on HLW and Annual Meeting on HLW Geological Disposal” with experts from Japan in 2017.

- “Conference on Radioactive Waste Regulation Technology” with experts from Germany in 2018.
- “Workshop on RESidual RADioactivity (RESRAD) Assessment during the NPP Decommissioning Period” with experts from the Argonne National Laboratory of the U.S. in 2018.
- “AEC-NRC Bilateral Technical Meeting” held in 2018.
- “Conference on SNF Final Disposal Technology” with experts from NRC of the U.S. in 2018.
- “Conference on Regulation of NPP Decommissioning” with experts from NRC of the U.S. in 2018.
- “Conference on Risk Reduction Strategy for the Security of Cs-137” with experts from National Nuclear Security Administration (NNSA) of the U.S. in 2018.
- Memorandum of understanding jointly signed by INER and Southwest Research Institute of the U.S. in 2018, for technical information exchange of radioactive waste final disposal, decontamination and decommissioning of nuclear facilities, and so on.
- “Taiwan-Japan Conference on HLW Final Disposal Technology” with experts from Japan in 2018.
- “AEC-NRC Bilateral Technical Meeting” held in 2019.
- “The 3rd Taiwan-Japan Nuclear Expert Meeting” held in 2019.
- “International Conference on Nuclear Facility Decommissioning” held in 2019.
- “Conference on Practical Technology and Safety Regulation of Spent Fuel Dry Storage” held in 2019.
- “Taiwan-Japan Technical Meeting on Decommissioning Technology” held in 2019.
- “Conference on Safety Regulation of Spent Fuel Dry Storage of NPP” held in 2019.
- “Conference on Actions Related to Nuclear Safeguards during the Decommissioning Period” jointly held by the IAEA and the AEC in 2019.

K.5 Suggestions and Improvement from International Peer Review of the Previous Report

In order to master international trends and good practice of radioactive waste management, and feedback to the regulation measures in Taiwan, the AEC has professional researchers study the content of national reports published by each Contracting Party of the Convention.

The AEC has reached an agreement with the U.S. Department of Energy (USDOE) to review the national reports of each other. In the peer review of the “2017 National Report” of Taiwan, the AEC replied to the 8 questions asked by USDOE, and modified relevant content in the English version of the “2017 National Report” accordingly.

USDOE mentioned that there seemed to have no siting activities in the Spent Fuel Final Disposal Project of Taiwan; that was because in the planning of Spent Fuel Final Disposal Project, stepwise approach was adopted for the implementation of the project, and at that time, the project had not entered the siting stage yet.

The estimation of the amount of LLW for Chinshan NPP, and a list of the existing and planned LLW storage facilities were added to the report to reply to USDOE about the planning of storage of LLW after Chinshan NPP is decommissioned.

Other questions include current status of dry storage facilities of Chinshan and Kuosheng NPP, decommissioning application and experience of TRR, influence to siting of LLW final disposal site from the feedback fund, and so on. These questions had all been answered by the AEC.

Moreover, USDOE had asked about the planning of bilateral exchange, relevant information has also been updated in this report.

K.6 Challenges in the Future, and Planning for Improving Safety

Spent fuel dry storage and radioactive waste final disposal are important issues that we are encountering in Taiwan. All of the stakeholders should have discussion and establish consensus to overcome the difficulties.

(1) Spent Fuel Dry Storage

The construction of the 1st phase spent fuel dry storage facility of Chinshan NPP has been completed and fulfilled performance test. Although the AEC approved TPC to carry out the hot test in September 2013, the soil and water conservation completion certificate of the facility has not been issued by the New Taipei City Government yet; therefore, the facility is pending for hot test at present.

As for spent fuel dry storage facility of Kuosheng NPP, the construction license had been issued by the AEC in August 2015. However, the run-off wastewater reduction plan has not been approved by the New Taipei City Government, and the construction of the facility has not started yet.

Under consideration of social consensus and public acceptance, the AEC has asked TPC to adopt indoor dry storage concept for the 2nd phase spent fuel dry storage facility of Chinshan NPP; and to commission the facility as fast as it can, so that the decommissioning of Chinshan NPP can be completed within 25 years as scheduled.

The investment feasibility study of the 2nd phase spent fuel dry storage facility of Chinshan NPP was approved by the Executive Yuan in August 2019. And the investment feasibility study of the 2nd phase spent fuel dry storage facility of Kuosheng NPP is under review by the State-owned Enterprise Commission of the MOEA at present. The AEC has regulated the implementation progress of the 2nd Phase Indoor Spent Fuel Dry Storage Facility of Chinshan NPP through monthly meetings, and has asked TPC to commence operation of the facility in the transitional phase, to facilitate the decommissioning activities.

(2) Spent Fuel Final Disposal

According to the regulations, TPC shall revise “Spent Fuel Final Disposal Program Plan” every 4 years, and submit to the AEC for review. The Plan was revised in 2018; and according to its planning, 2018 to 2028 is the second stage of the project, the “Candidate Site Selection and Approval” stage. The AEC has asked TPC to carry out siting activities based on three principles: detached organization, public participation, and objective criteria. The AEC has also asked TPC to implement the siting activities in host rock areas in priority based on former results, regional geological data, siting factors, and

verification and comparison with results from public work and academic research in large-scale investigation. The AEC has also promulgated relevant Legal Orders and Administrative Rules for the safety requirements of the siting of HLW final disposal sites.

(3) LLW Final Disposal

The MOEA has organized a siting group through open selection, and announced Daren Township (Taitung County) and Wuqiu Township (Kinmen County) to be the recommended candidate sites in 2012. However, the local governments of these two places have refused to hold local referendums for approval. Although the AEC has urged the MOEA and TPC to propose specific plan for local referendum many times, the siting activities have been postponed ever since. On the other hand, the AEC has asked TPC to plan for centralized storage as the interim storage facility, so the decommissioning of NPPs and the relocation of the LLW Storage Site can be further carried out.

The alternative plan was approved by the AEC in February 2017, and TPC has to commission the centralized storage facility in 8 years since March 2017. Nevertheless, TPC still needs to actively carry out the “LLW Final Disposal Plan”, to properly manage the LLW.

(4) Relocation of the LLW Storage Site

In June 2016, the AEC had asked TPC to submit the implementation plan for relocation of LLW Storage Site, and keep on communicating with the local people for support. Subsequently, the AEC had reviewed the “Planning Report on Relocation of LLW Storage Site” in February 2017, and asked TPC to prepare for the relocation.

Moreover, the AEC has also asked TPC to submit and implement the implementation plan for enhancement of operation safety of LLW Storage Site to repack 55-gallon drums in the trench into 3×1 and 3×4 containers to prepare for relocation in the future. TPC had started the repacking activities in November 2019, and completed all the repacking activities by February 2021.

L. ANNEXES

L.1 Relevant Laws and Regulations

Table L-1. List of Laws and Regulations for Spent Fuel and Radioactive Waste

Legislation level	Title	Date of revision/ promulgation
Act	Atomic Energy Law	1971.12.24
	Nuclear Materials and Radioactive Waste Management Act	2002.12.25
	Act on Sites for Establishment of Low Level Radioactive Waste Final Disposal Facility	2006.05.24
Legal Order	Fees for Regulatory Services under the Nuclear Materials and Radioactive Waste Act	2019.12.06
	Enforcement Rules for the Nuclear Materials and Radioactive Waste Management Act	2019.11.21
	Regulations on Treatment and Storage of Radioactive Waste and Safety Management of the Facilities	2019.06.25
	Regulations for Awards for Radioactive Materials Research and Development	2018.05.18
	Range and Identification Standards of Low Radioactive Waste Final Disposal Restricted Area	2017.03.23
	Regulations for the Nuclear Source Materials Operational Safety Management	2014.09.19
	Regulations on the Final Disposal of High Level Radioactive Waste and Safety Management of the Facilities	2013.01.18
	Regulations on Final Disposal of Low Level Radioactive Waste and Safety Management of the Facilities	2012.07.09

	Regulations for the Nuclear Source Materials Operational Safety Management	2009.10.30
	Regulations for the Nuclear Fuels Operational Safety Management	2009.10.30
	Regulations on Qualifications of Personnel Operating Radioactive Waste Treatment Facilities	2009.04.22
	Regulations for the Review and Approval of Application for Construction License of Radioactive Wastes Treatment, Storage and Final Disposal Facilities	2009.04.13
	Regulations for the Review and Approval of Application for Construction License of Nuclear Source Material and Nuclear Fuel Production and Storage Facilities	2008.01.24
	Administrative Regulations for Waste Generated from Naturally Occurring Radioactive Materials	2007.01.05
	Commission Inspection Regulations for Radioactive Materials Facilities	2005.12.30
	Regulations on Clearance Level for Radioactive Waste Management	2004.12.29
	Administrative Regulations for Nuclear Source Materials Mines and Minerals	1998.04.15
	Operational Regulations Governing Nuclear Safeguards	2019.07.25
Administrative Rule	Review Guides for Safety Analysis Reports of Spent Fuel Dry Storage Facilities	2019.01.18
	Safety Analysis Report Guides for Spent Fuel Dry Storage Facility Application	2019.01.18
	Review Guides for Re-evaluation Reports of Low-level Radioactive Waste Storage Facilities	2018.09.27
	Safety Analysis Report Guides for Low-level Radioactive Waste Storage Facilities	2018.08.30

	Regulations on Review of Application for Radioactive Materials Facilities Design Modification and Equipment Change	2018.01.22
	Regulations on Siting of High-level Radioactive Waste Final Disposal	2017.03.29
	Regulations on Siting of Consolidated Radioactive Waste Facilities	2017.03.29
	Safety Analysis Report Guides for LLW Final Disposal Facilities	2016.09.02
	Review Regulations on LLW Final Disposal Containers	2010.12.23
	Application Guides for Utilization of LLW Containers	2010.04.22
	Safety Analysis Report Guides for LLW Management Facility Application	2006.12.29

Remarks:
1. Updated to the end of December 2020.
2. For full text of the regulations please refer to the AEC Laws and Regulations Retrieving System (https://erss.aec.gov.tw/law/LawCategoryMain.aspx).

Table L-2. List of Laws and Regulations for Radiation Safety

Legislation level	**Title**	**Date of revision/ promulgation**
Act	Ionizing Radiation Protection Act	2002.01.30
Legal Order	Enforcement Rules for the Ionizing Radiation Protection Act	2008.02.22
	Administrative Regulations for Radioactive Material and Equipment Capable of Producing Ionizing Radiation and Associated Practice	2018.12.22
	Environmental Radiation Standards for Serious Contamination	2011.01.07
	Administrative Regulations for Operators of Radioactive Material or Equipment Capable of Producing Ionizing Radiation	2009.04.17
	Regulations on Safely Transportation of Radioactive Materials	2007.12.31

	Safety Standards for Protection against Ionizing Radiation	2005.12.30
	Exemption Standards for Radiation Sources	2016.06.20

Remarks:
1. Updated to the end of December 2020.
2. For full text of the regulations please refer to the AEC Laws and Regulations Retrieving System (https://erss.aec.gov.tw/law/LawCategoryMain.aspx).

Table L-3. List of Laws and Regulations for Environmental Protection

Legislation level	**Title**	**Date of revision/ promulgation**
Act	Environmental Impact Assessment Act	2003.01.08
	Waste Disposal Act	2017.06.14
Legal Order	Environmental Impact Assessment Enforcement Rules	2018.04.11
	Standards for Determining Specific Items and Scope of Environmental Impact Assessments for Development Activities	2018.04.11
	Regulations on Environmental Impact Assessment for Development Activities	2017.12.08
	Waste Disposal Act Enforcement Rules	2019.11.06

Remarks:
1. Updated to the end of December 2020.
2. For full text of the regulations please refer to the EPA Laws and Regulations Retrieving System (https://oaout.epa.gov.tw/law/LawCategoryMain.aspx).

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