English Version

The People's Republic of China
Fourth National Report
for the
Joint Convention
on the Safety of Spent Fuel Management
and
on the Safety of Radioactive Waste Management

Prepared for the Sixth Review Meeting

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Preface

Chinese Government has consistently accorded high priority to the safety of spent fuel management and the safety of radioactive waste management. The 21st Session of the Standing Committee of the 10th National People's Congress, the People's Republic of China, decided to access to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (hereinafter referred to as Joint Convention), which was adopted on 5 September 1997 by a Diplomatic Conference convened by the International Atomic Energy Agency and，at the same time, stated that the Joint Convention is not, for the time being, applicable to the Marco Special Administration Region of the People's Republic of China, unless otherwise stated by Chinese Government. On 13 September 2006, China sent its submission of accession instrument to the Depositary. The Joint Convention entered into force to China from the day of 12 December 2006 on.

The 1st, 2nd and 3rd National Reports of the People's Republic of China on the fulfillment of the obligations of the Joint Convention were submitted, in October 2008, and October 2011 and October 2014, respectively, to the 3rd, 4th and 5th Review Meetings of the Contracting Parties.

This report is provided, according to the Article 32 of the Joint Convention, as the 4th National Report of the People's Republic of China to the 6th Review Meeting of the Contracting Parties. This Report describes the situation of how the obligations of the Joint Convention is implemented in China, and is composed of two parts. The Part 1 is the status report of Joint Convention fulfillment by the Central Government of the People's Republic of China, and the Part 2 is the status report of Joint Convention fulfillment by the Hong Kong Special Administrative Region of the People's Republic of China. The data on the inventory and checklist provided in the present report was gathered as of December 31, 2016.

This report does not include information of Taiwan Province of the People's Republic of China.

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PART 1

A. INTRODUCTION

A.1 Theme of the Report

A-1 This report provides a description of the Chinese fundamental policies on, and practices of, the safety of spent fuel management and the safety of radioactive waste management.

A-2 The aim of spent fuel management and radioactive waste management in China is to achieve and maintain the high level safety and, at present and in future, to protect individuals, society and the environment against the harmful impacts of ionization radiation and promote the sustainable development and peaceful use of nuclear energy and nuclear technology. China has been adhering by the basic principles of ionizing radiation protection, radiation source safety, spent fuel management safety and radioactive waste management safety. China has been making efforts to establish well and improve legislative system, clarify and allocate safety management responsibilities, enhance and raising regulatory capabilities, attach importance to and actively participate with international cooperation, so as to ensure the safety of spent fuel management and the safety of radioactive waste management.

A.2 Concerned Facilities

A-3 In accordance with the Joint Convention, the Part 1 of this report is focused on a wide range of management facilities, such as at-reactor and/or away-from-reactor storage facilities erected for spent fuel generated from nuclear power plants (NPPs) and research reactors, radioactive waste treatment and storage facilities for nuclear facilities, radioactive waste temporary storage facilities for nuclear technology applications, and radioactive waste disposal facilities.

A.3 Structure

A-4 As required by the *Guidelines regarding the Form and Structure of National Reports* (INFCIRC/604/Rev.3), the Part 1 of this report explains China's fulfillment of the obligations of each article of the Joint Convention in each section. Each section begins with the corresponding Articles, given in the Joint Convention, enclosed with a box and underlying dark lines. The contents, in addition to the Introduction, are as follows:

Section B. Polices and Practices (Article 32-1)

Section C. Scope of Application (Article 3)

Section D. Inventories and Lists (Article 32-2)

Section E. Legislative and Regulatory System (Articles 18 to 20)

Section F. Other General Safety Provisions (Articles 21 to 26)

Section G. Safety of Spent Fuel Management (Articles 4 to 10)

Section H. Safety of Radioactive Waste Management (Articles 11 to 17)

Section I. Transboundary Movement (Article 27)

Section J. Disused Sealed Sources (Article 28)

Section K. General Efforts to Improve Safety

Section L. Annexes

A-5 To avoid the overlapping of the relevant parts in Chapters G and H, the general laws and regulations governing the safety of spent fuel management and the safety of radioactive waste management are addressed in Chapter E, as required in the INFCIRC/604/Rev.3.

A.4 Response and Answer to Suggestions, Challenges and Generic Issues Identified at the Fifth Review Meeting

A-6 During the Fifth Review Meeting of Contracting Parties, the Country Group 6 where China was in states there were five challenges facing China in spent fuel and radioactive waste management. Since then, active actions have been implemented in the country in many ways to respond these challenges.

A-7 As stated by the Fifth Review Meeting Summary Report, the national reports for the Sixth Review Meeting should, as appropriate, address the following four generic issues. These issues are addressed in the present National Report in all-round way based on the current Chinese laws/regulations and practices.

A.4.1 Response to Challenges

- **Improving radioactive waste management laws and rules**

A-8 A number of departmental rules have been newly issued, mainly including the *Projects Management Methods of the Funds for Treatment and Disposal of Spent Fuel from Nuclear Power Plants* (PMMFTDSFNPP), the *Regulatory Requirements for Nuclear Safety of Spent Fuel Dry Storage System at NPPs* (RRNSSFDSSN) (trial), and the *Methods of the Public Involvement in Environmental Protection* (MPIEP). The *Regulations on the Safety of NPP Design* (HAF102) was revised and re-issued; the nuclear safety guides *Radioactive Waste Minimization at Nuclear Facilities* was issued newly.

A-9 The efforts to revise a series of departmental rules have been launched,

mainly involving the classification of radioactive waste, the management of the safety of radioactive waste, and the management of civilian nuclear facilities decommissioning. In the years ahead, the focus will be on the development of 18 safety guides by reference to the IAEA Safety Standards and/or Guides, mainly involving safety case and safety assessment for the near-surface disposal of radioactive waste, assessment of the safety of nuclear and radiation facility decommissioning, decommissioning of nuclear fuel cycle facilities, and decommissioning of nuclear power plants and research reactors.

A-10 The development of the *Nuclear Safety Law* and the *Atomic Energy Law* are speeded up in the country. The draft *Nuclear Safety Law* has passed the review by the 12th NPC Standing Committee's 24th meeting and is available on the NPC official website for public comment. The draft *Atomic Energy Law* has entered officially acceptance procedure and listed in the 2017 legislation plan of the State Council, pending the further revision and improvement to the draft law, see E.2.1，K.1.1，K.1.3.

■ **Improving regulatory control capabilities**

A-11 The regulation of nuclear and radiation safety are further standardized and institutionalized by improving management system and training measures. The *Management Measures for Supervisor and Inspector on Nuclear and Radiation Safety* has entered implementation. The *Comprehensive Management Manual on Overseeing Nuclear and Radiation Safety* and the *Guidelines on Occupational Training for Oversight of Nuclear and Radiation Safety of National Nuclear Safety Administration (NNSA)*were issued.

A-12 Continued training of regulatory staff on nuclear and radiation were carried out. There were a total of 1263 staff having passed the primary occupational training and obtained the course-completion certificates. Another 796 staff participated in middle-class occupational training and obtained course-completion certificates. Furthermore, 518 staff participated in and completed the provincial-level training of radiation safety oversight and obtained the certificates. Additionally, more than 8200 staff accepted the on-job training.

A-13 The national program on construction of the research and development bases in relation to nuclear and radiation safety technology continued to move forward, involving the verifying capability construction for radioactive waste management safety and nuclear facility decommissioning safety, for radiation environmental monitoring techniques, and for nuclear and radiation safety monitoring and control and emergency response.

A-14 The continued efforts were focused on the capability construction for environmental monitoring, encompassing the movable radiation emergency monitoring at national level, the lab-based emergency response, analysis and monitoring at national level, the automatic environmental radiation monitoring stations across over various province or municipality or autonomous region, such as Beijing, Inner Mongolia, Yunnan and Tibet, see K.1.2.

■ **Ensuring spent fuel capacity meets nuclear program needs**

A-15 The capability construction plan for spent fuel storage system at NPPs were developed, which defines the planning and support policy concerning capability construction in relation to spent fuel transportation and storage and put forward the management principle of spent fuel keeping up with nuclear power expansion.

A-16 China Atomic Energy Agency (MII/CAEA) issued, in March 2014, the *Projects Management Methods of the Funds for Treatment and Disposal of Spent Fuel from Nuclear Power Plants* (PMMFTDSFNPP). The National Nuclear Safety Administration (NNSA) issued the *Regulatory Requirements for Nuclear Safety of Spent Fuel Dry Storage System at NPPs* (RRNSSFDSSN) (trial). The construction of spent fuel dry-storage facilities was lunched at Daya Bay NPP and Tianwan NPP. The pave to construct a large-sized commercial reprocessing plant is being accelerated in the country, see B.2，K.1.3.

■ **Public acceptance of radioactive waste disposal site**

A-17 Both the *Policy Statement on Nuclear Safety Culture (*PSNSC) and the *Methods of the Public Involvement in Environmental Protection* (MPIEP) were issued, which specify the public involvement way in attempt to raising the pubic acceptance. That is to ensure the information right, participation right and oversight right through a wide range and variety of ways. Also, the relevant chapters on information disclosure and public involvement can be found in the draft *Nuclear Safety Law*.

A-18 The open and transparent information release channels are built to increase the transparency of the information relevant to radioactive waste disposal site and to further raise the level of public acceptance. The special topic columns are established on the MEP/NNSA's official website. These columns are intended to describe the aims and tasks of radioactive waste disposal site, together with their acceptance process, and to announce the certificate granting procedures of radioactive waste disposal site, see K.1.4.

■ **Developing specific regulatory requirements for decommissioning**

A-19 A plan was launched to prepare the laws and regulations on nuclear facility decommissioning management with respect to nuclear and radiation safety during 13th Five Year Plan period. These include *Rules on the Management of Civilian Nuclear Facilities Decommissioning* (RMCNFD), *Safety Guidelines on Decommissioning of Nuclear Power Plants and Research Reactors* (SGDNR), and the *Safety Guidelines on Decommissioning of Nuclear Fuel Cycle Facilities* (SGDNFCF). Currently, the relevant documents are under preparation on the schedule.

A-20 Initial draft of the *Rules on the Management of Civilian Nuclear Facilities Decommissioning*（RMCNFD） was been completed. This document is applicable to the management of the decommissioning of nuclear power plants, research reactors and other nuclear cycle facilities, encompassing decommissioning activity classification, policy/strategy and termination, and involving decommissioning planning, investigation, technology selection, process, waste management, as well as records and reports etc.

A-21 A study effort has been initiated to develop department rules with respect to the management of nuclear facility decommissioning, which focuses on the requirements for the calculation, management and use of decommissioning funds. The research and development efforts with a view to enhancing the internal funds management system were deepened in various nuclear power group corporations and their operators see K.1.5.

A.4.2 Brief Answers of Generic Issues Identified in the Fifth Review Meeting Summary Report

■ **Staffing, staff development, reliability of funding, and human resources areas**

A-22 Education and training plans for nuclear stuff are under active development. The professional disciplines in aspects of nuclear engineering and technology and radiation protection are established in a number of universities of technology, with expanded enrollment amount and optimized discipline structure for this purpose.

A-23 In combination with universities and research institutions in the county, China's nuclear power groups or enterprises continue to explore the innovative mechanisms to jointly cultivate nuclear staff on a production-study-research basis. The higher education mode has developed progressively by providing funds to universities and students. That is the education mode based on "order +

joint cultivation" mode or "enterprise + university" mode.

A-24 China's nuclear power groups or enterprises are also sure to gain enough human resource via multiple channels. These are to build human resource information library, create human resource sharing platform, openly recruit experts at home and abroad, enlarge educational communication and cooperation in nuclear energy field, set up expert boards at different levels and technical working groups on special topics.

A-25 Qualification management system is practiced at national level upon the occupational workers involved in the prevention and control of radioactive contamination. Training and examinations on radiation safety knowledge and operating techniques are conducted by the relevant organizations for the occupational workers engaged in the treatment, storage and disposal of radioactive waste. Only qualified workers can be engaged in the relevant works, see F.1.

- **Maintaining or increasing public involvement and engagement on waste management, to provide public confidence and acceptance**

A-26 The matters on information disclosure and public involvement and cooperation in the field of radioactive waste management have been made clear in the relevant laws, regulations and rules that have been early published, such as the *Law of the People's Republic of China on Environmental Impact Assessment* (LPRCEIA), the *Government Information Openness Guidelines on Environmental Impact Assessment of Construction Project* (GIOGEIACP) (trial), the *Tentative Methods on Public Involvement in Environmental Impact Assessment* (TMPIEIA), and the *Methods on Public Involvement in Environmental Protection* (MPIEP).

A-27 The public's rights to informing, involvement and supervision are guaranteed through many ways. The comments and suggestions from the citizens, legal persons and other organizations on the matters or activities related to environmental protection are solicited through many ways, like questionaries, panel discussions, expert demonstration meetings and hearings. They may also put forward their comments and suggestions via telephone, letter, facsimile and network. These comments and suggestions submitted will be taken into full consideration in the environmental decision-making and fed back to them in an appropriate way, see G.3.2，H.3.2，K.1.4，K.4.

■ **Developing and implementing a holistic and sustainable management strategy for radioactive waste and spent fuel at an early stage**

A-28 During the country's early nuclear power development in 1980s, the policy on spent fuel reprocessing was defined. On the basis of the demands of nuclear power expansion in the near and long-term future, China has been making efforts to develop overall planning for spent fuel management capability building, encourage enterprises to participate in capability building and scientific research, improve the regulatory system, and train high qualified human resource, so as to ensure the smooth implementation of the spent fuel management policy. As has been pointed out in the *Outline of Thirteenth Five-Year Plan of National Economic and Social Development of the People's Republic of China* (OTNSPRC), the construction of large-sized commercial reprocessing plant will be demonstrated as soon as possible and pushed forward.

A-29 In accordance with the *Guidelines on Research and Development Planning for Geological Disposal of High Level Radioactive Waste* (GRDPGDHLW) issued in 2006, the project covering both the research and development and the disposal facility engineering are divided into three phases: (1) lab-based research and development and disposal facility siting (2006-2020), (2) underground experiment (2021-2040), and (3) prototype disposal facility validation and realistic disposal facility construction (2041- the mid-century). As stated further in the OTNSPRC, one underground laboratory for high level radioactive waste disposal will be completed in construction in the 2016-2020 period.

A-30 The construction program on regional LILW disposal site were defined in the *Twelfth Five-year Plan and 2020 Vision for Nuclear Safety and Radioactive Pollution and Control* issued in 2012. As further stated in the OTNSPRC, five regional LILW waste disposal sites will be constructed, see B.2，B.5.

■ **Management of disused sealed sources**

A-31 Adhering to the advanced ideology on radioactive source management, China attaches great importance to and strength the safety of management of radioactive sources during their entire lifetime. A number of regulations and rules were issued, such as the *Regulations on Safety and Protection of Radioisotope and Ray-generating Installations* (RSPRRI), the *Methods for Licensing of Radioisotopes and Ray-generating Installations Safety*

(MLRRIS), *Regulations on Safety of Radioactive Waste Management* (RSRWM), and the *Management Measures on Safety and Protection against Radioisotope and Ray-generating Installation* (MMSPRRI), These set forth the requirements for the production, distribution, use, transfer, import and export, use in different areas, storage, disposal, recycle and clearance of radioactive sources during their entire lifetime, as well as the disposition requirements for the orphan sources that would have been discovered in the process of scrap metal recycling smelting enterprises.

A-32 Abiding by the IAEA-issued *Code of Conduct on the Safety and Security of Radioactive Sources* and *Guidelines on the Import and Export of Radioactive Sources*, China promises to recover radioactive sources exported from China, see B.5 and J.

A.5 Main Update since the Last Report

A-33 The present report updates and supplements the following main activities and progress, as follows, made in China since January 1, 2014 until December 31, 2016 on the safety of spent fuel management and on the safety of radioactive waste management.

Newly issued and revised laws, regulations and rules:

(1) *Projects Management Methods of the Funds for Treatment and Disposal of Spent Fuel from Nuclear Power Plants* (PMMFTDSFNPP), issued by the China Atomic Energy Agency (MII/CAEA), in March 2014;

(2) *Notification on Normalized Management of the Workers at Critical Positions in Nuclear Technology Field,* issued by the MEP/NNSA in February 2015;

(3) *Methods of the Public Involvement in Environmental Protection* (MPIEP), issued by the MEP/NNSA in July 2015;

(4) *Regulations on the Management of Nuclear Emergency Exercises*, by the NNAECC in July 2015;

(5) *Guidance on the Public Communications on Nuclear Technology application project*, by the MEP/NNSA in October 2015;

(6) *Regulatory Requirements for Nuclear Safety of Spent Fuel Dry Storage System at NPPs* (RRNSSFDSSN) (trial), by the MEP/NNSA in December 2015;

(7) *Management Method of Nuclear Emergency Training* and the *Management Method of Nuclear Accident Information Release*, by the

NNAECC in December 2015;

(8) *Principles on Classification of Nuclear Fuel Cycle Facilities and their Basic Safety Requirements* (trial), by the MEP/NNSA in January 2016;

(9) *Implementation Methods on Oversight and Inspection of the Environment Impact Assessment Bodies of Nuclear and Radiation Construction Project*, by the MEP/NNSA in March 2016; and

(10) *Regulations on the Safety of Nuclear Power Plants Design*, by the MEP/NNSA in October 2016.

Newly issued programs and action plans

(1) *Technical Requirements for Building Onsite Rapid Rescue Force in Response to a Nuclear Accident Emergency* (trial), issued jointly by the MEP/NNSA and National Energy Administration (NEA) in April 2014, see F.5.1.1;

(2) *Policy Statement on Nuclear Safety Culture* (PSNSC) issued jointly by the MEP/NNSA, NEA and China Atomic Energy Authority (CAEA) in December 2014, see K.1.4, K.3;

(3) *China's Nuclear Emergency* white paper issued by the CAEA and approved by the State Council for publication in January 2016;

(4) *National Thirteenth Five-year Plan for Nuclear Accident Emergency* issued in April 2012 by National Nuclear Accident Emergency Coordination Committee (NNAECC) in June 2016;

(5) The *Summarized Principles on Developing Nuclear Emergency Assistance Program* and the *General Action Program on the Participation of National Nuclear Emergency Assistance Force with Nuclear Accident Emergency Assistance*, issued by National Nuclear Accident Emergency Response Office (NNAERO)/CAEA in October 2016; and

(6) *Outline of Thirteenth Five-Year Plan of National Economic and Social Development of the People's Republic of China*（OTNSPRC), issued by the State Council in November 2016, seeB.5，K.2.2，K.2.3.

Newly constructed facilities

(1) Both at-reactor spent fuel storage facilities and radioactive waste treatment and storage facilities were constructed for the newly constructed sixteen nuclear units, see L.1.1 and L.3.1.

Licensing issued

(1) In 2014, the MEP/NNSA granted both the Storage License of Radioactive Solid Waste and the Disposal License of the Radioactive Solid Waste to CNNC Qingyuan Environmental Engineering and Technology Limited Company, and the Disposal License of the Radioactive Solid Waste to Guangdong Daya Bay Nuclear Power Environmental Protection Limited Company.

(2) In 2014, the MEP/NNSA approved CNNC Chengdu Gaotong Limited Company and CNNC 404 Limited Company to conduct recycle and reuse of Co-60 and Cs-137 disused sealed sources in their respective way. In 2016, the MEP/NNSA approved Atomic High-tech Limited Company to conduct recycle and reuse of Co-60, Cs-137 and Am-241/Be (Pu-238/Be) disused sealed sources, see B.5.

Inspection Actions Carried out

(1) MEP/NNSA organized to conduct the special inspection of radioactive sources during May to July 2014;

(2) MEP/NNSA organized to conduct joint oversight and inspection of radiation safety during November to December 2014;

(3) MEP/NNSA conducts nuclear safety inspection of China's NPPs and research reactors during August to October 2015;

(4) MEP/NNSA conducted radiation safety inspection and comprehensive oversight and inspection at eight provincial environmental protection agencies, including Liaoning, Jiangxi and Henan provinces, etc during September to November 2015;

(5) MEP/NNSA conducted the special inspection of conditionally exempted radioactive source-containing equipment in municipalities or provinces of Being, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong and Guangdong during May to October 2016;

(6) MEP/NNSA organized to conduct the special inspection of radioactive source safety during October 2016 to May 2017; and

(7) The inventories and lists are updated in the present Report, see D and L.

A.6 Major Events Taking Place since the Last Report

A-34 The present Report provide additional information on major events that have occurred since January 1st 2014 to December 31 2016 with respect to the safety of spent fuel management and the safety of radioactive waste management.

- **Change has taken place in the authority of reviewing, approving and granting the radiation safety license.**

A-35 The MEP/NNSA transferred, in January 2014, the authority to review, approve and grant the radiation safety license of holding Category I source to the provincial environmental protection agencies.

- **The long-term post-FDA improvement program of the nuclear facility operator continued to implement.**

A-36 As of December 31, 2016, the long term improvement program of various civilian nuclear facilities continued to be in steady progress in accordance with the June-2012 MEP/NNSA-issued *General Technical Requirements for Nuclear Power Plants Modification following Fukushima Accident* (trial).

- **Joining the IAEA nuclear emergency response and assistance network and the national nuclear emergency exercise was launched by.**

A-37 China joined International Nuclear Emergency Response and Aid Network in May 2014. The NNAECC organized to launch the Shendun-2015 Joint Exercises of Nuclear Emergency at a country level in June 2015.

- **A follow-up IRRS mission was conducted on nuclear and radiation safety regulatory system**

A-38 An IAEA international team conducted a follow-up IRRS mission, at the request of China, to the country's nuclear and radiation safety regulatory system from 28 August to 8 September 2016.

A.7 Good Practices

A-39 With respect to the safety of spent fuel management and the safety of radioactive waste management, it was believed that China has the following six good practices worthwhile attention:

- **Systematic introduction of IAEA safety standards system into departmental rules and guides**

A-40 To establish and improve China's nuclear and radiation safety

standards system by reference to the existing IAEA safety standards system is a long-term basic effort for guaranteeing the sustainable development of nuclear industry and technology in the country. The IAEA safety standards and guidelines will be transformed, on the basis of systematical introduction, to the corresponding departmental rules and guides. At present, some departmental rules are under revision, like radioactive waste classification, rules on the safety of radioactive waste management, rules on the management of civilian nuclear facilities decommissioning. As many as more than 10 safety guides concerned with safety assessment are in the process of development, such as safety case and safety assessment for the near-surface disposal of radioactive waste, minimization of radioactive waste arising from nuclear technology applications, decommissioning of nuclear power plants and research reactors, decommissioning of nuclear fuel cycle facilities and so on.

- **Carrying out countrywide dissemination, implementation and training of nuclear safety culture**

A-41 The *Policy Statement on Nuclear Safety Culture*（PSNSC) issued in 2014 expresses the firm attitude for nuclear safety culture to be cultivated, explicitly requiring for each of regulatory and relevant agencies and relevant organizations and stakeholders to comply and implement the requirements of the Statement. A countrywide special action to disseminate and implement nuclear safety culture was carried out from 2014 to 2015. This action covered NPPs and research reactors, nuclear fuel cycle, nuclear technology application, radioactive waste treatment and disposal and nuclear safety equipment, with more than 500 000 people involved. As required by the *MEP/NNSA's Directive Opinion on the Training of Nuclear and Radiation Safety Regulation* issued in 2016, nuclear safety culture is included in the curriculum of variety of qualification and job training organized by MEP/NNSA. And also, the "special training of nuclear safety culture" is going to be listed in the 2017 Training Plan, which specifies that oversight stations and nuclear organizations should include nuclear safety culture in their respective training plans. For the purpose of providing guidance on the evaluation of nuclear safety culture in nuclear and radiation sectors, the *Characteristics of Nuclear Safety Culture* (NNSA-HAJ-1001-2017) was issued.

- **Conducting the study on waste minimization strategy and top level design to promote achievement transformation**

A-42 During 2008 to 2011, a study on waste minimization strategy and top level design was carried out in China, focusing on radioactive waste

minimization involved in strategy and policy, at the front- and back-end of nuclear fuel cycle and at NPPs, and in relation to nuclear technology applications and research reactor. Also the special technologies were developed about sorting techniques and equipments of radioactive waste minimization. Based on the relevant research achievements, the guideline *Radioactive Waste Minimization at Nuclear Facilities* was issued（HAD 401/08-2016). These achievements have been partly applied to the design and construction of the construction project of centralized waste management center at Tianwan NPP base, to the design of waste treatment facility at Xudabu NPP site and to a "research and development project of waste minimization technology at NPPs" prioritized by the CNNC.

- **Management of temporary storage of disused sealed source based on "one repository for one province"**

A-43 To ensure the safety of disused sealed source management, one temporary storage facility is built at each of provinces, municipalities and autonomous regions to collect and store the radioactive waste, including disused sealed sources, generated by nuclear technology applications in their respective localities. Based on the safety conditions and capacities of these facilities, the upgrade, modification and extension of them were launched in 2005 and completed in 2012. To the end of 2016, a total of 31 temporary storage facilities for this purpose, together with one national centralized disused sealed sources storage facility, were completed and put into operation, with total capacity of 27625 m^3 and storage of 124789 disused sealed sources in total.

- **Action plan implemented for radioactive sources safety covering disused sealed source**

A-44 The "national management system of radiation safety of nuclear technology applications" was officially put into use in 2010. So far, the whole-process dynamic regulation of radioactive source has been achieved so as to be possible to provide important data source for the day-to-day regulation. The management of disused sealed sources is an input to the system. This System has made possible to realize the dynamic management of disused sealed sources. 2017, this System 2.0 version will be updated, which will lay a solid foundation of big data applications.

A-45 At the April 2016 Nuclear Security Summit in Washington, Chinese President Mr. Xi Jinping promised that China would implement the Action Plan for Strengthening Sealed Radioactive Sources Safety. In order to prevent large

numbers of radioactive sources from terrorists' coveting, the current situations of radioactive sources within the country's territory will be ascertained further in the next 5 years to improve the security system, with focus on real time monitoring of high-risky radioactive sources. In 2016, a countrywide special action of radioactive source safety was launched, through which the inventory and lists of actual radioactive sources were acquired. The identified radioactive sources that have not yet been registered are now listed into the scope of regulation, which improve the quality of the data in the System. In meanwhile, the research and pilot program on the real-time monitoring system of high-risk movable radioactive sources (HMRS) were deployed through technical breakthrough. In 2017, the online monitoring and the real-time monitoring of the HMRS were approved, respectively, as two pilot projects. Both prototype debugging and pilot application are now underway.

- **Implementation of "order + joint cultivation" or "enterprise + university" education mode**

A-46 The "order + joint cultivation" education mode means that, as directed by nuclear power groups, their subsidiary nuclear power enterprises sign employment intent agreement, every year, with a set number of full-time nuclear-related undergraduates at grader three of higher educational institutions. After graduation, these students will go to work in these nuclear power groups/enterprises with which they have signed agreement. The nuclear power groups or enterprises pay educational costs to these educational institutions and scholarships to the students. On a basis of meeting undergraduate education program, the higher educational institutions arrange nuclear power-related curriculums for the students. Nuclear power groups or enterprises may select and send the related staff to these institutions for part-time or full-time teaching.

A-47 The "enterprise + university" education mode is intended for higher educational institutions to enroll the examinees of fixed direction allocation, for which nuclear power groups pay the tuition and accommodation fees of students during school and to provide the targeted scholarships of nuclear industry. These students also can enjoyed other types of scholarship which the non-fixed direction students enjoyed, and after graduation go to work in nuclear power groups.

A.8 Matrix of Spent Fuel and Radioactive Waste Management in China

Type of Liability	Long-term Management Policy	Funding of Liabilities	Current Practice/Facility	Planned Facilities
Spent fuel	Reprocessing	Funds for the treatment and disposal of spent fuel at NPPs (only limited to PWRs)	Stored in 36 spent fuel pools and 1 spent fuel interim dry storage facility for spent fuel from NPPs, stored in 3 spent fuel pools for spent fuel from research reactors	Two spent fuel dry-storage facilities, reprocessing plants
Nuclear fuel cycle wastes including NPP's waste	Geological disposal of HLW	Funds for treatment and disposal of spent fuel at NPPs		1 underground laboratory for geological disposal
	Near surface disposal of LILWs	Provided by the generator	2 operational LILW disposal sites	5 near-surface disposal facilities
Waste arising from Nuclear Technology Applications	Decay, clearance, storage and by-categorized disposal	Provided by the generator and the related government	Stored in 31 temporary storage facilities for waste arising from nuclear technology applications	
Decommissioning liabilities	Immediately demolished, delay in demolition	Provided by the operator and the related government		
Disused sealed sources	Returned to original manufacturer, delivered for storage or disposal, clearance, reuse	Provided by the generator and the related government	Stored in 31 temporary storage facilities for waste arising from nuclear technology applications and 1 national centralized DSRS storage facility	

B. POLICIES AND PRACTICES (Article 32-1)

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 Contraction 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 Spent Fuel Management Policy

B-1 China's spent fuel management policy is to implement the reprocessing of spent fuel and to extract and recover uranium and plutonium materials, so as to achieve maximum use of resources, reduce the generation of high level radioactive wastes (HLW) and to ensure the safety of spent fuel management and the public safety, and to lower the risks to the future generations.

B-2 On the basis of the demands of nuclear power expansion in the near and long-term future, China is making efforts to develop overall planning for spent fuel management capability building, encourage enterprises to participate in capability building and scientific research, improve the regulatory system, and train high quality talent team, so as to ensure the smooth implementation of the spent fuel management policy.

B.2 Spent Fuel Management Practices

B-3 At present, the spent fuels generated from NPPs and research reactors are stored at reactors. The operators of NPPs and research reactors shall have the overall responsibility over the safety of management of the spent fuels generated by them.

B-4 The construction plan on storage system of spent fuel generated from NPPs is under development by CAEA. With the demands of the transportation and storage of spent fuel withdrawn from NPPs, this plan will define the planning and support policy in building spent transportation and storage ability, and put forward spent fuel management principle compatible with its nuclear power expansion.

B-5 The spent fuel storage facilities have been established to variable extent at NPPs to accommodate the spent fuel arising from NPPs within a certain

period of time and ensure storage safety. The spent fuel storage facility was built at each of NPPs, with more information found in section L.1.1

B-6 An interim dry storage facility of spent fuel has been erected at QNPP III site, consisting mainly of spent fuel preparation zone, transport zone, and dry storage zone. The first two modules were put into operation in September 2009; the second two began in operation since the end of 2013, as described in Chapter G.

B-7 Under the *Regulations on NPP operation safety* (HAF103) and the *Research reactor operation management* (HAD202/01), the operators of both NPPs and research reactors have responsibilities for all activities of managing reactor core and fuel, including spent fuel. The management procedures for nuclear fuel and reactor-core components are prepared, including handling of irradiated fuel, storage in plant area, and preparatory work for delivery of spent fuel to the outside. This can ensure the safety of fuel using in a reactor and the safety of fuel during the transfer and storage in the plant area. Spent fuel withdrawn from Daya Bay Nuclear Power Plant was partly delivered to centralized storage facility at a reprocessing pilot plant for purpose of away-from-reactor storage and reprocessing.

B-8 Under the HAF103 and the HAD 202/01, the operators of NPPs and research reactors prepare the operational procedures for various steps of spent fuel management and implement wide variety of activities, such as spent fuel withdrawing operation, radiation measurement, radiation protection supervision, spent fuel storage, management and surveillance of plant building and installations, documentation, water chemistry analysis and quality assurance.

B-9 China has set up the funds for treatment of spent fuel from NPPs available for the transportation, storage and reprocessing of spent fuel and the disposal of HLW. The CAEA, has issued the *Projects Management Methods of the Funds for Treatment and Disposal of Spent Fuel from Nuclear Power Plants* (PMMFTDSFNPP) governing the management of the funded-projects, so as to improve the efficient use of the funds.

B-10 To meet the demands of nuclear power expansion, China makes effort, based on an overall planning, to construct the facilities for storage, transportation and reprocessing of spent fuel. The ongoing efforts involve the extension of the research and development of spent fuel dry-storage and reprocessing technologies, the initiation of large scale commercial reprocessing-recycle plant. The capacity of the storage and reprocessing of spent fuel continued to be constantly improved as needed.

B.3 Criteria Used to Define and Categorize Radioactive Waste

B-11 As specified in the *Law of the People's Republic of China on Prevention and Control of Radioactive Pollution* (LPCRP), radioactive waste is those that contain, or are contaminated with, radionuclides with activity concentrations or total activity greater than the clearance level as established by the regulatory body without foreseen further use.

B-12 In China, radioactive wastes arise mainly from NPPs, research reactors, nuclear fuel cycle, nuclear technology applications, and mining and uses of uranium (thorium) resources. The current Chinese radioactive waste categorization is implemented under the *Classification of radioactive waste* (GB 9133-1995), as shown in Table 1. In the process of radioactive waste categorization, account was taken of the activity concentration level and physical properties of waste and the half life and radiation types of radionuclides among others. According to their activity concentration level, wastes are classified into exempt waste, low-level radioactive waste, immediate-level radioactive waste and high level radioactive waste. However, such classification is not applicable to the waste generated in the process of mining and milling of uranium (thorium) ores.

B.3.1 Low and Intermediate Level Radioactive Waste

B-13 Low- and intermediate-level radioactive waste is mainly generated from civilian reactor operation, nuclear fuel cycle and nuclear technology applications.

B-14 Low- and intermediate-level radioactive wastes (LILWs) means those containing low activity concentration of radionuclides but without need for special shielding during handling and transportation, along with negligible heat release but without need for cooling during storage.

B.3.2 High-Level Radioactive Waste

B-15 High level radioactive waste (HLW) includes the high-level liquid waste generated from the reprocessing of spent fuel, and the solidified form of such waste, as well as spent fuel generated from nuclear power reactors or research reactors pending direct disposal.

B.3.3 Uranium (Thorium) Mining and Milling Waste

B-16 Uranium (Thorium) mining and milling waste means those with radioactive levels exceeding the relevant regulatory levels, which was generated from exploration, mining, milling and closure, mainly covering barren rocks and tailings.

Table 1 Classification of Radioactive Waste

Physics condition	Waste categorization	Waste characteristics/index
Gaseous	Low level waste (LLW)	Activity concentrations not exceeding 4×10^7 Bq/m^3
	Intermediate level waste (ILW)	Activity concentrations higher than 4×10^7 Bq/m^3
Liquid	Low level waste (LLW)	Activity concentrations not exceeding 4×10^6 Bq/L
	Intermediate level waste (ILW)	Activity concentrations higher than 4×10^6 Bq/L but not exceeding 4×10^{10} Bq/L
	High level waste (HLW)	Activity concentrations higher than 4×10^{10} Bq/L
Solid	Low level waste (LLW)	Activity concentrations not exceeding 4×10^6 Bq/kg
	Intermediate level waste (ILW)	(1) Half-life longer than 60 d but shorter than or equal to 5 a, with activity concentrations higher than 4×10^6 Bq/kg (2) Half-life longer than 5 a, but shorter than or equal to 30 a, with activity concentrations higher than 4×10^6 Bq/kg but not exceeding 4×10^{11} Bq/kg and heat release rate less not exceeding to 2 kW/m^3 (3) Half-life longer than 30 a, specific activity higher than 4×10^6 Bq/kg, and heat release rate not exceeding 2 kW/m^3
	High level waste (HLW)	(1) Half-life longer than 5a, but shorter than or equal to 30 a, with heat release rate more than 2 kW/m^3 or activity concentrations higher than 4×10^{11} Bq/kg, (2) Half-life longer than 30a, activity concentrations higher than 4×10^{10} Bq/kg, or heat release rate more than 2 kW/m^3
	Alpha radioactive solid waste	Alpha nuclides with half-life longer than 30 a, activity concentrations in a single container higher than 4×10^6 Bq/kg

B.4 Radioactive Waste Management Policy

B-17 The generators of radioactive wastes shall bear overall safety responsibility.

B-18 Radioactive wastes shall be managed in terms of their classifications.

B-19 The amounts of radioactive wastes generated and of their release to the environment shall be made consistent with the ALARA principle based on the reasonable selection and use of raw materials, the adoption of advanced technologies and equipments and the implementation of recycle and reuse of

materials.

B-20 Relevant radioactive waste management facilities shall be simultaneously established together with their main technological process facilities in their design, construction and operation.

B-21 Radioactive waste generated from nuclear technology applications shall be stored in the centralized radioactive waste storage facilities at provincial-, municipal- and autonomous regional-level.

B-22 The release to the environment of gaseous and/or liquid radioactive wastes shall be subject to the national standards on radioactive contamination prevention and control. Solid radioactive waste shall be disposed of in accordance with their classification. Solid LILW shall be disposed of in regional near-surface disposal facilities. Solid HLW waste shall be disposed of in a centralized deep geological disposal repository. Wastes arising from uranium (thorium) mining and milling tend to be in relatively-centralized in-situ landfill.

B-23 Solid radioactive waste is prohibited to be disposed of in inland rivers and waters or seas. Both radioactive waste and radioactively-contaminated articles are prohibited to export to, and transfer in, the territory of the People's Republic of China.

B.5 Radioactive Waste Management Practices

B-24 In accordance with the requirements of "three simultaneous" to radioactive waste management facilities, the liquid and/or gaseous waste treatment facilities and the solid radioactive waste storage facilities are erected for NPPs and research reactors. Radioactive waste management programs are developed by the operators of various NPPs, along with radioactive waste management procedures, to manage radioactive wastes in accordance with their classifications.

B-25 Usually, at NPPs and research reactor facilities, gaseous radioactive waste undergoes filtration, absorption, storage for decay and then is released when met relevant standards; liquid radioactive waste undergoes filtration, evaporation and ion-exchange etc. and then is released when met relevant standards; concentrated liquid waste and spent resin are cement solidified; technology waste experiences sorting, compression and immobilization; spent filter cartridge is cemented for treatment. The waste packages, meeting acceptance criteria for near surface disposal of radioactive waste, formed following treatment are in safe storage. At other nuclear fuel cycle facilities, waste generated is under the effective management in a manner similar to those

mentioned above.

B-26 Radioactive waste minimization is implemented at the operating NPPs. The training and publicity on waste minimization have brought about enhanced awareness to personnel and contractors in this issue. Wide varieties of minimization technologies are employed, such as pre-compression and super-compression as volume reduction technology, trial of paper garment and shoe covers made from biodegradable materials and other protective articles, and changing cement barrels to metal drum as the cement solidified packaging container. Novel waste treatment technologies and operational models are incorporated into the design of newly constructed NPPs, such as drum drying, waste resin static hot pressing processor, High Integrity Containers (HIC), mobile liquid waste processing installation, Site Radioactive Treatment Facility (SRTF), and so on. Under the joint effort of the CAEA and the MEP/NNSA, the project "study on strategy and top-level design of waste minimization" was sponsored during 2008 to 2011 by the related research institutions, nuclear fuel cycle enterprises and NPP companies concerned. This study project covered the policy and strategy on radioactive waste minimization, the radioactive waste minimization at front- and back-end of nuclear fuel cycle including NPPs, and the radioactive waste minimization of nuclear technology applications and research reactors, and the development of practical techniques and specific equipments for radioactive waste minimization sorting. Based on the results achieved, the document *Radioactive Waste Minimization at Nuclear Facility* (HAD 401/08-2016), which has partly been applied to the design and construction of centralized waste management center project at Tianwan NPP, to the design of waste treatment facility at Xudabu NPP and to the Study of Radioactive Waste Minimization at NPPs as a CNNC-prioritized development project.

B-27 China has attached importance to the HLW disposal planning. The *Guidelines on Research and Development Planning for Geological Disposal of High Level Radioactive Waste* (GRDPGDHLW) was issued in 2006 under the joint effort the CAEA and the MEP. As stipulated by it, the general objective of China's HLW geological disposal study is to select a site featuring stable geological formation and suitable socioeconomic environment and to complete the country's HLW geological disposal facility by the mid-21 century. With the aid of the confinement and retardation by the engineering and geological barriers, this facility will protect the environment and the public health from unacceptable harms from HLW within a long time period. The research, development and disposal facility construction shall be divided into three phases:

(1) laboratory-based research, development and disposal facility siting (2006-2020), (2) underground laboratory-based research (2021-2040), and (3) prototype facility validation and actual facility construction (2021-2040). The *Outline of Thirteenth Five Year Plan for National Economic and Social Development of the People's Republic of China* (OTNSPRC) issued in March 2016 given a clearer description: one underground laboratory for HLW geological disposal shall be completed in construction during 2016-2020.

B-28 CAEA has been developing siting and relevant research efforts for geological repository of HLW. Screening survey was conducted in six pre-selected regions of Eastern China, Southern China, Southeastern China, Inner Mongolia, Xinjiang and Gansu, with emphasis on the study of site characteristics in Beishan pre-selected region. Early-phase preparatory work of underground laboratory construction is in progress.

B-29 Chinese government attaches importance to the planning of LILW disposal. The State Council approved in 2012 the *Twelfth Five-year Plan and 2020 Vision for Nuclear Safety and Radioactive Pollution and Control* (TFP2020VNSRPC). It puts forward nine key tasks, such as ensuring the safe NPP operations, eliminating the potential safety hazards at research reactors and nuclear facilities, standardizing the nuclear technology applications and accelerating the nuclear facilities decommissioning and waste cleanup. It defined the key projects in the aspects of radioactive contamination cleanup, accident emergency guarantee, and regulatory capability construction, including construction project of regional waste disposal site. To match up to the country's nuclear power expansion planning, five LILW disposal sites were planned to be constructed during 2016-2020, as has further made clear in the *Outline of thirteenth Five-Year Plan for National Economic and Social Development of the People's Republic of China*（OTNSPRC).

B-30 There have been two solid LILW disposal sites in operation in China. The efforts for siting of solid LILW disposal repositories are being conducted, under the organization of the CAEA, in provinces where multiple NPPs are located in such as Fujian, Zhejiang, Guangdong, Liaoning and Shandong.

B-31 Nuclear technology application radioactive wastes temporary storage facilities are constructed in 31 provinces, autonomous regions or municipalities countrywide to store the disused sealed sources arising, within their respective scope, from industry, agriculture, medicine, education and research fields. Provincial environmental protection agencies have set up special-purpose organizations staffed with specialists or professionals who are responsible for

oversight disused sealed sources and environmental monitoring. It has been known from the National Radiation Regulation System for Nuclear Technology Applications in operation for many years that, as of December 31st 2016, a total of 40341 disused sealed sources have been collected and stored in as many as 31 provincial repositories for nuclear technology applications, 84448 in the national centralized disused sealed sources storage facility of disused radioactive source, and 27320 returned to the original manufacturers. In meanwhile, the manufacturers are licensed to undertake the practices of recycle and reuse of Co-60, Cs-137, Am-241/Be and Pu-238/Be disused sealed sources.

C. SCOPE OF APPLICATION (Article 3)

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 defense programmers, 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 defense programmers if and when such materials are transferred permanently to and managed within exclusively civilian programmers.

4. This Convention shall also apply to discharges as provided for in Articles 4, 7, 11, 14, 24 and 26.

C.1 Applicability to Spent Fuel

C-1 This report shall apply to the management of spent fuel arising from the operation of civilian nuclear reactors, but not to those held at reprocessing facility.

C.2 Applicability to Radioactive Waste

C-2 This report shall apply to the management of radioactive waste arising from the operation of civilian nuclear reactors and civilian nuclear fuel cycle facilities, and to the management of disused sealed sources (including ^{226}Ra disused sealed sources) arising from nuclear technology application, but not to the management of radioactive waste containing naturally occurring radioactive materials (NORMs) and those due to nuclear technology applications.

C.3 Applicability to Spent Fuel and Radioactive Waste from Defense or Military Programs

C-3 This report shall not apply to the management of spent fuel and radioactive waste arising from military or defense programs.

C.4 Applicability to Effluent

C-4 This report shall apply to the discharge of gaseous and liquid radioactive effluents described in Articles 4, 7, 11, 14, 24 and 26 of this Convention.

D. INVENTORIES AND LISTS (Article 32-2)

This report shall also include:

i) a list of the spent fuel management facilities subject to this Convention, their location, main purpose 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 location, main purpose 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 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 Spent Fuel Management Facilities

D-1 There are a total of 37 spent fuel storage facilities in place to serve, separately, 35 nuclear reactors at 14 NPPs in China, as listed in Annexes L.1.1.

D-2 A total of 3 spent fuel storage facilities were constructed to give the service to 13 research reactors that are operated by 3 operators, as listed in Annexes L.1. 2.

D.2 Inventory of Stored Spent Fuel

D-3 As of 31 December 2016, China's NPPs have produced a total of 4,501.4 tons of spent fuel held in pool storage at-reactor, 1348.4 tons of spent fuel held in dry storage facility, as shown in Annexes L.2.1.

D-4 The spent fuel, 0.527 tU, associated with research reactors are stored in the at-reactor pool, see Annexes L.2.2.

D-5 As of 31 December 2016, there is not any spent fuel disposal activity occurred in China.

D.3 Radioactive Waste Management Facilities

D.3.1 Radioactive Waste Treatment and Storage Facilities

D-6 Wide variety of radioactive waste treatment and storage facilities have been constructed by the end of December 31st 2016, including 58 by the 14 NPP operators, 10 by the 3 research reactor operators and 13 by the 4 operators of nuclear fuel cycle facilities, as shown in Annexes L.3.1-L.3.3.

D-7 In addition, 31 temporary storage facilities of radioactive waste arising from nuclear technology application have been constructed, together with 1 country's centralized facility for disused sealed sources, as shown in Annexes L.3.4.

D.3.2 Radioactive Waste Disposal Facilities

D-8 There are two solid LILW disposal sites in operation, as shown in Annexes L.3.5.

D.4 Radioactive Waste Inventories

D-9 As of December 31st 2016, the conditioned radioactive waste that has been stored is 12762.4 m^3 in the radioactive waste storage facilities by the NPP operators, as listed in Annexes L.4.1.

D-10 As of December 31st 2016, the conditioned radioactive waste that has been stored is 2707.6 m^3 in the radioactive waste storage facilities by the research reactor operators, 408.9 m^3 in those by the operators of nuclear fuel cycle facilities, as listed in Annexes L.4.2.

D-11 As of December 31st 2016, there have been 40341 disused sealed sources stored in 31 temporary storage facilities of radioactive waste arising from nuclear technology applications and 84448 in the national centralized disused sealed sources storage facility, listed in Annexes L.4.3.

D-12 As of December 31st 2016, there have been a total of 13524.4 m^3 of solid LILW accepted at two solid LILW disposal sites, listed in Annexes L.4.4.

D.5 List of Nuclear Facilities under Decommissioning

D-13 Since the last report, there has not yet been any nuclear facility in decommissioning.

E. LEGISLATIVE AND REGULATORY SYSTEM

(Articles 18 to 20)

E.1 Implementing Measures (Article 18)

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

E-1 For the purpose of extending the effort to fulfill the China's commitment to the Joint Convention and to implement its obligations under the Joint Convention, the Chinese Working Group for Joint Convention Implementation (CWGJCI) was formed, under the approval of the State Council, to undertake the responsibility for organizing and coordinating the fulfillment of the Joint Convention. The CWGJCI is composed of Ministry of Environmental Protection/National Nuclear Safety Administration (MEP/NNSA), China Atomic Energy Agency (CAEA), Ministry of Foreign Affairs, Ministry of Public Security (MPS), the National Health and Family Planning Commission (NHFPC) and the National Energy Administration (NEA). The CWGJCI is headed by the MEP/NNSA, with the CAEA as the deputy Group head. The CWGJCI's Secretariat is based in the Department of International Cooperation under the MEP.

E-2 In order to prepare the National Report to the Joint Convention, a National Report Review Committee (NRRC) and a National Report Writing Group (NRWG) were established. The NRRC consists of the experts relevant to the safety of spent fuel management and the safety of radioactive waste management. Under the guidance of the CWGJCI, the NRRC and the NRWG organize (1) to prepare and review China's National Report to the Joint Convention, (2) to initially review China's questions to the National Reports of other Contracting Parties, (3) to review the questions to China's National Reports by other Contracting Parties, and (4) to prepare for, take part in, summarize and take the follow actions to the next Review Meeting to the Joint Convention.

E.2 Legislative and Regulatory Framework (Article 19)

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 of spent fuel and radioactive waste management activities;

(iii) a system of prohibition of the operation of a spent fuel or radioactive waste management facility without a licence;

(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 licences;

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

Safe management of activities involving radioactive materials comprises two inseparable aspects: radiological protection and nuclear safety.

E.2.1 Legislative Framework

E-3 Under the *Legislation Law of the People's Republic of China* (LLRPC) and consistent with the statutory power and procedures, China established and maintained a legislative framework governing the safety of spent fuel management and the safety of radioactive waste management, that incorporates a comprehensive set of the relevant national laws, administrative regulations, departmental rules, management guides and reference documents, as shown in Figure 1. The laws applicable to the safety of spent fuel management and the safety of radioactive waste management are developed and promulgated by the National People's Congress Standing Committee (NPCSC); administrative regulations are developed and issued by State Council as mandated by the National Constitution and the relevant laws; departmental rules are developed and issued by environmental protection authority, nuclear facility authority and health and family planning authority, under the State Council, as mandated by the relevant national laws, regulations and responsibility assignment; the management guides are developed and issued by the relevant departments of the

State Council. Reference documents are developed and issued by the State Council's subsidiary departments or its mandated agencies.

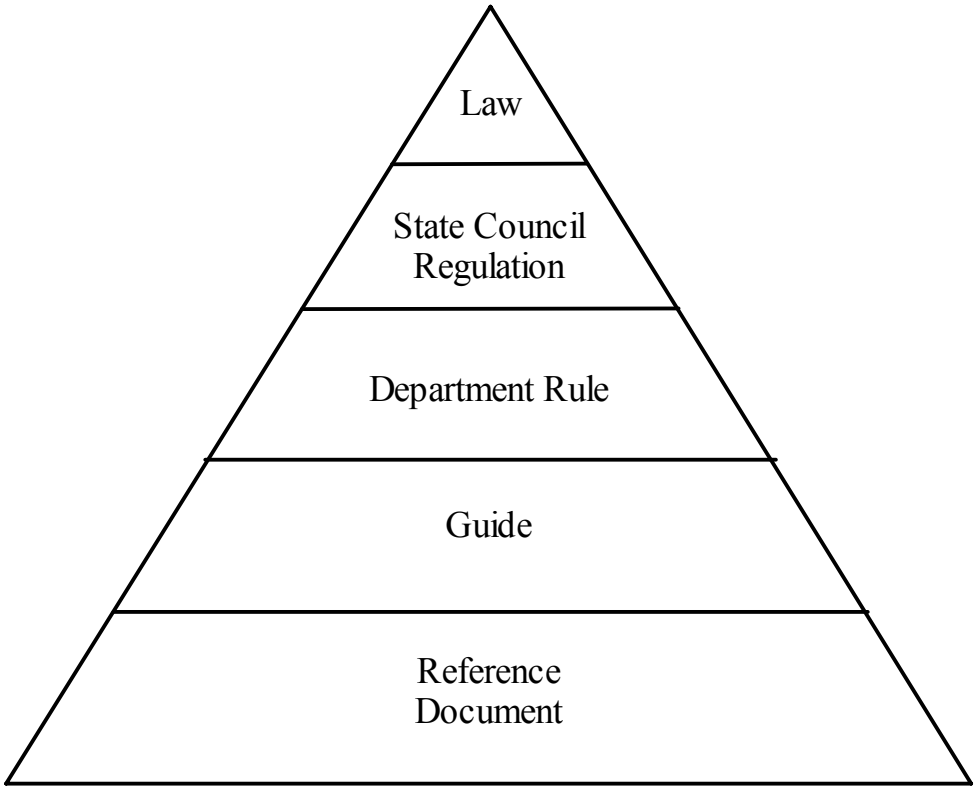

Figure 1 Legislative Framework System in China

E-4 The laws, regulations and rules that have been in effect applicable to such purpose set forth the safety requirements for the management of spent fuel and radioactive waste, which are:

- *Law of the People's Republic of China on Prevention and Control of Radioactive Pollution* (LPCRP), enacted by the NPCSC in 2003;

- *Regulations of the People's Republic of China on Safety Control of Civilian Nuclear Installations* (HAF001), issued by the State Council in 1986;

- *Regulations on Safety and Protection of Radioisotope and Ray-generating Installations* (RSPRRI), issued by the State Council executive meeting in 2005; and

- *Regulations on Safety of Radioactive Waste Management* (RSRWM), issued by the State Council executive meeting in 2011.

E-5 The laws, regulations, rules, guides applicable for such purpose can be seen in L.5.1 ~ L.5.4.

E-6 In addition, a series of technical standards were issued by the relevant governmental departments, which has further defined and made clear the

technical requirements for the management of spent fuel and radioactive waste such as:

- The *Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources* (GB18871-2002), which stipulates the basic requirements of radiation protection and radiation source safety, which apply to the protection of workers in intervention and practice and the safety of radiation sources.

- The *Regulations for Radioactive Waste Managemen*t (GB 14500-2002), which laid down the management objective and basic requirements for the generation, collection, pre-treatment, treatment, conditioning, transportation, storage, disposal and discharge and for the decommissioning and other activities related to the environment and the politics.

E-7 Technical standards applicable to such purpose are listed in Annexes L.5.5.

E-8 The laws, regulations, rules, guides issued since the last Review Meeting are as follows:

(1) Departmental rules

- Regulations on the *Safety of Nuclear Power Plant Design*, revised by the MEP/NNSA in October 2016;
- *Regulatory Requirements for Nuclear Safety of Spent Fuel Dry Storage System at NPPs* (RRNSSFDSSN) (trial)*;*
- *Principles on Classification of Nuclear Fuel Cycle Facilities and their Basic Safety Requirements,* (trial), by the MEP/NNSA in January 2016;
- *Notification on Normalized Management of the Workers at Critical Positions in Nuclear Technology Field,* issued by the MEP/NNSA in February 2015;
- *Projects Management Methods of the Funds for Treatment and Disposal of Spent Fuel from Nuclear Power Plants* (PMMFTDSFNPP);
- *Regulations on Management of Nuclear Emergency Exercise;*
- *Rules on Management of Nuclear Emergency Training*;
- *Management Method of Nuclear Accident Information Release, by the NNAECC in December 2015;*

- *Methods of the Management of Public Involvement in Environmental Protection*（MPIEP*).*
- *Guidance on the public communications on nuclear technology application project* (trial) by the MEP/NNSA in October 2015; and
- *Implementation Methods on Regulatory Inspection of the environment Impact Assessment bodies of Nuclear and Radiation Construction Project* by the MEP/NNSA in March 2016*;*

(2) Management guides

- *Radioactive Waste Minimization at Nuclear Facility* (HAD 401/08-2016).

E.2.2 Regulatory Framework

E-9 The followings are implemented under the LPCRP, HAF001, RSPRRI and RSRWM:

(1) The licensing regime of spent fuel and radioactive waste management activities has been established, banning the operation of a spent fuel and radioactive waste management facilities without licenses concerned:

- Nuclear facility safety licensing system is implemented in China. The MEP/NNSA is responsible for establishing and approving the granting of nuclear facility safety licenses. These include nuclear facility siting censor position paper，nuclear facility construction license, nuclear facility operation license, and nuclear facility decommissioning permit. Nuclear facilities here refer to NPPs, research reactors, other nuclear fuel cycle facilities, and radioactive waste treatment and/or disposal facilities. The licensees of these facilities must apply for the construction and operation license and for authorizations for siting, fueling and decommissioning, prior to carrying out such activities. No activity can be started for construction, fueling, operation and decommissioning unless the licenses for such activities have been granted after review and approval of regulatory authority.

- Graded licensing system is implemented in China. The operators of production, distribution and use of radioactive sources must apply for radiation safety licenses. The licenses for the producers of radioactive sources and the users of Category I radioactive source (excluding medical users of Category I source) are reviewed, approved and granted directly by MEP/NNSA, whereas the licenses for the users of Category II, III, IV and V by environmental protection agencies at provincial level.

- The operators dedicated exclusively to the storage and disposal of solid radioactive waste must apply for licenses of such activities. The licenses of such activities are reviewed, approved and granted by the MEP/NNSA.

(2) The system of institutional control, regulatory inspection and documentation and reporting has been established:

- A radioactive contamination monitoring system is implemented in China, such as gaseous and liquid radioactive waste release licensing system, effluent and environmental monitoring system, and nuclear accident emergency system and so on. Additionally, the certificate management systems are exercised for the regulatory inspection personnel and the qualification management systems are for the technical professionals engaged in critical positions of nuclear safety.

- The NNSA and its regional branches implement routine inspection, non-routine inspection and daily inspection, and dispatch inspection personnel (or group) to the manufacture, construction and operation fields for implementation of regulatory mission. Under the LPCRP and the RSRWM, the environmental protection departments of the people's governments at or above county-level, jointly with other related departments, implement regulatory inspection of the safety of radioactive waste treatment, storage and disposal activities.

- The operators of nuclear facilities implement file management of testing procedures, operational procedures, QA records, testing results and data, operation and maintenance records, defects and abnormal events; the producers, distributors and users of radioactive sources establish their own relevant management accounts, personal dose files, occupational heath surveillance files; the operators of solid radioactive waste storage and disposal facilities establish records and files of radioactive waste storage and disposal activity as it was.

- The operators of nuclear facilities, nuclear technology application and solid radioactive waste storage report truthfully, as required by the MEP/NNSA, the status of radioactive waste's generation, discharge, treatment, storage and clearance and delivery for disposal. The operators of solid radioactive waste disposal facilities are required to report, prior to 31st March every year, to the related departments the situations about waste acceptance and disposal and facility operation in the previous year.

- In the event of a nuclear and radiation emergency, the operators of nuclear facilities must report immediate the emergency event to the related departments; the operators of nuclear technology application should report immediately the

related departments if found radioactive source(s) lost or stolen; the operators of solid radioactive waste storage and disposal facilities should report the related departments the found hidden safety hazards or potential accident.

(3) The regulations and licensing provisions are enforced on spent fuel and radioactive waste management are enforced in China. For the license holder who violates the regulations and licensing terms and conditions, the NNSA has the right to take compulsory measures when necessary or order the license holders to take safety measures or stop the activity endangering the national safety. Depending on their seriousness, the NNSA shall give warning for improvement within a time limit, or order to halt or stop operations for rectification, or order to revoke license for punishment; for the license holder who would not carry out the decision on punishment and not to prosecute overdue, the NNSA shall apply to the people's court for compulsory execution.

(4) The assignment of responsibilities is clearly defined for various administrative departments in aspects of spent fuel and radioactive waste management are clearly defined. The competent administrative department for environmental protection under the State Council exercise overall regulatory control over the radioactive pollution prevention work throughout the country. The CAEA is responsible for developing the policy, regulations, plan and standards, and for organizing the related nuclear emergency works and for coordinating and pushing forward the capability construction concerned. The competent administrative department of public health under the State Council and other relevant departments, according to the duties specified by the State Council, are responsible for the oversight and administration of the spent fuel and radioactive waste management (see E.3 and E.4).

E-10 Under the *Activity Concentration for Materail not Requiring Radiological Regulation* (GB27742-2011), the *Clearance Levels for Recycle and Reues of Steel and Aluminum from Nuclear Facilities* (GB17567-2009) and GB18871-2002, the MEP/NNSA treats the wastes containing higher radioactivity than regulatory level as those that shall be under the regulatory control, in such a way so as to protect the individuals, society and the environment from the harmful impact from ionization radiation and to keep a consistent goal with the objective of the Joint Convention.

E.3 Regulatory Body (Article 20)

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.

E-11 China's independent regulatory bodies involved in spent fuel and radioactive waste management are MEP/NNSA, NHFPC, MPS and State Administration of Work Safety (SAWS)

E.3.1 Independency of Regulatory Body

E-12 In China, the independent regulatory bodies which are relevant to the safety of spent fuel management and the safety of radioactive waste management are the MEP/NNSA, NHFPC and MSP.

E-13 The responsibility assignment of various relevant regulatory bodies is defined clearly in the LPCRP, *Law of the People' s Republic of China on Prevention and Control of Occupational Disease* (LPCOD), HAF001, RSRWM and RSPRRI to ensure the independency of regulatory bodies. For example, the LPCRP stipulates that the competent authority of radiation protection under the State Council shall implement, by law, overall regulatory control of radioactive pollution prevention and control work countrywide and that the health and other related competent authorities therein shall be responsible for oversight and administration according to law. The HAF001 points out that the NNSA shall be responsible for making, approving and granting the nuclear facility safety permission certificates.

E.3.2 MEP/NNSA

E.3.2.1 MEP/NNSA Organizational Structure

E-14 MEP/NNSA consists of the headquarter, local surveillance or monitoring stations and technical support organizations, with its organizational structure illustrated in Figure 2.

E-15 The MEP/NNSA's headquarter is based in Beijing, with six regional branches in Shanghai, Shenzhen, Chengdu, Beijing, Lanzhou and Dalian, respectively, which are responsible for routine oversight of nuclear safety and radiation safety in designated areas.

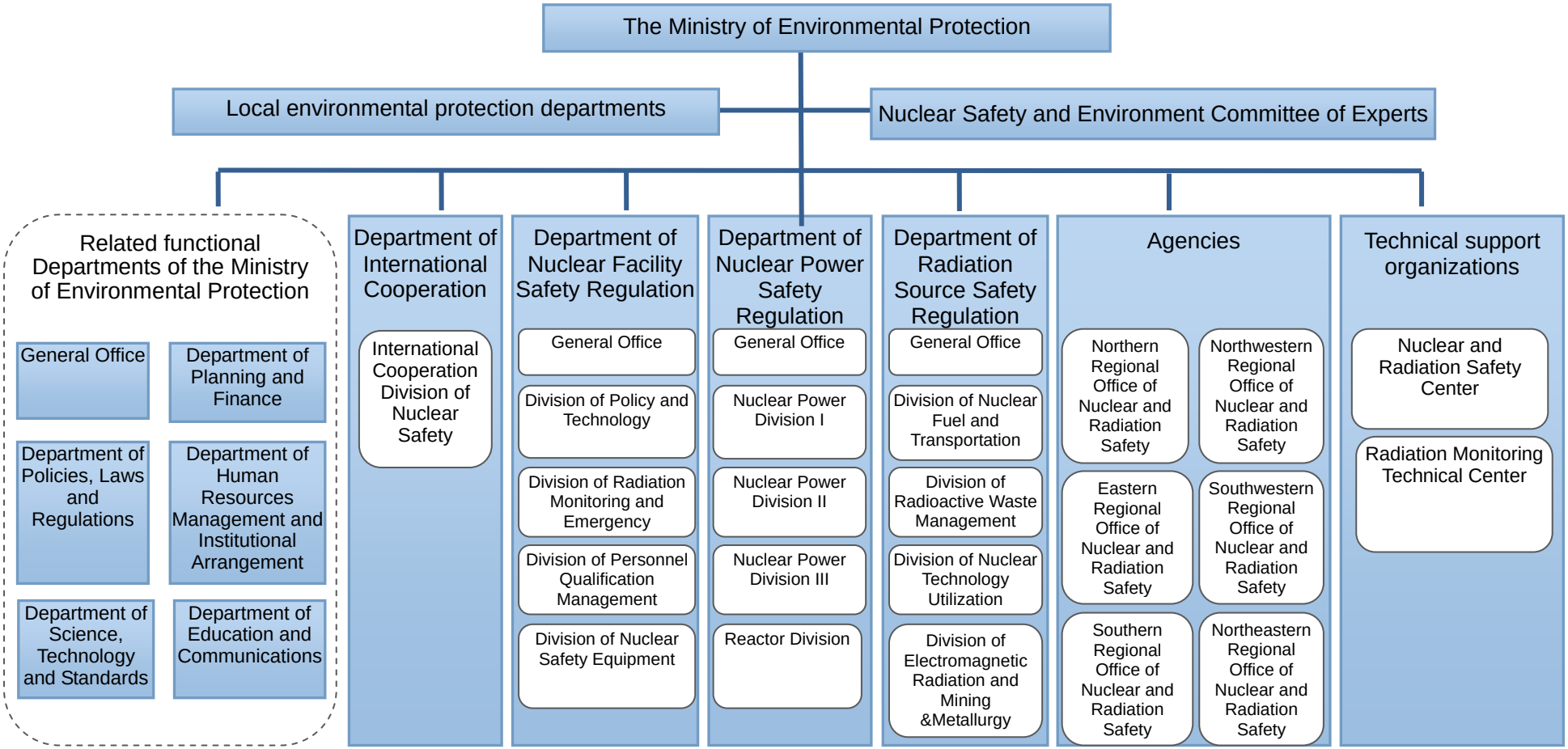

Fig. 2 Organization structure of the MEP/NNSA

E-16 The MEP/NNSA's specific routine work is undertaken, respectively, by its subsidiary Department of Nuclear Facility Safety Regulation, Department of Nuclear Power Safety Regulation, and Department of Radiation Source Safety Regulation.

E-17 In order to fulfill a better implementation of regulatory functions, the MEP/NNSA set up the Nuclear and Radiation Safety Center to provide technical support, and subsequently in 2011 added a Radiation Environmental Monitoring Technology Center to further strengthen the technical power for the radiation environmental monitoring and management countrywide. Additionally, the MEP/NNSA has also established long-term and reliable partnership with other technical support and assistant organizations.

E-18 An Expert Panel of Nuclear Safety and Environment was set up by the MEP/NNSA to provide technical support in drafting nuclear and radiation safety laws and regulations, developing nuclear safety technology/technique and implementing nuclear safety review and oversight.

E.3.2.2 MEP/NNSA Responsibilities

E-19 The MEP/NNSA has the following responsibility over the safety of spent fuel management and the safety of radioactive waste management:

(1) for regulatory control of nuclear and radiation safety; development of policy, planning, laws, administrative regulations, departmental rules, standards and criteria in relation to nuclear and radiation safety, electromagnetic radiation, environmental radiation protection, and nuclear and radiation accident;

(2) for overall regulatory control over nuclear facility safety, radiation safety, environmental radiation protection;

(3) for regulatory control over the licensing, design, manufacture, assembly and non-destructive testing of nuclear safety equipment; and for the safety inspection of imported nuclear safety equipment;

(4) for regulatory control of nuclear material regulation and physical protection;

(5) for regulatory control of radiation safety and environmental radiation protection against nuclear technology application projects, uranium (thorium) mines and naturally occurring radioactive materials (NORMs); and for radiation protection;

(6) for regulatory control of radioactive waste treatment and disposal safety,

and environmental radiation protection work; and for regulatory inspection of radioactive contamination prevention;

(7) for regulatory control of the safety of radioactive material's transportation;

(8) for the MEP/NNSA' nuclear and radiation emergency response, investigation and treatment; participation in prevention and deposition of nuclear and radiation terrorist events;

(9) for management of qualification of reactor manipulators and special nuclear process workers;

(10) for organizing and implementing of radiation environmental monitoring, supervisory monitoring of nuclear facilities and key radiation sources;

(11) for China's fulfillment of international convention on nuclear and radiation safety;

(12) for guiding the work at nuclear and radiation safety oversight stations.

E.3.2.3 Financial and human resources of MEP/NNSA

E-20 The MEP/NNSA' s annual financial budget at central headquarter level was, respectively, 350 millions RMB in 2014 and 2015, and later grew to 420 millions RMB in 2016.

E-21 By the end of 2016, there has been 100 workers in the headquarter office, 1000 and nearly 10000 workers, respectively, at the central level and local level.

E.3.3 The NHFPC

E-22 The NHFPC was established in 2013 through the government structural reform.

E-23 The NHFPC has, in regard to the safety of spent fuel management and the safety of radioactive waste management, the main responsibilities as follows:

(1) developing the laws and regulations concerning prevention and control of occupational diseases in conjunction with the departments concerned, and organizing to develop and issue national occupational health standards;

(2) being responsible for the regulatory control and administration of radioactive occupational disease in medical institutions;

(3) organizing the radiological injury diagnosis and treatment and the medical rescue in case of nuclear and radiation events; and

(4) being responsible for health emergency related to nuclear and radiation accidents.

E.3.4 Ministry of Public Security (MPS)

E-24 The MPS is, in the aspects of the safety of spent fuel management and the safety of radioactive waste management, principally responsible for

(1) reviewing and approving of on-road transport of spent fuel; and

(2) providing guidance on the investigation of the case of radioactive materials lost and/or stolen.

E.3.5 State Administration of Work Safety

E-25 The State Administration of Work Safety has the following responsibility over the safety of spent fuel management and the safety of radioactive waste management:

(1) developing the rules and standards relevant to occupational health in workplace within its responsibility scope;

(2) undertaking the its own responsibility in regulatory inspection of implementation of the "three simultaneous project", namely, the relevant radioactive waste management facilities should be simultaneously constructed together with their newly-constructed, reconstructed and extended projects in their design, construction and operation;

(3) undertaking the responsibility of granting the license of occupational health and safety; and

(4) fulfilling the responsibility of directing and coordinating the emergency assistance to the production safety.

E.4 Government Authorities for Nuclear Power Expansion

E.4.1 China Atomic Energy Authority (CAEA)

E-26 The CAEA is composed of the Department of Development and Comprehensive Affairs, the Department of Development and Planning, the Department of Systematic Engineering, Department of Nuclear Emergency and Safety, the Department of Technology and Quality, the Department of Foreign Affairs, the Department of International Cooperation, and Department of Coordination, together with National Nuclear Accident Emergency Office, Nuclear Materials Control Office, and Radioisotope Management Office. Among the technical centers affiliated to the CAEA are National Nuclear Emergency Technology Support Center, Nuclear Technology Support Center and National Nuclear Security Center.

E-27 Its main responsibilities are as follows:

(1) studying and proposing the policy and regulations concerning the peaceful use of atomic energy in China;

(2) studying and developing the development program, plan and industry standards concerning the peaceful use of atomic energy in China;

(3) organizing demonstration of major nuclear energy research projects and review and approval of the projects concerning the peaceful use of atomic energy in China, and supervising and coordinating the implementation of the major nuclear energy research projects;

(4) regulating nuclear materials, and conducting physical protection of nuclear facilities;

(5) reviewing and managing the export of nuclear materials;

(6) carrying out inter-governmental and international cooperation and exchange in the nuclear field, and, on behalf of Chinese government, join the IAEA and participating with the activities thereof;

(7) coordinating the responsibility of national nuclear accident emergency administration: and

(8) being responsible for nuclear facility decommissioning and radioactive waste management.

E.4.2 NEA

E-28 The NEA encompasses the Department of Comprehensive Affairs, the Department of Legal System and Structural Reform, the Department of Development and Planning, the Department of Energy Conservation and Technology Equipment Department, the Department of Electricity, the Department of Nuclear Power, the Department of Coal, the Department of Oil and Gas (National Oil Reserve Office), the Department of New and Renewable Energy, the Department of Market Regulation, the Department of Power Safety Regulation, the Department of International Cooperation, and the China Nuclear Power Development Center.

E-29 The responsibilities of the NEA are:

(1) taking the responsibility of nuclear power administration and organizing the development of laws and regulations on nuclear power;

(2) proposing nuclear power expansion program, access conditions, and technical standards, and causing them to be implemented;

(3) providing review comments on geographical distribution of NPPs and other major projects;

(4) organizing, coordinating and providing guidance on research efforts related to nuclear power;

(5) organizing the emergency arrangement in the event of nuclear accident at NPPs; and

(6) organizing intergovernmental exchange and cooperation in relation to nuclear power and the foreign negotiation and agreement between governments on peaceful use of nuclear energy.

F. OTHER GENERAL SAFETY PROVISIONS

(Articles 21 to 26)

F.1 Responsibility of the License Holder (Article 21)

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 licence and shall take the appropriate steps to ensure that each such licence holder meets its responsibility.

2. If there is no such licence holder or other responsible party, the responsibility rests with the Contracting Party which has jurisdiction over the spent fuel or over the radioactive waste.

F.1.1 General Responsibility of the Nuclear Facility Safety License Holder

F-1 Under the HAF001, the operators of the following facilities shall obtain the nuclear facility safety licenses:

(1) nuclear power plants, including NPP, nuclear thermo-electric plant, heat and steam supply plant;

(2) reactors other than nuclear power reactors, including research reactor, experimental reactor, critical device;

(3) nuclear facilities involving fuel production, manufacture, storage and reprocessing;

(4) treatment and disposal facilities of radioactive waste; and

(5) other nuclear facilities that shall be subject to strict oversight and management.

F-2 A spent fuel storage facility or a treatment or disposal facility of radioactive waste constructed together with a nuclear facility shall not be required to individually obtain nuclear facility safety license; a spent fuel storage facility or a treatment or disposal facility of radioactive waste not constructed together with a nuclear facility shall be required to obtain nuclear facility safety license;

F-3 under the HAF001, the operators of nuclear facilities should be responsible for the safety of nuclear facilities they operate, with the following main responsibilities:

(1) complying with the relevant national laws, regulations and technical standards to ensure the safety of nuclear facilities;

(2) accepting the regulatory control of nuclear safety by the MEP/NNSA and reporting safety situation and providing the related information in a timely and true manner;

(3) holding overall responsibility over the safety relating to nuclear facility, nuclear materials, the workers, the public and the environment.

F-4 The following measures shall be taken to ensure the license holders of nuclear facility safety to fulfill their responsibilities.

(1) the MEP/NNSA and its dispatched agencies are entitled to dispatch oversight group or personnel to the manufacture, construction and/or operation sties of a nuclear facility concerned to implement the regulatory mission of nuclear safety. They are tasked with verifying whether or not the safety documents submitted are consistent with the actual situations, inspecting whether or not the construction works are in accordance with the approved design, checking whether or not the management is in line with the approved QA program, inspecting whether or not the construction and operation of such a nuclear facility comply with the requirements provide for in both Nuclear Facility Construction License and Nuclear Facility Operation License, examining whether or not operating personnel have acquired with the ability to carry out safe operation and to exercise emergency plan, and so on; and

(2) the MEP/NNSA are entitled to take the compulsory measures, if necessary, to order a nuclear facility operator to take safety measures or terminate the activities endangering the safety. For the license holder who violates the regulations, the MEP/NNSA shall give warning for improvement within a time limit, or order to halt or stop operations for rectification, or order to revoke license for punishment.

F.1.2 General Responsibility of the Radiation Safety License Holder

F-5 The following responsibilities are under RSPRRI.

(1) disused sealed sources should be returned to the manufacturers, original exporters, or sent to storage or disposal facilities of solid radioactive waste;

(2) the manufacturers, distributors and users of radioactive sources should obtain radiation safety licenses.

(3) the holders of radiation safety licenses should be responsible for the protection and safety of radioactive sources they operate and assumes any legal

liability for any harm that such radioactive sources might cause.

F-6 The following measures will ensure that the holders of radiation safety licenses fulfill their liabilities or responsibilities.

(1) the competent environmental protection agencies of the people's governments at or above county-level shall work with other related agencies to implement regulatory inspection of the license holder within their responsibility scope.

(2) For the license holder who has not complied with the requirements provided for by the original license, the competent environmental protection agencies of the people's governments at or above county-level shall order for improvement within a time limit, or order to halt or stop operations for rectification, or order to revoke license for punishment. For the license holder who has illegal income, the proceeds concerned shall be confiscated and the appropriate penalties shall be imposed.

F.1.3 General Responsibility of License Holder for Solid Radioactive Waste Storage and Disposal

F-7 Under the RSRWM and the *Management Measures for Licensing the Storage and Disposal of Solid Radioactive Waste* (MMLSDSRW), the facilities dedicated exclusively to the storage and/or disposal of solid radioactive waste, including disused sealed sources, should be obtain the license for solid waste storage and/or disposal.

F-8 The operators dealing with the storage and/or disposal of radioactive waste arising nuclear technology applications should be involved with the relevant licenses.

F-9 Under RSRWM and MMLSDSRW, the license holder should take the responsibility for the safety of solid radioactive waste they store and dispose of.

F-10 The following measures ensure the license holder of solid radioactive waste to fulfill their responsibilities.

(1) the competent environmental protection agencies of the people's governments at or above county-level shall work, with other related agencies, to implement regulatory inspection of the safety of solid radioactive waste storage and disposal within their responsibility scope.

(2) for the license holder who has not complied with the requirements provided for by the original license, the competent environmental protection agencies of the people's governments at or above county-level shall order for

improvement within a time limit, or order to halt or stop operations for rectification, or order to revoke license for punishment. For the license holder who has illegal income, the proceeds concerned shall be confiscated and the appropriate penalties shall be imposed; contamination cleanup measures shall be taken within a time limit or a fine shall be imposed about for contamination cleanup.

F.2 Human and Financial Resources (Article 22)

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

i) qualified staff is 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.

F.2.1 Assurance of Qualified Workers

F.2.1.1 Human resource cultivation

F-11 The talent education and training plan has been under the vigorous development to strengthen the cultivation of all kinds of talents. Investments are increased in abundant talent reserves to meet the growing demand of nuclear energy and technology expansion for the availability of good human resources. By the way of government support and cooperation between the higher education institutions and some enterprises, a wide range and variety of professional disciplines are established, like nuclear engineering, nuclear technology, radiation protection and other related ones in these educational institutions, thus enlarge university enrollment scale of nuclear professionals and optimizing the structure of academic disciplines.

F-12 Nuclear power groups or enterprises, in combination with universities and research institutions, to explore and develop progressively the “order+joint cultivation” or “university+utility” education mode. Based on the “order+joint cultivation” mode, their subsidiary nuclear power enterprises sign employment intention agreement, every year, with a set number of full-time nuclear-related undergraduates at grader three of higher educational institutions. After graduation, these students will go to work in these nuclear power groups or their subsidiary enterprises with which they have signed agreement. The nuclear power groups or enterprises pay educational costs to

these educational institutions and provide the scholarships to the students concerned. On a basis of meeting undergraduate education program, these universities will arrange nuclear power-related curriculums for the students. Nuclear power groups or enterprises may select and send the related technical experts, providing teaching, practice supervising and graduation designing, to these educational institutions as part-time teaching staff. In terms of "university+enterprise" education mode is intended for higher educational institutions to enroll the examinees of fixed direction allocation, for which nuclear power groups pay the tuition and accommodation fees of students during school and to provide the targeted scholarships of nuclear industry. These students also can enjoy other types of scholarship which the non-fixed direction students enjoy and, after graduation, go to work in nuclear power groups.

F.2.1.2 Recruitment, Training and Examination of Staff in Nuclear Facilities

F-13 Under the HAF103, the operators of nuclear facilities implement the system of recruitment, training, re-training and delegation of the personnel engaged directly with the management of spent fuel and radioactive waste,

F-14 The operators of nuclear facilities efforts to recruit the professional talents necessary for the spent fuel and radioactive waste management in such manner as high school education, countrywide selection of senior specialists, employment of technicians from conventional power plants and other sectors in the country, and hiring foreign experts and so on.

F-15 The requirements for post qualification are defined in accordance with the relevant regulations, guides, and standards and on the basis of the post-specific task analysis. The training and retraining program and procedures are developed and implemented for those involved directly in spent fuel and radioactive waste management. The relevant personnel can carry out the relevant post with responsibility only after appropriate training, qualification inspection, and acquirement with post qualification certificate or authorization granted.

F-16 Validity period management is applied by the above operators to the qualification and authorization for personnel. After expiration of effective period, the extension and renewal of qualification certificates shall be made in accordance with the post-specific requirements. Furthermore, additional re-training and re-authorization are needed to ensure for the personnel to meet the post-specific requirements.

F-17 Both Chinese and foreign contractors shall be subject to the same

training, authorization and qualification during the operating lifetime of spent fuel and radioactive management facilities. They shall also be subject to strict control and supervision according to the contractor management policy.

F.2.1.3 Training and Examination of Radiation Safety Workers

F-18 Under the RSPRRI, a producer, distributor or user of radioactive sources shall provide training in safety and protection knowledge to its workers directly associated with production, distribution and use of such sources. Inspection shall be given to the trainee. The worker who would not pass the given inspection is not fit the job post with radiation safety related responsibility. The training program, in conjunction with training materials, was developed by the MEP/NNSA in such a way as to have an enhanced training management and consistent training and inspection requirements.

F-19 On the invitation of China, the IAEA has provided training to the trainers at eight national-level training institutions evaluated and recommended accredited by the MEP/NNSA in China. Meanwhile, provincial level environmental protection departments also sponsored radiation safety training within their regions. The trainees are divided into three levels according to the radiation risks they face in radiation safety work involved. The primary radiation safety training is implemented by the provincial level departments and the training at other two levels is undertaken by the above national-level training institutions. The qualified trainees need to accept re-training at four year intervals.

F-20 Since early 2014 to the end of 2016, the national-level training bodies provided more than 41,000 training opportunities.

F.2.1.4 Qualification, training and examination for nuclear and radiation safety regulatory inspection staff

F-21 Under the *Management Methods for the Regulatory Inspection Staff Certificate of Nuclear and Radiation Safety*, the MEP/NNSA implement identification of the staff who apply for and receive such a Certificate and give training and examination to them, including oral and written examinations. The qualified will be granted the Certificate for Nuclear Safety Supervisor or Certificate for Radiation Safety Supervisor by the MEP/NNSA. Both certificates are valid for five years.

F-22 The MEP/NNSA pays high attention to the training of nuclear and radiation safety regulatory inspection staff, with continued strengthening the training of nuclear safety and radiation safety regulatory inspection staff in many ways, for example, developing training program, enhancing the

on-the-job training of nuclear and radiation safety regulatory inspection staff, inviting international experts to present lectures on nuclear and radiation safety training in workshop or seminar, dispatching personnel to participate in short-term training workshop sponsored by foreign regulatory agencies and international organizations.

F-23 A certificate holder who applies for renewal of his (her) Certificate shall submit, through an authorized organization where he or she works in, the written application to the MEP/NNSA prior to March 31 or September 30 of each year, and on-the-job training will be attended. After reviewed by MEP/NNSA, the renewal Certificate will be granted when the requirements are met.

F.2.1.5 Registered Nuclear Safety Engineer System

F-24 Under the LPCRP, the qualification management system is applied in China to the professionals involved in radioactive pollution prevention and control. The *Temporary Regulations on Registration qualifications for Nuclear Safety Engineer* (TRRQNSE) was issued in November 2002. Under the TRRQNSE, the certified qualification system is implemented for the on-the-key-post technical workers in the organizations of nuclear energy and technology and nuclear technology service. The working scope of a Registered Nuclear Safety Engineer involves nuclear safety review, nuclear safety regulatory inspection, manipulation and operation of nuclear facility, nuclear quality assurance, radiation protection, environmental radiation monitoring and other activities related closely nuclear safety.

F-25 The national-organized examination is applied every year to those who have passed the systemic training and then apply for qualification examination. The qualified examinees shall be granted the Qualification Certificate of the People's Republic of China for Registered Nuclear Safety Engineer, with effective period of 2 years. Registered nuclear safety engineer shall be subject to the continued education system.

F-26 To ensure the safety of storage and disposal of solid radioactive waste, the RSRWM points out that the facilities dedicated solely to storage and/or disposal of solid radioactive waste should set up the organization with capability of ensuring the operation safety of such facilities; the storage facility should be staffed with more than 3 technicians involved in radioactive waste management, radiation protection and environmental monitoring, at least 1 of which is registered nuclear safety engineer; the LILW disposal facility should manned with more than 10 technicians working with radioactive waste management,

radiation protection and environmental monitoring, among which at least 3 are registered nuclear safety engineers; the facility for disposing of HLW and alpha waste should have more than 20 technicians working with radioactive waste management, radiation protection and environmental monitoring, at least 5 of which are registered nuclear safety engineers.

F.2.2 Financial Guarantee

F.2.2.1 Financial Guarantee for Operation and Decommissioning

F-27 In China, the cost required every year for carrying out the activities relating to safe operation of, and safety modification to, nuclear facilities, including spent fuel and radioactive waste management facilities, will be borne by the operators of such nuclear facilities. A certain amount of fees shall be raised from the revenues collected by every year of electricity generation as the facility's cost needed for the safety modification to such a NPP, the safe operation of spent fuel and radioactive waste management facilities, and final decommissioning activities. The yearly planning and financial budget of a nuclear facility attach higher priority to the project associated with safety modification.

F-28 The *Interim Procedures on Collection, Utilization and Management of the Funds for Treatment and Disposal of Spent Fuel at Nuclear Power Plants* (IPCUMFTDSFNPP) was issued in July 2010 by the CAEA together with the related departments. The said funds are intended for use in the treatment and disposal of spent fuel, involving (1) spent fuel transport, (2) spent fuel away-from-reactor storage; (3) spent fuel reprocessing; (4) treatment and disposal of HLW generated from such reprocessing, (5) construction, operation, modification and decommissioning of reprocessing plant, and (6) other applications related to such treatment and disposal. Funds are collected for the actual online sales electricity generated by NPPs after 5 years commercial operation. Such funds are charged into electricity generation costs for a NPP. By using such funds, the spent fuel transport capability building and the maintenance of spent fuel storage facilities are underway by the effort of the CAEA.

F-29 Under LPCRP and RSRWM, the operators of nuclear facilities and nuclear technology applications shall, as required by the competent department of environmental protection under the State Council, treat solid radioactive waste and liquid waste that cannot be purified for release to make them become stable and standardized solidified waste forms. Such wastes should be timely sent to licensed storage and disposal facilities of solid radioactive waste for

storage and disposal, while at the same time the incurred costs should be borne by the operators of nuclear facilities generating such waste,

F-30 Under the LPCRP, the operators of nuclear facilities shall prepare its decommissioning program, in which the costs to decommission shall be predicated and listed in the cost estimates or production costs. At present, decommissioning funds have been pre-appropriated for the operational NPPs in China, including spent fuel and radioactive waste management facilities at the NPP sites, with the account established for such funds. With reference to international conventions, the eventual decommissioning costs for nuclear facilities are determined to be 10% of final account for nuclear equipment online at the time such NPPs is completed in construction. The interest fees calculated, within the lifetime of NPPs using the actual interest rate method on the basis of the amortized costs of estimated liabilities, are charged into financial costs. At present, the above funds are managed on the part of NPPs and subject to the oversight of special regulatory bodies to prevent such funds from being used for other purposes.

F-31 China has established insurance regime for nuclear incident liability. Under the *State Council's Reply on Nuclear Accident Damage Compensation Liability* (SC Letter 64, 2007), all operators of such NPPs have bought insurance enough to fulfill their nuclear liability, during operation of NPPs or prior to spent fuel storage, transport and reprocessing. As the third part liability insurance, the highest compensation to injury or damage in the event of a nuclear incident is limited to RMB 300 million. If exceeding this limit, the highest financial compensation provided by the country is RMB 800 million.

F.2.2.2 Financial Guarantee for Post-closure of Disposal facilities

F-32 For radioactive waste disposal facilities that are closed in a normal condition, the surveillance responsibility for the post-closure active period rests with the license holder of such facilities, otherwise with the government of the locality during post-closure passive period. The costs required for the post-closure maintenance, monitoring and emergency response are covered in the disposal fees collected on the part of LILW disposal site.

F-33 Under the RSRWM and MMLSDSRW, the operator of a facility dedicated exclusively to disposal activities of solid radioactive waste, when applying for the license of solid radioactive waste disposal, (1) shall provide a matched amount of registered fund, with not less than RMB 30 million for solid LILW disposal facilities and not less than RMB 100 million for solid HLW and alpha waste; (2) shall have the capability of financial guarantee to ensure that

disposal activities shall persist to the end of safety surveillance period; and (3) the unit supplying financial guarantee shall bear the costs required for facility shutdown and safety surveillance in the case of the operator of the facility bankruptcy or license termination.

F.3 Quality Assurance (Article 23)

Each Contracting Party shall take the necessary steps to ensure that appropriate quality assurance programmers concerning the safety of spent fuel and radioactive waste management are established and implemented.

F.3.1 Basic Quality Assurance Requirements

F-34 Basic QA requirements are provided for under the *Regulations on NPP Quality Assurance Safety* (HAF003), which are applicable to the quality assurance of NPPs-generated spent fuel and radioactive waste management. The quality assurance for the management of spent fuel and radioactive waste from other nuclear facilities other than NPPs is implemented by reference to such basic requirements. The basic QA requirements are mainly as follows:

(1) to prepare and effectively implement overall QA program for nuclear facility and QA related sub-program for various tasks, to prepare written procedures, detailed rules and drawings and to provide periodic review and revision of them, making periodic management review to determine QA program's status and validity and, if necessary, to take appropriate corrective actions;

(2) establishing a licensed organization and/or body with clearly allocated responsibility and authority as well as and channel of internal and external communication; controlling and coordinating working interfaces between various organizations, controlling the selection, staffing, training and qualification inspection of personnel to ensure that the personnel acquire and maintain adequate technical skills;

(3) controlling the development, review, approval, circulation and renewal of all the documents necessary for the execution and verification of task in such a manner as to prevent the outdated and inappropriate use of such documents;

(4) controlling the process, interface, change of design and verifying design to ensure that prescribed design requirements are correctly presented on the technical specifications, drawings , procedures or instructions;

(5) controlling the development of procurement documents, evaluating and selecting the proper suppliers and controlling the procured items and services to ensure the said items are consistent with requirements of procurement

documents;

(6) identifying and controlling materials, spare components and components, controlling the loading, unloading, storage and transportation of items and taking appropriate maintenance related important items to ensure the quality of the said items are properly protected from being damaged;

(7) controlling technological processes affecting quality employed in design, fabrication, construction, test, commissioning and operation of nuclear facility to ensure that such processes are operated by qualified personnel using qualified equipment in the line with authorized procedures;

(8) establishing and effectively implementing the inspection and test program, verifying satisfaction of items and activity with specified requirements in order to demonstrate that the functions of the structure, system and components are in a satisfactory manner; controlling the selection, calibration, and operating conditions of the measuring and test equipment, and identifying and controlling the inspection, test and operating conditions;

(9) controlling the marking, review and treatment of items that do not satisfy requirements, prescribing the responsibility and authority for reviewing and treating them and making re-inspection of repaired items at work;

(10) identifying and correcting the conditions that may affect or has detracted from quality; for the conditions that has severe detracted from quality, corrective actions should be taken after investigation of cause in order to prevent re-occurrence;

(11) establishing and implementing the QA record system, controlling the codification, collection, indexing, filing, storage, maintenance and disposal of records to ensure that records are such clear, complete and correct as to provide the sufficient evidence to quality of items and activity; and

(12) establishing and implementing internal and external auditing system to verify the implementation and validity of QA program; corrective measures must be taken against the defects discovered during audit and the subsequent actions should be taken for follow-up and verification.

F-35 In addition, 10 QA safety guides are developed which provide complementary requirements and implementation recommendations for the above-mentioned basic requirements.

F.3.2 Quality Assurance for Spent Fuel Management

F-36 The systematic QA programs were developed by the operator of spent

fuel management facilities and submitted to the MEP/NNSA for recognition as part of license application documents.

F-37 All matters involved in the design and operation of spent fuel management facilities are implemented strictly as required by QA program. These matters include design and manufacture of important items and systems in spent fuel storage facilities, maintenance of sub-criticality of stored spent fuel, radiation protection, fuel heat removal, fuel shielding, erosion control, related operational procedures of nuclear material or fuel during commissioning, normal operation and in the event of predicated operation incident, maintenance, test, inspection and check of safety related equipment, record and documentation, radioactive waste management, record-keeping of fuel characteristics during storage, nuclear material safeguard system (when needed), and physical protection system and so on.

F-38 QA bodies, independent of other departments, are responsible for development, management, supervision and improvement of the QA program. They implement planned internal and external QA supervision, audit, review and assessment through which the defects existing in QA system can be found and improved in a timely manner. Meanwhile, further strict management shall be conducted by taking on non-conformance and corresponding corrective measures, collecting and analyzing of QA information and trend, and reporting the followed results periodically to the higher competent authorities. If necessary, the timely corrective actions shall be taken.

F-39 The management department provides periodic scrutiny on the suitability and effectiveness of QA programs. These departments focus attention on the internal and external oversight and inspection results within assessment period, together with the related information, such as quality problems, corrective measures, quality trend, incident and malfunction, personnel qualification and training, among others. Based on the problems found in the above scrutiny, like defects in QA program, management, and quality, they shall, by conducting reason analysis, prepare and implement specific corrective measures and notify the related departments and facilities in written form.

F.3.3 Quality Assurance for Radioactive Waste Management

F-40 Under the GB 14500-2002, the following steps are taken, by the operators of both nuclear fuel cycle facilities and nuclear technology application radioactive waste storage facilities, to ensure the development and implementation of QA program relevant to radioactive waste management and/or disused sealed sources.

(1) the operators of waste management facilities have developed QA program according to facility scale and complexity as well as the potential hazards of radioactive waste and/or disused sealed sources and thereby strictly implement management of radioactive waste and disused sealed sources in accordance with the QA program that has been reviewed and approved by the regulatory body;

(2) in order to ensure the implementation of QA program, the designer, constructor and operator of both nuclear fuel cycle facilities and nuclear technology application radioactive waste storage facilities have developed, and have been implementing, the relevant QA sub-program and other quality-related documents;

(3) in the process of developing and implementing the QA management documents, the above operators focused special attention to the personnel's education and provided training and inspection of these personnel in respect of safety culture; and

(4) QA program consists mainly of quality policy and system; organizations for developing and implementing of QA; control of design, construction, operation and commissioning of facilities; procurement control of materials and services; control of waste generation and sorting; identification and control of radioactive waste and/or disused sealed sources; control of technological parameters in the stages of waste management; control of documents and records; and oversight and inspection.

F.3.4 Quality Assurance for Near Surface Disposal of Radioactive Waste

F-41 There have been two solid LILW disposal sites in operation. Under the *Regulations for Shallow Ground Disposal of Solid Low and Intermediate-Level Radioactive Wastes* (GB 9132-1988) and the *Acceptance criteria for near surface disposal of radioactive waste*, (GB 16933-1997), the operators all prepared and have been implementing respective QA programs in siting, designing, construction and operation of the disposal sites, with representation of the QA inclusions and requirements for closure and post-closure institutional control period.

(1) during the time period from the beginning construction until the end of active institutional control period, the overall responsibility for facility safety rests with the operators. These operators have developed and implemented comprehensive QA program, which is subject to the recognition by the MEP/NNSA; and

(2) the comprehensive QA program takes account of the potential impacts of all safety-related activities, structures, systems and components upon a disposal facility. The QA program describes every step from planning, siting, design, construction, operation, and safety evaluation through to facility closure, permanent record-keeping and institutional control activities relating to disposal facility.

(3) QA for radioactive waste disposal acceptance is a part of a whole-process QA involving waste generation, treatment, storage, transportation and disposal. QA program is developed and implemented by waste generator and disposal facility operator with a view to ensuring a waste package in consistence with the disposal acceptance requirements. The waste disposal acceptance process is described in the QA program for waste disposal acceptance. The inspection and random test for waste disposal acceptance include document, appearance quality, sign, surface dose rate and surface contamination examination, as well as destructive or non-destructive test of waste package. Waste generator and disposal facility operator set up their respective QA departments in order to rigorously comply with the provisions of the GB 9132-1988 and the GB 16933-1997.

F.3.5 Regulatory Bodies' Primary Activity

F-42 The MEP/NNSA controls QA activities related to spent fuel and radioactive waste management safety in respects of:

(1) reviewing and recognition the QA programs for spent fuel and radioactive waste management and other types of safety related important documents, including their important revisions, as required of QA, safety regulations and other types of safety related guides;

(2) supervising the implementation of the QA program for spent fuel and radioactive waste management with respect to nuclear safety; selecting control points of the related quality plans in respect of the safety and quality-related major activities and overseeing them on-site; organizing technical review and demonstration of the results of such activities;

(3) organizing technical review of major non-conformance and oversee effectively the process of addressing such non-conformance.

F.4 Operational Radiation Protection (Article 24)

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 the workers and the public caused by the facility shall be kept as low as 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 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.

F.4.1 Keeping Radiation Exposure ALARA

F-43 Under GB 18871-2002, for radiation exposure from a given source in a practice, the optimization of protection and safety should be achieved. Taking account of socioeconomic factors, the doses to individuals, number of exposed individuals and the possibility of exposure are all kept as low as reasonably achievable (ALARA).

F-44 Under the *Regulations on NPP Operation Safety* (HAF103), the radiation exposure in nuclear facilities are ensured to have been kept at ALARA through the following measures taken:

(1) developing waste management program and report to the MEP/NNSA and other relevant agencies for approval;

(2) developing and practically implementing radiation protection program including prevention measures taken in management and technology, for

example environmental radiation monitoring and decontamination on personnel, equipment and structures and so on;

(3) checking whether or not radiation protection program is correctively implemented or the objective of the program is achieved through oversight, inspection and monitoring; and additionally revising the program as needed;

(4) deploying the qualified health physicists who have acquired with the knowledge of radiological protection in design and operation of spent fuel and radioactive waste management facility;

(5) deploying equipments or devices used for radiation protection monitoring in operational and accidental conditions, like the stationary dose rate meter, the monitoring system for measuring activity concentrations of radioactive materials in the air, the instrument and meter used for measuring surface radioactive contamination and individual dose and contamination;

(6) treating and/or storing spent fuel and radioactive waste in an appropriate way and condition;

(7) taking measures to reduce the amount and concentration of radioactive materials dispersed over on-site or released to the environment at a spent fuel or radioactive waste management facility;

(8) controlling the generation and release of radioactive effluent and waste in a reasonable manner and enhancing management of radioactive waste; and

(9) developing and periodically review effluent release limits, developing methods and procedures to monitor and control effluent release. In addition, off-site monitoring program is also developed.

F-45 The principled requirements that should be complied with in radiation protection in nuclear facilities are put forth by national nuclear safety regulatory bodies in a range of rules on the siting, design and operation of nuclear facilities.

(1) in siting of nuclear facilities, the public and the environment should be protected from excess radiation impacts caused by radioactive incident and while at the same time the account should be taken of radioactive release in normal conditions;

(2) the radiation protection requirements should be incorporated into the design of nuclear facilities, for example, optimizing the facility layout, arranging for shielding and reducing the activities and stay time of workers within radiation zone, and radioactive materials should be treated into proper

forms in appropriate ways and conditions ;

(3) amount and concentration of radioactive materials released to the site or environment should be reduced by taking measures;

(4) full consideration should be taken of possible accumulation of radiation level with time in worker stay area and minimizing the generation of radioactive waste and so on;

(5) the operators of nuclear facilities should make evaluation and analysis of radiation protection requirements and situation in such facilities, and develop radiation protection programs to ensure the verification of whether or not such programs is implemented and the established goal is achieved in such manners as oversight, inspection and inspection, take corrective measures when needed; and

(6) functional departments of radiation protection should develop and implement radioactive waste management program and the environmental monitoring program and carry out assessment of environmental radiation impacts.

F.4.2 Dose Limits

F-46 The GB18871-2002 sets forth the radiation protection principles, requirements and the dose limits, which are consistent with the ICRP Publication 60 and the BSS developed by the IAEA.

F-47 The individual dose limits to workers and the members of key group of population are as follows:

—Occupational exposure

(1) annual average effective dose limit of 20 mSv is prescribed by regulatory body, averaged over 5 consecutive years, rather than any traceable average;

(2) annual effective dose limit should not exceed 50 mSv in any single year;

(3) annual equivalent dose limit for lens of the eye is 150 mSv; and

(4) annual equivalent dose limit for extremities or skin is 500 mSv.

—Public exposure

(1) annual effective dose limit is 1 mSv；

(2) in special circumstances a higher effective dose value of 5 mSv could be allowed in a single year, provided that the annual average over defined 5 successive year periods does not exceed 1 mSv;

(3) annual equivalent dose limit for lens of the eye is 15 mSv; and

(4) annual equivalent dose limit for skin is 50 mSv.

F-48 Dose constraints have been respectively set by all nuclear facilities taking account of economic and social factors, which are less than the relevant national limits.

F-49 As has been shown by the monitoring results of occupational exposure, the annual effective doses to workers in China's operating NPPs are less than the national relevant limits. Annexes L.6 indicates the annual effective doses to the NPP workers for the time period 2014-2016

F.4.3 Preventing Unplanned or Uncontrolled Release of Radioactive Materials to the Environment

F-50 Under the *Technical Requirements for Discharge of Radioactive Liquid Effluents from Nuclear Power Plant* (GB14587-2011) and the *Management of Radioactive Effluents and Waste Arising from Nuclear Power Plant* (HAD401/01), the following measures are taken by the operators of NPPs to prevent unplanned or uncontrolled release of radioactive materials to the environment:

(1) based on the environmental characteristics at NPP sites and the technological level at which radioactive waste could be treated and in compliance with ALARA principle, the amounts of radioactive effluent to be released are applied to the MEP/NNSA for authorization prior to the first fueling (afterwards reviewing at 5 year regulars);

(2) total annual amount released by a NPP is controlled on a basis of quarter and month, with the total quarterly amount released not exceeding half of the annual amount authorized and the total monthly amount released less than one fifth of the total annual release amount;

(3) pool discharge is employed for liquid radioactive effluent while air-borne radioactive effluent needs to be purified or stored for decay before released into the environment via stack;

(4) for the purpose of locating the discharge outlet of liquid radioactive effluent, several considerations are taken into account, such as downstream water collection point, and thermal and radionuclide discharge, to keep away from centralized water collection point, aquatic breading site, migratory route, fishery and other environmentally sensitive zones;

(5) discharge of liquid radioactive effluent is controlled based on

radionuclide concentration, for which optimal practicable technology is considered and is optimized in combination with site condition and operational experience feedback;

(6) effluent monitoring program is developed, in line with which air-borne and liquid effluents are monitored;

(7) liquid radioactive effluent in pool is monitored prior to be discharged with automatic alarm and release control devices are also installed on the discharge pipelines; and

(8) reliable QA system is established by the operators of NPPs, and suitable measuring equipment and approach are deployed for effluent monitoring in normal operational condition.

F-51 The corresponding measures were taken by the operators of other nuclear facilities to prevent unplanned and uncontrolled release of radioactive materials.

F.4.4 Discharge Limits

F-52 Under Article 40 of the LPCRP, discharge of gaseous and liquid radioactive waste must be consistent with the national standards on prevention and control of radioactive pollution.

F-53 *Regulations for Environmental Radiation Protection of Nuclear Power Plants* (GB6249-2011) sets forth the specific requirements for the release of airborne and liquid effluents from on-land stationary NPPs in the normal conditions, as follows:

(1) the effective dose to any individual of the public arising from all nuclear power reactors at any site must be less than 0.25 mSv dose constraint; the dose management goal values for air-borne and liquid effluents should be set, respectively, by the operators of NPPs in accordance with the values of dose constraints authorized by the national regulatory bodies;

(2) the total annual release amount of radioactive effluents should be controlled on the one-reactor basis; the control values for a 3000 MW (thermal) reactor are shown in Table 2 and 3;

(3) the control values for a larger-than or less-than 3000 MW (thermal) reactor should be adjusted appropriately; and

(4) for multiple same reactors at one site, the total annual release from all

units should be controlled up to a fourfold increases; for multiple various reactors at one site; the total annual release from all units should be controlled according to the authorization by the MEP/NNSA.

Table 2 Control of airborne radioactive effluents (Bq/a)

	LWR	HWR
Inert gas	6×10^{14}	
Iodine	2×10^{10}	
Particle (halflife≥8d)	5×10^{10}	
Carbon 14	7×10^{11}	1.6×10^{12}
Tritium	1.5×10^{13}	4.5×10^{14}

Table 3 Control of liquid radioactive effluents (Bq/a)

	LWR	HWR
Tritium	7.5×10^{13}	3.5×10^{14}
Carbon 14	1.5×10^{11}	5.0×10^{11} (other than tritium)
Other nuclides	5.0×10^{10}	

F-54 In the time period 2014-2016, the percentage of annual release of radioactive effluents from China's NPPs to the annual limit authorized by the MEP/NNSA is shown in Annexes L.7, indicating the releases of radioactive effluent from NPPs are all less than the relevant national limits.

F.4.5 Corrective Measures for Unplanned or Uncontrolled Release of Radioactive Materials to the Environment

F-55 Regarding unplanned or uncontrolled release, as have been pointed out in the RSRWM, the operator of solid radioactive waste storage and/or disposal facilities should conduct radioactivity monitoring for groundwater, surface water, soils and air around the facility. If any hidden danger to safety is discovered to have occurred or any radionuclide content in the ambient environment is in excess of relevant national standards, the necessary precautionary measures should be taken immediately after identification of cause while at the same time such situation should be reported to the relevant competent body. If a radiation accident would be rated, then emergency response plan for such facility should be activated and accordingly reported to the relevant bodies under the relevant laws and regulations so as to carry out accident emergency work.

F-56 Since the last Review Meeting, no unplanned or uncontrolled release of

radioactive materials has occurred in China.

F.5 Emergency Preparedness (Article 25)

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 at an 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.

F-57 China has already developed the emergency plan and conducted the corresponding emergency exercise, at a suitable frequency, in response to (1) the severe deviations from operational conditions unlikely to occur at nuclear facilities or associated nuclear activities inside and outside the territory of the country, to (2) the potentially resulting radioactive releases, with significant radiological consequences, that are likely occur or would have occurred, and to (3) the events in which radioactive source is lost, stolen or out of control, or radioisotope is out of control, therefore leading to abnormal exposure of radiation to person.

F.5.1 Emergency Preparation for Nuclear Accident

F.5.1.1 Emergency plan for nuclear accident

F-58 Under the *Law of People's Republic of China on Dealing with Emergency Event* (LDEE), the *Law of the People's Republic of China on Prevention and Control of Radioactive Pollution* (LPCRP), the *Regulations on Nuclear Accident Emergency Management at Nuclear Power Plant* (RNAEMN), the *Emergency Preparedness and Response of NPP Operators* (EPRNPO), and the *Emergency Preparedness and Response of Nuclear Fuel Cycle Facility Operators* (EPDNFO), three-level organization regime is implemented in China for nuclear emergency response at national, provincial, and facility levels.

F-59 At the national level, the *National Nuclear Emergency Plan* (NNEP, revised) was issued by the State council in June 2013 and in effect. It is not only applies to nuclear incidents occurring at nuclear facilities within territory of China and caused by the associated activities, but also to those that could have occurred outside the territory of China but could have led, and have potentials to lead, to impacts on the mainland of China.

F-60 At the NNAECC members' and provincial level, the members of the

NNAECC and relevant provincial authorities all have improved their respective special emergency plans and prepared associated off-site emergency plan in accordance with the NNEP (revised).

F-61 the nuclear facility operators have prepared their respective onsite emergency plans and, prior to first fueling, submit them together with final safety analysis report to the MEP/NNSA for review and approval. Emergency plan should be re-reviewed and revised during nuclear facility operation.

F-62 Additionally, at the nuclear group level, the CNNC, the China General Nuclear Power Group (CGN) and the State Power Investment Corporation (SPIC) all establish, in May 2014 and May 2015, their respective nuclear accident emergency assistance teams and meanwhile prepared their emergency plans and related emergency response implementation procedures.

F.5.1.2 Nuclear accident emergency exercise

F-63 Under NNEP, the nuclear accident emergency organizations at various levels should carry out nuclear emergency exercise through desktop and actual maneuvers to test, maintain and enhance emergency ability in response to nuclear accident. The nuclear accident emergency joint exercise at the national level will be implemented under the coordination of the NNAECC, generally once every three to five years. Provincial level nuclear accident emergency exercise will be organized by provincial nuclear accident emergency committee for implementation, normally once every two to four years. Nuclear facility emergency exercise will be organized and implemented under the deployment of nuclear facility emergency headquarter, generally once every two years, but with appropriate addition for the site with more than three units. Prior to first fueling, the nuclear facility operators all participate with the onsite and offsite joint exercise organized by provincial nuclear accident emergency committee.

F-64 The NNAECC launched the country-level Shendun-2015 joint exercises of nuclear emergency on June 26th 2015. Simulating the scenario of limited release of radioactive material to the environment from a NPP, a wide range and variety of exercises and drills were carried out under the organization and direction of various nuclear emergency agencies at national- provincial- and nuclear facility-levels, including coordination, analysis and judgement, off-site emergency assistance, information release, and emergency response actions and so on. According to this exercise, the ability of response to nuclear and radiation unexpected events was fully checked, the nuclear accident emergency assistance teams were exercised. IAEA, France, Pakistan and Hongkong all appointed person to view and emulate this exercise.

F-65 Several nuclear accident emergency exercises and drills in combination with associated offsite emergency organizations were conducted, one each in 2014 at Fuqing NPP, Fangjiashan NPP and Changjiang NPP, in 2015 at Fangchenggang NPP and in 2016 at Dayabay and Ling'ao NPPs.

F-66 During 2014 to 2016, full-range on-site nuclear accident emergency exercises were conducted each at Qinshan NPP, Hongyanhe NPP, Ningde NPP, Tianwan NPP and Qinshan NPP base and Dayabay NPP base.

F.5.2 Emergency Preparation for Radiation Accident

F.5.2.1 Emergency Plan for Radiation Accident

F-67 Chinese laws and regulations on radiation accident emergency include LPCRP, HAF001, MMSPRRI, and *National General Emergency Plan for Environmental Emergency Events* (NGEPEEE) etc. Radiation accident refers to those in which radioactive source is lost, stolen or out of control, or to those in which radioisotope is out of control causing abnormal exposure of radiation to person, or to those in which radioactive material is leaked causing environmental contaminated. According to the nature, severity, controllability and impact extent of a radiation accident, they are classified into exceptionally serious radiological accidents, major radiological accidents, serious radiological accidents and ordinary radiological accidents.

F-68 Environmental protection departments of people's governments at or above county level should prepare radiation accident emergency plan governing the areas under their jurisdiction in conjunction with departments of public security, health and family planning, finance, news and press. These departments should submit the prepared emergency plans to the local people's governments at the same level for authorization. Such plans should present emergency agency, responsibility assignment, emergency personnel training, emergency rescue equipment, funds, materials reserve, radiation accident classification, emergency response measures, radiation accident investigation, reporting and treatment procedures, radiation accident information disclosure, pubic communication plan, etc.

F-69 The holders of radiation safety license prepared emergency plans based on the estimated risks of radiation accident for their own respective facilities and are ready for emergency.

F-70 When finding radiation accident or operation malfunction likely to result in radiation accident, the holder of radiation safety license should start emergency plan and take emergency measures, while at the same time fill in a preliminary report to the local governments within two hours. If a radiation

accident would have taken place, the holder of license should also report to local governments, public security departments and health and family planning departments.

F-71 Under RSPRRI, graded response and graded treatment are implemented against radiation accident in China. While accident taking place, the local governments at or above county level should, based the radiation accident classification, activate and implement the relevant emergency plans. The government departments above county level, including environmental protection, public security, and health and family planning, should make all-out effort to take effective and timely measures in the event of radiation emergency within their respective responsibility scope.

F.5.2.2 Emergency exercise and drill for radiation accident

F-72 The MEP/NNSA officially launched in 2014 country-wide joint radiation accident emergency exercises and drills at provincial-level on a rotational basis. By the end of 2016, there have been 17 provincial environmental protection departments, like Beijing, Shandong, Liaoning, Guangxi and Innner Mogolia, to conduct a wide range and variety of radiation accident emergency exercises in response to different situations on different scales. These activities were organized by the MEP/NNSA's regional branch stations under the guidance provided by the MEP/NNSA. In order to strength the experience exchange in emergency between various provinces, both the on-scene observation and online video of such emergency exercises were organized in real time among the provinces concerned. After conclusion of exercises, the talks on evaluation and exchange were held.

F-73 The scenarios of exercises that have been so far already completed by various provinces involve different types of radiation emergency activities, such as the safety of radioactive source management, the search and collection of lost radioactive sources, disposal of beyond-standard radioactive articles for transboundary motion. These exercises fully demonstrated the emergency plan for radiation accident with regard to its program system, organizational system, assurance system, equipment system and coordination system, therefore progressively implementing the main responsibility of local governments concerned and training local emergency personnel team.

F.5.3 Emergency Preparation in Response to Radiation Events outside the Boundary

F-74 When a nuclear accident to have occurred outside the boundary may have potential impact upon the country, the NNAECC shall, under the NNEP,

make unified arrangements to implement emergency responses, consisting of information gathering and release, radiation monitoring, discussion and coordination between departments, analysis and judgement, control at ports, market control, international notification and assistance etc. If necessary, the national headquarter for nuclear emergency should be formed to implement the unified leadership, organization and coordination of nuclear emergency.

F.6 Decommissioning (Article 26)

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.

F-75 Nuclear facility decommissioning is equipped with qualified personnel. Under the *Safety Requirements for Decommissioning of Nuclear Facility* (GB/T 19597-2004), the management organizations of nuclear facility decommissioning are all provided with proper number of decommissioning experts and original operational and management personnel of the facility to be decommissioned. Among the nuclear facility decommissioning workforce are professionals and experts involved in operation, decontamination, robot or remote manipulator, engineering technology, dismantling and demolition, quality assurance, waste management, and security and safety.

F-76 Nuclear facility decommissioning is provided with enough financial resource. Under LPCRP, the costs required to decommission shall be predicated and listed in the cost estimates or production costs. At present, decommissioning funds have been pre-appropriated for the operational NPPs in China, including spent fuel and radioactive waste management facilities' decommissioning at the NPP sites. For instance, the eventual decommissioning costs for Daya Bay NPP is determined to be 10% of original assets value online at the time it was completed in construction.

F-77 Radiation safety measures are considered and implemented in nuclear facility decommissioning to ensure limited release. Under GB/T 19597-2004, independent radiation safety organizations have been set up in all nuclear facilities and safety management is implemented in the line with proper safety procedures. In preparatory phase of decommissioning, the radiation protection

program was prepared, involving abnormal decommissioning conditions and emergency measures; special radiation safety equipment, technical procedures, administrative procedures are employed in accordance with actual conditions; division of facility zone to be decommissioned, division and management of sub-zone were carried out according to radiation level, contamination level or radionuclides; appropriate safety system and necessary radiation monitoring meters were deployed, including isolation room and/or shutter, to keep the doses to workers and the public ALARA; radiation safety measures are used, like effective ventilation and air purification devices; radiation monitoring is performed including effluent monitoring; limits and control are imposed to doses to worker and the public. Management should be made, as specified by the relevant laws and regulations, of gaseous and liquid effluents from nuclear facilities in the process of decommissioning.

F-78 Emergency preparedness is implemented for nuclear facility decommissioning. Under GB/T 19597-2004, the operators of nuclear facilities should, based on specific situations, prepare and implement the emergency plans that might be in response to the abnormal conditions likely to occur. Such emergency plans should incorporate the potential event-related emergency procedures and personnel training among others. Emergency procedures should be updated through emergency drill and test.

F-79 Documentation important to nuclear facility decommissioning should be reserved. Under GB/T 19597-2004, the operators should implement appropriate and most recent QA program. In preparing the QA program relating to decommissioning project, attention should be paid to collection and preservation of documents and data. The records on all decommissioning projects should be long-term preserved.

G. SAFETY OF SPENT FULE MANAGEMENT

(Articles 4 to 10)

G.1 General Safety Requirements (Article 4)

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 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 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 In China, the primary responsibility of spent fuel management safety rests with the operators of NPPs, research reactors and spent fuel storage facilities. Under HAF001, the operators shall hold the overall responsibility for nuclear facilities they operate, including spent fuel management facility, and shall be subject to the supervision of the nuclear safety regulatory bodies.

G-2 The safety of management of spent fuel stored at NPP reactors are subject to the provisions of the *Regulations on the Safety of NPP Siting* (HAF101), HAF102, HAF103, and *Design Criteria for Pressurized Water Reactor Spent Fuel Storage Facilities at Nuclear Power Plant* (EJ/T 883-2006).

G-3 The safety of management of spent fuel at research reactor shall be subject to the requirements of the *Regulations on Research Reactor Design Safety* (HAF201) and the *Regulations on Research Reactor Operation Safety*

（HAF202）.

G-4 The safety of management of spent fuel away from reactor shall abide by the provisions of *Regulations on Civilian Nuclear Fuel Cycle Safety* (HAF301) and *Design Criteria for Spent Fuel Storage Pool away from Reacto*r (EJ/T878-2011).

G-5 For the management of spent fuel stored at reactor and/or away from reactor at NPPs and research reactors, the following measures are taken to reduce as much as possible undue burden over the future generations:

(1) avoid as much as possible actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation. Vitrification shall be implemented of liquid HLW generated from spent fuel reprocessing and the vitrified waste forms shall be disposed of in deep geological formation. Under RSRWM, the deep geological disposal facility for solid HLW should meet safety isolation requirements of more than 10,000 years after its closure; and

(2) avoid as much as possible imposing undue burdens on future generations. The CAEA, in conjunction with other related agencies, issued in July 2010 the *Interim Procedures on Collection, Utilization and Management of the Funds for Treatment and Disposal of Spent Fuel a*t Nuclear Power Plants (IPCUMFTDSFNPP). The funds mentioned here are intended for the costs needed for spent fuel transportation, away-from-reactor storage, reprocessing and resultant HLW disposal, the construction, operation, reconstruction and decommissioning of reprocessing plant and the treatment and disposal of spent fuel. China is striving to construct a large sized reprocessing plant.

G.1.1 Requirements for Management Safety of Spent Fuel Stored at Reactor at NPPs

G-6 As required by HAF102, RRNSSFDSSN (trial), *Management of core and fuel at NPPs* (HAD103/03), and EJ/T 883-2006, the following measures are taken to ensure enough protection of individuals, society and the environment from radioactive hazards during all phases of spent fuel management at NPPs:

(1) to ensure that the criticality issues are solved properly. The major measures to be taken are to comply with the layout that has been approved, meet the requirements for neutron absorbers in storage facility, implement relevant QA program and ensure the inventory of spent fuel less than the maximum capacity of storage. Here, neutron absorber may be fixed thin plate as absorber or boron-containing water in storage pool.

(2) to ensure that the residual heat release are addressed properly. Considerations are taken into account, such as the maximum capacity of storage pool, burnup, radioactive decay, design the cooling capacity of spent fuel pool, so as to ensure the redundancy of cooling system to a certain degree; to provide with suitable systems of water make-up and drainage to achieve forced cooling function and maintain the required water temperature, as well as equipped with restorable ability for the loss of cooling capability; to consider the coolant flow required to derive maximum decay heat of fuel assembly in design of spent fuel rack; and

(3) to ensure the amount of radioactive waste generated is kept as low as practicably achievable. The major measures to be taken are to use stainless steel and other materials as fuel pool liner to ensure leak tightness of spent fuel pool; select proper surface roughness of liner for convenient decontamination, consider possibility of container falling on spent fuel assembly in design of container loading and unloading pool to provide collision; provide monitored zone with necessary monitoring and decontamination equipment to prevent occurrence of unacceptable contamination; to prevent contaminated cooling water from leakage; to make the equipment and materials that may contact with water compatible with pool water; to provide damaged fuel with storage equipment;

(4) to consider interdependent relationship between various steps. The spent fuel drawn from reactors is stored temporarily in storage at NPPs and then sent to centralized storage facility or to reprocessing facility. The spent fuel sent to the centralized facility will be also sent to reprocessing facility. Type, burnup, cooling period and other characteristics of spent fuel are all considered in devices and transport operations involved in every stages of the spent fuel management. In this process, the applicants should submit detailed technical documents to evidence the measures taken can ensure the safety of spent fuel management in every stage.

(5) to ensure providing effective protection of individuals, society and the environment. Complying with the Departmental Rules on the siting, design and constructions of NPP, the operators perform management of spent fuel facilities, implement QA program approved by the MEP/NNSA and meet the dose constrains approved by the MEP/NNSA.

(6) to adequately consider potential biological, chemical and other hazards. During the normal operation, the temperature in pool should be kept at safety level to make workers conformable. Fuel plant should be designed and

constructed in such a manner to have capability of preventing local fire spread.

G.1.2 Requirements for Management Safety of Spent Fuel Storage at Research Reactor

G-7 Under the HAF201and HAF202, the following measures are taken to ensure enough protection of individuals, society and the environment against radioactive hazards during the all phases of spent fuel management at research reactor:

(1) to ensure that the criticality issues are solved properly. The major measures to be taken are to provide adequate place to store research reactor spent fuel, to store spent fuel assembly in accordance with approved procedures and assessed layout, set fixed absorber (such as boron carbide aluminum plate) in storage pool, or neutron absorber dissolved in pool water, and implement required supervisory and management procedures.

(2) to ensure that the residual heat release issues are dealt with properly. The major measures to be taken are to ensure smooth flow of coolant in design of rack and storage pool, employ forced or natural circulation approach to release residual heat and set water make-up equipment with some redundancy.

(3) to ensure the amount of radioactive waste generated is kept as low as practicably achievable. The major measures to be taken are to set purification system, control composition of cooling medium, prohibit weights from moving over fuel storage zone, limit crane operation at required minimum height, periodically examine crane, monitor leakage from pool, and individually store and timely treat the damaged and leakage spent fuel.

G-8 Additionally, the interdependent relationship between different steps in spent fuel management is taken into account in much the same way as nuclear power plant to ensure provide enough protection of individuals, society and the environment and take full consideration of the potentials of biological, chemical and other hazards relative to spent fuel management.

G.1.3 Requirements for Spent Fuel Storage Away-from-reactor

G-9 Requirements and recommendations on away-from-reactor spent fuel management are provided in the HAF301, RRNSSFDSSN (trial) and EJ/T878-2011, with special emphasis on the safety of dry storage or pool storage. The main points are as follows:

(1) to maintain the sub-criticality of spent fuel. The basic objective of design away-from-reactor spent fuel pool is to ensure spent fuel to be kept at subcriticality in normal and accidental conditions. The main measures include

the analysis of the likelihood and consequences of fuel movement and high-density storage or internal and external events that are likely to affect subcriticality, by firstly adopting geometrically safe system, then using maximum fuel burnup and taking into account moderator density change in criticality calculation;

(2) to ensure heat removal. The design basis of pool water cooling system is aimed at keeping bulk water temperature to be not higher than 40℃. After cooling system could have failed to work, the cooling system shall recover to normal conditions before pool water temperature exceeding the design limit;

(3) to ensure the amount of radioactive waste generated is kept at as low as actually achievable. The major measures to be taken include the assurance of integrity of spent fuel cladding, deployment of several systems, such as the multiple secondary barriers and purification system, the cooling systems of primary, secondary, tertiary coolant loops, and the pool water leakage monitoring, collection and return system.

G-10 QNPP III's spent fuel interim dry storage facility is an away-from-reactor dry storage facility, with the following main features:

(1) spent fuels removed from HWRs contain too low content of U-235 and Pu-239 to reach criticality;

(2) MACSTOR-400 module is storage container capable of passive heat removal, which can make spent fuel cladding temperature not to exceed the specified limits under natural convection conditions;

(3) during storage and subsequent transportation, spent fuel is shielded with provided pool water, workbox, transportation cask and concrete. Such shield can assure the safety of workers and the public; and

(4) in addition to spent fuel cladding, both fuel basket and storage cask also provide shield to radioactive materials, thus ensuring containment of radioactive materials.

G.2 Existing Facilities (Article 5)

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.

G-11 To ensure the safety of the existing facilities, the MEP/NNSA shall, prior to their construction and operation, conduct the review and on-field inspection of the environmental impact statement submitted by the operators, along with safety analysis report and other related submittals. During operation of a facility, the MEP/NNSA shall, together with its subsidiary regional branch stations, conduct regulatory inspection of nuclear safety on a routine or non-routine basis. Additionally, the operator of a NPP shall conduct re-assessment of safety systems at its NPP at a regular interval.

G.2.1 Review of Facility Safety

G-12 Under HAF001, prior to construction and operation, the operators of existing NPPs and research reactors all prepared and submitted to the MEP/NNSA the environmental impact statements, preliminary safety analysis reports, final safety analysis reports, nuclear facility QA programs, nuclear facility commissioning program, nuclear accident emergency plans and other related documents.

G-13 The MEP/NNSA mandates its technical support organizations to review the submittals, such as environmental impact statements and preliminary safety analysis reports, etc., from such operators and to carry out onsite inspection. After such review and inspection, the findings of technical support organizations shall presented to the nuclear and radiation expert panel for further review. Subsequently, the panel shall form review results. Based on these findings and review results, the MEP/NNSA shall decide whether or not approve the above application presented by the operators.

G-14 After having approved by the MEP/NNSA, the operators of existing NPPs and research reactors begin construction and operation of such facilities including spent fuel management facilities.

G.2.2 Regulatory Inspection of Facility Safety

G-15 MEP/NNSA, together with its regional branch stations, exercises routine and non-routine inspection of nuclear safety, so as to verifying and overseeing whether or not nuclear operators' facilities, material items and activities meet the regulatory requirements of nuclear safety and license

requirements, causing the operators to correct defects and abnormal conditions and ensuring facilities, material items and activities consistent with approved documents and requirements.

G-16 March to December 2011, a full-range of civilian nuclear facility safety inspection countrywide was conducted including NPPs and research reactors.

G-17 The inspection results have shown that China's NPPs have capability to prevent and mitigate accident occurring to some extent that risks of safety are under control and safety is safeguarded. Based on the discoveries in the inspection, the requirements for safety improvement are proposed. Depending on the importance and feasibility of safety modification, the short- medium- and long-term plans are separately developed, which require and urge the modification task to be completed on the schedule. With aim to normalize the safety modification at various NPPs with common features, MEP/NNSA issued of in June 2012 the *General Technical Requirements for Nuclear Power Plant Modification following Fukushima Accident* (GTRNPPM) (trial), as guidance on follow-up actions for improvement.

G-18 GTRNPPM (trial) puts forward technical requirements for monitoring of spent fuel pool water, encompassing monitoring method and extent, monitoring meters and availability of systems. It also provides for technical requirements for emergency feedback system and related equipment at NPPs, pointing out that residual heat removal should be carried out using emergency feedback water in secondary and primary loops and in spent fuel pool.

G-19 In compliance with the requirements mentioned above, all operators of NPPs developed implementation procedures. By the end of 2016, all of these operators have completed their own projects of safety improvement on the schedule.

G.2.3 Periodic Safety Review of Operational NPPs

G-20 Under HAF103, the operators shall, based on the gained operational experiences and on the new significant safety information from related sources throughout operating lifetime, conduct systematic re-assessment of NPP safety in accordance with management requirements. The HAF103 also specifies that the above re-assessment shall be based on periodic safety review. Periodic safety review targeted at operational NPPs has been listed in the license review requirements for NPPs

G-21 Safety review, conventional and specific, and periodic (10 years

normally) safety review of China's existing NPPs are conducted by their operators under *In-commissioning examination of NPPs* (HAD103/07) and *Periodic safety review for NPPs* (HAD103/11). The period safety review is conducted after 10 years of NPPs' operation, subsequently once a decade or so, until the end of facility lifetime. The periodic safety review covers all aspects of NPP safety, namely all in-plant facilities, structures, system and components covered in the operation license, as well as personnel allocation, organizational structure, emergency plan, radiation environmental impacts and other safety elements relevant to nuclear units, including spent fuel management facilities.

G-22 The second 10-year periodic safety review to the QNPP was conducted in 2011 and the first 10-year review to QNPP II and QNPP III was also conducted in the same year. The second 10-year periodic review to Daya Bay NPP was conducted in 2012. The scope of review covers design and actual aspects of spent fuel handling and storage systems, spent fuel storage pool cooling and purification systems, together with enough relevant documents and records. Modification approaches are suggested to improving the identified deviation and weakness. Timely improvements were made in such a way as to raise the safety and reliability of system.

G.3 Siting of Proposed Facilities (Article 6)

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 facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 4.

G.3.1 Review and Approval of Spent Fuel Storage Facility Site

G-23 Under the HAF001, prior to constructing a nuclear facility, the license of construction shall be obtained. One of the prerequisites of obtaining nuclear facility construction license is that the site selected has been approved by environmental department and planning department of the State Council or provincial government and national nuclear safety department.

G-24 China has established a comprehensive set of licensing process for site selection as follows:

(1) the applicant shall submit the MEP/NNSA the site safety analysis report and environmental impact statement in the siting phase of a NPP, including the analysis and assessment of spent fuel storage facility;

(2) the MEP/NNSA's technical support organizations shall conduct review of these submittals, giving written comments;

(3) based on applicant's answered questions and revised version of above documents, the reviewing organizations shall write their review comments on above both documents (or review reports) and submit to the MEP/NNSA;

(4) the MEP/NNSA shall organize the expert panel of nuclear safety and the environment to review the both reports revised and presented by the applicant along with the review comments or review report provided by reviewing organizations; and

(5) based review comments above, the MEP/NNSA shall grant site use permit and the EIA approval to the applicant and copy them to other related departments.

G.3.2 Siting of Spent Fuel Storage Facilities

G-25 Under LPCRP, all nuclear facilities, encompassing both the at-reactor and away-from-reactor spent fuel storage facilities built for NPPs and research reactors, have passed scientific demonstration and licensing procedures with respect to their siting. Prior to undergoing licensing procedures, the environmental impact statements have been prepared and submitted to MEP/NNSA for approval.

G-26 Under HAF101, HAF201, HAD301 and other related nuclear safety guides, in the process of siting the existing spent fuel storage facilities, the following tasks are completed:

(1) evaluating the natural and human factors that may influence the safety of spent fuel management facilities in their lifetime. The former includes, such as industrial, transportation and military facilities in the surrounding environment,

hurricane, tornadoes, lightning, hail, freezing rain, snow and tropical cyclones, rainfall-caused floods, earthquake-caused waves, broken liquid-retaining structure-caused floods and waves, potential volcano, earthquake rupture, slope instability, ground subsidence, subsidence and uplift, earthquake, soil liquefaction, the plane crash, significant natural phenomena and extreme conditions. The latter includes plane crash, chemicals explosion and other important man-made events, etc.

(2) evaluating the impacts on the safety of individuals, society and the environment arising potentially from spent fuel management facilities. Evaluating potential release of radioactive materials; using suitable models to evaluate the atmospheric dispersion of radioactive materials, the potential impacts of contaminated surface water on local population and the migration of radionuclides in hydrogeological unit, potential impacts of contaminated groundwater on local population and the ability of mitigation measures required to be taken under accident condition, including emergency plan;

(3) providing the pubic with the information on the safety of spent fuel management facilities. Under the LPRCEIA, GIOGEIACP (trial) and TMPIEIA, the applicants in the phase of NPP siting shall disseminate the information on NPP project construction to the public at internet websites and on the publicly available media. The information mainly included potential impacts of the construction project on the environment, countermeasures and actions to prevent and mitigate adverse environmental impacts, summary of assessment conclusions. The applicants also initiatively announced the environmental impact assessment statement to the public and solicited the public comments. For example, before submitting environmental impact assessment report on QNPP III's spent fuel interim dry storage facility, the applicants disseminated the main content of the report to the public through the local media for comment collection. They also held the public meetings, briefing the situation of construction projects, exchanging the main assessment results with each other, collecting and answering questions. Among the stakeholders participating in meetings are professionals, representatives of enamoring communities and surrounding villagers. MEP/NNSA makes all information of the environmental impact assessment statement available to the public when accepting such a statement, make public the proposed comments on approving or disapproving such a statement before final decision, and open the information on licensing process to the public after making final decision.

(4) real-time continuous monitoring sites are established around proposed

sites for air environment, marine environment, territorial water environment, soil, organisms, and electromagnetic radiation during site election of a nuclear facility equipped with spent fuel storage pool or during siting independent spent fuel storage pool. The data concerned data are made available to the public at regular intervals. In doing so, it is convenient for neighboring countries to know necessary information in a timely manner and thus evaluate potential impact that may be imposed from the proposed nuclear facilities based on such information.

(5) Chinese NPPs are almost located in the eastern and southern coastal areas, with spent fuel storage facilities built on site. No impacts upon any other Contracting Parties could be from its current spent fuel storage facilities, for which appropriate steps have been taken in consistent with the General Safety Requirements as stated in G.1.

G.4 Design and Construction of Facilities (Article 7)

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 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 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.

G.4.1 Design and Construction of Spent Fuel Management Facility at NPPs

G-27 Under HAF102, RRNSSFDSSN (trial), EJ/T883-2006, *Safety Requirements for Decommissioning of Nuclear Facilities* (GB/T 19597-2004), GB18871-2002 and GB 6249-2011, the following main measures were taken in the design and construction of spent fuel management facilities at NPPs in addition to preventing criticality and ensuring residual heat removal.

(1) the engineering technological measures were taken for the purpose of release restriction and planned release. These measures include segregation and filtration, controlling iodine and other radioactive materials below the required limits, making airflow to be controlled within fuel building, controlling release from fuel handling room at minimum limits, filtering gaseous waste before released to stack, installing airborne radioactivity monitoring system, monitoring and controlling dispersion of contaminants, setting drainage sump

leading to liquid radioactive waste treatment system, monitoring and controlling liquid radioactive waste release to the environment, and preventing storage facility from being submerged.

(2) conceptual plan of decommissioning was considered. The structures, equipment and systems in spent fuel storage facility were designed to consider future convenient decommissioning of nuclear facility as a whole. The preliminary decommissioning plan for nuclear facility, along with spent fuel management facility, were developed and submitted to the higher competent authorities. The inclusions of the plan encompass considerations of basic safety issues, expected decommissioning strategy, the impacts of the current or proposed technology on facility to be decommissioned, arrangement of systems sheared between the facilities under decommissioning and in service, impacts of decommissioning process on the environment, management of decommissioning wastes, decommissioning costs and their raise, and assurance agencies.

(3) experience, test, and analytical means were used to support the technology to be employed in design and construction of spent fuel management facility. The NNSA-approved engineering design specifications were used as the acceptance criteria of systems and components. Facility design was guided on the basis of operational experiences in combination with safety analysis and safety research outcomes. Design basis for significant safety items were developed and confirmed through iterative process.

G-28 Under RRNSSFDSSN (trial) issued in 2015, the design and operation of a spent fuel dry storage system, as a newly added auxiliary system to a NPP, must be consistent with the Regulations HAF102, HAF103 and the *Detailed rules for the regulations of the People's Republic of China on regulating nuclear materials* (HAF501/01), as well as the Standards GB18871-2002, GB6249-2011 and *Nuclear criticality safety for fissile materials outside reactors* (GB15146). An on-site spent fuel dry storage system（SFDSS) at a NPP shall complies MEP/NNSA's relevant guiding documents with regard to its design, construction, operation and decommissioning.

G.4.2 Design and Construction of Spent Fuel Storage Facilities at Research Reactors

G-29 Under HAF201, the following main measures were taken in the design and construction of spent fuel management facilities at research reactors in addition to preventing criticality and ensuring residual heat removal.

(1) the measures with capability to prevent radioactive materials from being

released to the environment were taken. Adequate systems of containment, ventilation, filtration and decay were put in place in spent fuel storage facility. Both radiation monitoring system and ventilation system, along with necessary filtration system, were installed in place where radioactive concentrations were higher. Adequate sampling measures were provided.

(2) decommissioning of reactors along with their spent fuel storage facility should be put into consideration in the phases of design and construction in order to release the decommissioned site for future unrestricted use. The measures to facilitate decommissioning and demolishing should be considered. Suitable materials were selected as building materials of structures, systems and components required so as to minimize the generation of radioactive wastes and to facilitate decontamination. Account was taken of the facilities necessary for managing radioactive wastes generated from decommissioning.

(3) experience, test, and analytical means were used to support the technology to be employed in design and construction of spent fuel facility. Sufficient safety analysis and assessment were applied to the design of spent fuel storage facilities at research reactors to demonstrate enough safety, and necessary functional tests were conducted for all safety-related important items.

G.4.3 Design and Construction of Away-from-reactor Spent Fuel Storage Facilities

G-30 Under HAF301 and EJ/T878-2011 the following main measures were taken in the design and construction of nuclear fuel cycle facilities, along with spent fuel management facilities, in addition to preventing criticality and ensuring residual heat removal.

(1) primary barrier system, multiple secondary barrier system, pool water purification system, containment system, ventilation system, waste gas filtration system, and adequate radiation monitoring equipment were put in place to control concentrations and amounts of radioactive material to be released to the environment.

(2) decommissioning plans were developed, with associated measures being designed, including easy decontamination and demolition of contaminated plants and equipment, minimization of radioactive waste and contaminated equipment generated in amount and number, and keeping radiation dose to workers at ALARA.

(3) the technologies that have been proven by test and engineering to be effective were employed to conduct safety analysis and assessment in respect to

design. Account should be taken of ergonomics, especially, operation, control and limitation of the systems and parts important to safety.

G-31 Fuel basket and storage cask within module were designed and manufactured for QNPP III's spent fuel interim dry storage facility to confine radioactive materials during storage of damaged spent fuel bundles. Two different preliminary decommissioning plans were considered for spent fuel interim dry storage facility, postponed module demolition and released site for unrestricted use. Both covered the issues related to demolition, decontamination, and site restoration, including materials selection, facility design and layout, radioactive materials handling and storage, etc.

G.5 Safety Analysis of Facilities (Article 8)

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).

G-32 Under LPCRP and HAF001, prior to applying for construction and operation licenses of proposed nuclear facilities and for decommissioning authorization, the operators of such nuclear facilities should prepare environmental impact statement and submit them to competent environmental authority under the State Council for review and approval. Prior to construction, such operators should submit the MEP/NNSA nuclear facility construction written application, preliminary safety analysis report and other related documents. Prior to operation, such operators should submit the MEP/NNSA nuclear facility operation written application, final safety analysis report and other related documents. No fueling and commissioning operations can be carried out until the relevant authorizations have been granted.

G-33 Under *Detailed Rules of the People's Republic of China on Regulating Civilian Nuclear Facility Safety I —Application and Granting of NPP Safety Licenses* (HAF001/01), applying for NPP construction license needs submittal of (1) approval letter to NPP feasibility study report, (2) approval letter to NPP environmental impact statement earlier one month than construction license granted, (3) preliminary safety analysis report for NPP, and (4) NPP QA program (in design and construction phases). Applying NPP first fueling

authorization requires submittals of (1) final NPP safety analysis report, (2) approval letter to NPP environmental impact report (earlier one month before first fueling), (3) NPP commissioning program, (4) NPP emergency plans by operators, and (5) NPP QA program (in commissioning phase), as well as other relevant documents.

G-34 Under RRNSSFDSSN (trial) issued in 2015, the operator of a NPP shall provide technical support documents on design demonstration, safety analysis an test validation for spent fuel dry storage system (SFDSS) and submit them to the MEP/NNSA in a form of SFDSS Safety Analysis Report. This Report incorporates the information on location, layout and foundation condition of a SFDSS within plant area, design and operation of related support system, spent fuel healing and transportation system. It incorporates also other related inputs incorporating the operation and management of a SFDSS into current management of a NPP, which include, but not limited to, radiation protection, waste management, nuclear material accountancy and physical security, emergency planning, environmental monitoring, operation restriction and conditions, periodic test, in-service inspection, etc. It also deals with the interfaces of a SFDSS, as an onsite temporary option, with the NPP, transportation system and reprocessing plant and validates the operationability. It also provides information on environmental impact assessment of SFDSS and on demonstration of whether or not environmental impact of a newly added SFDSS is consistent with license requirements of such a NPP.

G-35 For existing spent fuel storage facilities, both safety analysis and environmental impact assessment were conducted prior to their construction and operation and associated safety analysis report and environmental impact statement report were prepared, with increasingly extended scope and depth. Safety analysis and environmental impact assessment encompass the description of structures, systems and components; performance criteria for their uses; description of design process; description of facility construction and management; general description of facility operation; performance predication and analytical and assessment methodology. Regarding performance predication, the models, parameters, boundary conditions, assumptions and reasons used in such analysis and assessment were made clear; potential impacts on spent fuel storage facility of natural conditions and phenomena, in the external man-made events and natural events were confirmed, the natural conditions and phenomena are like weather, climate, hydrogeology, geological conditions, topography and geomorphology, potential natural fire and explosion, etc, external man-made events include explosions, fire, aircraft crash, flying object,

downfall of fuel container and weights, release of toxic, hazardous or radioactive materials, etc, and the external natural events are floods, earthquake, subsidence and landslide, etc., together with temporal variation of impacts; based on structure analysis, the integrity of facility's components was demonstrated under the operational conditions (structure and mechanical load, thermal load and process, temporal variation of materials nature, measures incorporated in design) and accident conditions; radioactive and/or non-radioactive impacts of spent fuel storage facilities on human and the environment were analyzed under normal operating and accident conditions, and compared with the developed performance criteria, involving maintenance of sub-criticality, decay heat removal and radiation protection, etc; the conclusions were drawn on safety analysis and environmental impact assessment.

G-36 For instance, prior to construction of spent fuel interim dry storage facilities, the operators conducted preliminary safety analysis and preliminary environmental impact assessment of them and prepared and submitted the associated reports to bodies concerned. In these reports, engineering plan was described; on-site strata, structure, rock and soil physical and mechanical properties, and adverse geologic phenomena and groundwater were assessed, indicating the suitability of the site; environmental impacts and doses to workers under normal operating and accident conditions were analyzed to ensure they are entirely below the relevant national limits. Prior to the operation of spent fuel interim dry storage facilities, the operators conducted final safety analysis and environmental impact assessment, and prepared and submitted the associated reports to the relevant bodies. In addition to detailed description of design of spent fuel interim dry storage facilities encompassing fuel bundles, fuel handling equipment, fuel basket, shielded transportation cask, transportation equipment, module structure, structures, auxiliary facilities, such both reports described the seismic and geological properties, gave design earthquake parameters, analyzed potential impacts of external natural events and human factor-induced events and precautionary measures, assessed possible radiation exposure of workers and the public. About public exposure, the public is exposed directly to spent fuel storage module will not suffer significant radiation impacts. For occupational exposure, radiation doses occur during transfer of spent fuel bundles in storage pool into spent fuel baskets, during operation of spent fuel in shielded workbox and during operation of transportation casks and transfer of spent fuel baskets from transportation canisters to storage modules. Sufficient shielding and monitoring system are

taken into consideration in design of spent fuel interim dry storage facilities. A periodic safety analysis of spent fuel interim dry storage facility is performed. Corrective measures are taken according analytical results of safety, if necessary.

G.6 Operation of Facilities (Article 9)

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

(i)the licence to operate a spent fuel management facility is based upon appropriate assessments as specified in Article 8 and is conditional on the completion of a commissioning programme 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 licence to the regulatory body;

(vi) programmes to collect and analyse 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.

G-37 In China, the operators of nuclear facilities are required to be directly responsible for the safety of the nuclear facilities they operate, and take overall safety responsibility. Under the HAF001, prior to construction and commissioning, such operators shall submit the relevant documents to the MEP/NNSA in phases. Only after approved by the MEP/NNSA, can the construction of such facilities and fuel handling and commissioning be started. Only when nuclear facility operation license have been granted, can such nuclear facilities be put into operation.

G.6.1 Operation of Spent Fuel Storage Facilities at NPPs

G-38 The operators prepared operation plans for their own respective spent fuel storage facilities. Such plans cover commissioning, operation, maintenance and modification, inspection and testing, radiation protection, prevention of

radioactive release to the environment, accident and emergency preparation, accident records, reporting and investigation, quality assurance and inspection, training, nuclear materials regulation, physical protection, etc, to the extent that each of such all aspects corresponds to specific system or incident significant to safety.

G-39 In order to manage and control risks to safety within facility, the operators developed, as required by the *OL&C and operational procedure for nuclear power plant* (HAD103/01), operational limits and conditions in accordance with the technical specifications for design, test, experience and assessment of spent fuel storage facility. These include minimum cooling capacity of spent fuel cooling system and the minimum water level above spent fuel, prohibition of storing spent fuel in any places outside the specified location, minimum backup storage capacity, reactive remaining redundancy, and radiation monitoring requirements in spent fuel storage area. These limits and conditions all have gained the approval by the MEP/NNSA. Additionally, authorized limits lower than these limits are also established by the operators with a view to prevent violation of such operational limits and conditions as have been approved.

G-40 All operators implement the management of spent fuel storage facilities in accordance with the programs and procedures prepared and approved before they are put into operation. The programs said here cover those concerning operation, periodic maintenance, monitoring, testing and inspection on which the operation safety closely related safety systems and the safety related structures and components are based. The procedures include those related to water chemistry monitoring, fuel handling, sub-criticality maintenance, radiation protection, fuel containment, maintenance and verification of heat removal, shielding maintenance, loosen components and vibration monitoring, periodic testing, inspection of storage facility, response to operational events and accident conditions, emergency plan, management of periodic review, and other related procedures.

G-41 For the management and operation of spent fuel assembly storage, the prime assurance conditions are to:

(1) record in detail fuel serial number, storage location, storage time and label them with marks;

(2) monitor water temperature, level and leakage of lining in spent fuel storage pool, maintain normal operation of spent fuel storage pool and cleaning system, carry out periodic water sampling and analysis to keep controlling

water quality in terms of various parameters, and recharged water consistent with water quality requirements for desalt water;

(3) maintain normal and continuous operation of radiation monitoring system and ventilation system in plant; and

(4) prohibit fuel hoisting operation and prohibit heavy items other than hoisting and rigging equipment from moving above spent fuel storage pool without written consent, so as to prevent heavy items from falling to damage spent fuel;

(5) carry out the inspection and verification of neutron absorber in the case of adopting high-density storage.

G-42 The inspections of irradiated fuel assemblies are managed in such manner as to:

(1) prepare spent fuel inspection plan prior to each shutdown and inspect irradiated fuel assembly in accordance with approved plan;

(2) timely repair the defects of irradiated fuel assembly in accordance with procedures if discovered; and

(3) record the inspection and repair of irradiated fuel assemblies.

G-43 Under the *Organization and operational management of operators of NPPs* (HAD103/06), during their whole operation lifetime, the operators of spent fuel management facilities dedicated to NPPs have been obtaining the engineering and technical supports from various safety-related areas, like fuel management, performance analysis, in-service examination, environmental monitoring, evaluation of design modification or procedure revision, chemical control, overhaul and decontamination. These were achieved through signing contracts with relevant entities of advisory company, engineering company, supplier to NPPs, equipment manufacture and contractor, employing experts in the fields of metallurgy, health physics and seismology, and hiring equipments and devices needed for data processing, training, chemical experiment and radioactive test.

G-44 The operators of NPPs submit their annual operation safety reports to the MEP/NNSA every year. Under HAF001, the accident occurring in spent fuel management should be reported to the MEP/NNSA as part of all production activities at NPPs.

G-45 Pursuant to the *Management Methods for Experience Feedback about Operational NPPs* (MMEFONPP), the MEP/NNSA takes the lead in effort to

gather, analyze and release the experience feedback information needed by operational NPPs and issues regulatory requirements; as required by the MEP'NNSA' the NPP operators develops and effectively implements the experience feedback management program or management procedures and responses timely to the experience feedback management requirements made by the MEP/NNSA; the Nuclear and Radiation Safety Center carries out periodic full-range analysis and assessment of domestic and international experience feedback information and performance index data and provides the MEP/NNSA with regulatory recommendations and suggestions; MEP/NNSA's regional branches are responsible for regulatory inspection to the experience feedback work and activities at operational NPPs. The MEP/NNSA built, in November 2014, a NPP experience feedback platform, which has been put into operation since July 2016. This is an integral part of NPPs experience feedback system and has the functions of information collection and inquiry, incident significance abnormality judgment, mainly useful for gathering and releasing the operational experience feedback information about NPPs.

G-46 Under GB/T 19597-2004, the nuclear facility decommissioning mid-term plans should be developed after a period of operation, or after a major event or accident would have occurred. A very wide range of possible occurrences must be considered when developing such mid-term plan, like advances in decommissioning technology, changes in national laws, regulations and policies, current situations in nuclear facility, decommissioning resources assurance, and commissioning costs, etc. The impacts of any possible event or accident occurring during operation of nuclear facility on decommissioning must be reflected in the mid-term plans.

G.6.2 Operation of Spent Fuel Storage Facilities at Research Reactors

G-47 The principled requirements for spent fuel assembly management is specified in the HAF202, to which supplementary explanations are made in HAD202/01 and *Core management and fuel handling for research reactors* (HAD202/07), thus detailing the safety requirements for research reactor core management and spent fuel handling, and providing guidance an recommendations on these issues.

G-48 The operators of research reactors are responsible for and arrange for all activities covered by the reactor core management and the onsite fuel management. In order to ensure the safety of spent fuel assembly handling and storage, the operators prepared technical specifications in relation to the safety of spent fuel management facility operation, which specified the operating

limits and conditions of reactors along with their spent fuel storage facilities. For instance, limit k_{eff} is developed to maintain sub-criticality of spent fuel, storage pool water level limits to ensure radiation exposure reduction and residual heat removal, and storage water quality limits to ensure no degradation of fuel cladding. Additionally, the accident treatment procedures were established to cope with the possible occurrence of accident during spent fuel handling.

G-49 In practical operation and handling, the developed operational procedures were implemented strictly and necessary measures taken, to ensure the system will have enough redundancy available to make operating limits and conditions not to be exceeded. Spent fuels withdrawn from reactor core are generally put on fuel racks in core to wait radioactive decay of short-lived radionuclides and subsequently sent to storage pool. For handling of spent fuel, materials movement over spent fuel storage racks is strictly controlled to avoid materials downfall leading to damage to fuel assemblies. And safety interlocks were installed on handling equipment to prevent fuel assemblies from downfall during lifting. Underwater cameras were used for periodic inspection of spent fuel assemblies to eliminate hidden dangers in a timely manner. Safety oversight was enhanced to determine whether or not pool water meet the standards required; and pool water was monitored and sampled at regular intervals for determining radionuclides in water and their activity concentrations so as to ensure the quality of water of pool meet the standards required. Measures to ensure normal operation of ventilation system were taken to make airborne concentrations within the range of the operating limits and conditions. A comprehensive set of record regime was established to document the details of spent fuel assemblies and ensure the accuracy and traceability of related information.

G-50 Any events occurring at research reactors should be reported and treated in accordance with the relevant provisions. After treatment, written reports should be submitted to higher authorities and regulatory bodies.

G-51 Analyses of data collected during the operation of spent fuel storage facility indicates that, in order to reduce exposure of workers to radiation, necessary modifications to spent fuel storage facility may be conducted where appropriate. Modifications significant to safety must be reported to the MEP/NNSA for review and approval. Such modifications must be in compliance with the procedures of safety analysis, design, construction and commissioning.

G-52 During operating lifetime of a research reactor, the operator and reactor management organizations must prepare its decommissioning plan abiding strictly by the decommissioning requirements for reactor along with spent fuel management facility.

G.6.3 Operation of Away- from-reactor Spent Fuel Storage Facilities

G-53 The HAF301 puts forth the principled requirements for the operation and management of civilian nuclear fuel cycle facilities, along with away-from-reactor spent fuel storage facilities. The *Operation of spent fuel storage installation* (HAD301/03) defines the safety requirements and recommendations on away-from-reactor spent fuel storage facilities.

G-54 Away-from-reactor spent fuel storage facilities are in consistent with design requirements and safety requirements. The operators established the scheme for safe operation of spent fuel storage facilities, including operating procedures, commissioning plan, QA program, training plan, radiation protection program, emergency preparedness, environmental release control of radioactive materials.

G-55 Operating limits and conditions are defined, including sub-criticality maintenance, radiation safety, and residual heat removal, etc. For instance, any spent fuel bundle to be transferred into basket will be required to have cooled for 6 years in spent fuel pool before being transported to spent fuel interim dry storage facility. The dose limit within module preparation area and spent fuel storage area is set at 25 μSv/h.

G-56 The operation, maintenance, monitoring, inspection and testing of spent fuel interim dry storage facility is proceeding in line with the plans, provisions, procedures and requirements that have been already approved. The above plans, provisions, procedures and requirements are comprised of those in relation to spent fuel storage, storage module, storage drum, fuel basket serial number, fuel basket inspection, basket loading, drying and welding, transportation and lifting, gamma-rays continuous monitoring, radiation protection in module storage area, storage drum routine inspection and oversight, storage module, storage drum, fuel basket and shielded workbox inspection and maintenance, equipment maintenance, testing and acceptance.

G-57 Spent fuel interim dry storage facility can gain all of engineering and technical supports related to safety during its lifetime.

G-58 Any event or accident deviating from operating conditions should be reported, as specified, to the relevant regulatory bodies with respect to its nature,

extent, consequence and remedial measure.

G-59 Operating data of spent fuel interim dry storage facility are gathered in relation to gamma radiation monitoring in onsite environment, radiation monitoring at storage module and workplace. Also air sampling for storage drum and heat conductivity monitoring in interior of module are conducted in attempt to verify design and provide experience feedback for the subsequent module manufacturing.

G-60 Decommissioning plan shall be reviewed and updated on an as-needed basis, during operation of away-from-reactor spent fuel storage facility, with advance in decommissioning technology, possible occurrence of event, revision of laws, regulations and policy, and variation in facility operating experience and costs, etc.

G.7 Spent Fuel Disposal (Article 10)

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 Chapter 3 relating to the disposal of radioactive waste.

G-61 China's spent fuel management policy is to implement the reprocessing of spent fuel and to extract and recover uranium and plutonium materials, so as to achieve maximum use of resources. With account taken of economic and technical factors, however, the likelihood for direct disposal of a few types of spent fuel shall be not excluded in future. No spent fuel is designated to propose to undergo direct disposal at present.

H. SAFETY OF RADIOACTIVE WASTE MANAGEMENT

(Articles 11 to 17)

H.1 General Safety Requirement (Article 11)

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 that 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 In China, a systematic set of policy and strategy, along with a complete set of laws and regulations and standards, on radioactive waste management has been established and a wide range of measures envisaged for implementing the safety of radioactive waste management, so as to achieve the goals of protecting individuals, society and the environment against radiological and other hazards.

H-2 The appropriate steps have been taken to ensure the residual heat produced during radioactive waste management can be removed well. Under GB 14500-2002 and the *Regulations for designing storage building of high level radioactive liquid waste* (GB 11929-2011), for the design of liquid HLW

storage tank, all reasonable and practical approaches should be taken to ensure criticality safety. The storage tanks are in-built with cooling systems with a full standby capability and equipped with multiple and diverse instrumentations to measure such important process parameters as temperature and liquid level. In the event of cooling water failing to supply, the independent emergency cooling system in the tanks can ensure the temperature in storage tank remains below 60℃.

H-3 China's laws and regulations require that the quantity of radioactive wastes generated should be kept at the levels that are as low as reasonably achievable (ALARA). Under the LPCRP, any nuclear facility operator and nuclear technology utility should adopt advanced technologies and equipments, reasonably select and utilize raw materials and in such a way as to minimize the quantity of radioactive wastes generated. Under GB 14500-2002, the generation of waste shall be controlled in all nuclear activities in such a way as to keep radioactivity in and volume of waste at as low as actually achievable. Under GB 6249-2011 and HAD 401/08-2016 the operator of a nuclear facility under design, construction, operation and decommissioning shall, with respect to radioactive waste minimization, implement source control, recycle and reuse, clearance, optimization of waste treatment, and enhanced management, and cost- benefit analysis so that amount (volume and activity) of solid radioactive waste generated can be controlled at as low as reasonably achievable.

H-4 In process of waste management, optimization is applied to the overall control of gaseous, liquid and solid wastes, as a whole, from generation to disposal of them, so as to obtain the best technical, economic and social effects and to be beneficial for sustainable development. The regulations, standards , guides that have been already issued take account of the interdependency between several different steps to manage radioactive waste, for example, from their generation, collection, classification, treatment and conditioning to their storage, disposal and release and even to their recycle and reuse, as shown in Figure 4.

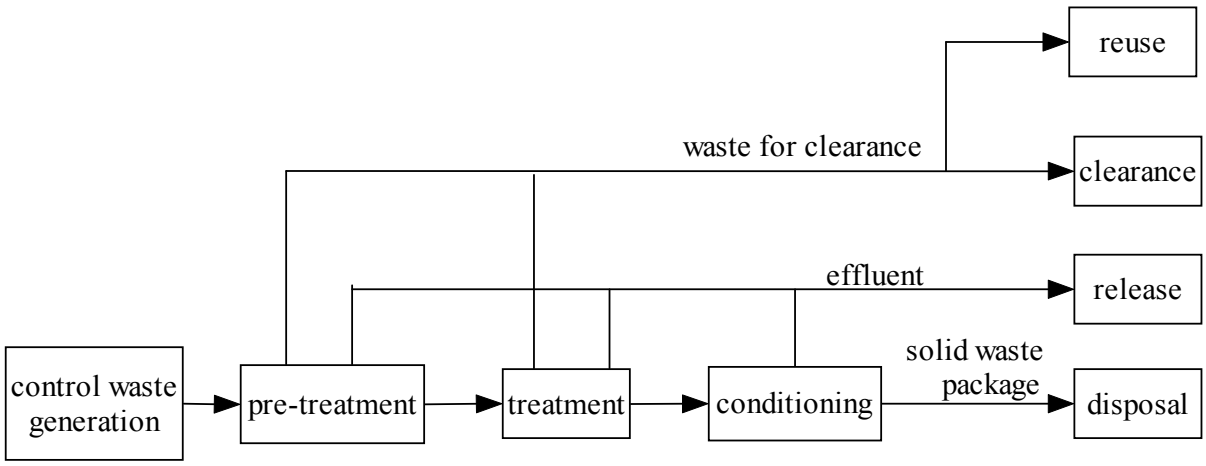

Figure 4 Basic Steps towards Radioactive Waste Management

H-5 A legal framework comprised of national laws, administrative regulations, departmental rules (national standards), management guides and reference legal instruments governing radioactive waste management has been established and maintained in China. Implementation of these instruments can provide the protection of individuals, society and the environment. These documents were developed and issued after stringent review by relevant authorities including regulatory control department. These set out the specific requirements for every step in radioactive waste management and criteria for protection of the public, the workers and the environment in respect of several main links in waste management (including the disposal of solid radioactive waste and the release of radioactive effluents), which are basically consistent with internationally endorsed standards and criteria. The MEP/NNSA, alongside with the competent authorities of nuclear facilities, shall conduct regulatory control and supervisory monitoring of compliance of such facilities with standards.

H-6 China has taken full consideration of biological, chemical and other hazards that are likely attributable to the management of radioactive wastes. Under GB 9133-1995, GB 16933-1997, GB 9132-1988 and GB 14500-2002, when developing the classification system of radioactive wastes, account was taken of potential chemical, biological and other hazards. Wastes received and disposed have enough chemical, biological, thermal and radioactive stability and will not produce toxic gases. Radioactive waste treatment systems are equipped with fire protection and explosion-proof device in such a way as to ensure that radioactive waste and other hazardous waste released to the

environment are below regulatory limits.

H-7 In its laws, regulations and standards, China stipulated that efforts should be made to avoid the taking of actions that are expected to impose greater adverse impacts on the future generations than the current generation. Under the RSRWM, the solid radioactive waste generated in operating nuclear facilities, and the liquid radioactive waste that could not be discharged through purification shall be treated by turning into stabilized and standardized solid waste, and be timely delivered to the licensed solid radioactive waste disposal facility for disposal. The solid LILW disposal facilities should meet safety isolation requirements of more than 300 years after closure; and the deep geological disposal facilities for solid HLW should meet safety isolation requirements of more than 10,000 years after closure. Under the GB9132-1998, After closure, control shall be exercised over disposal site during required control period, to make sure meeting radiation protection requirements and no adverse impact upon the environment. After closure, disposal site management shall be divided into three phases: closed, semi-closed and open. Only when radioactivity in waste has been shown and verified to be lower than the required radiation protection level upon the expiration of the control period, the site can be unrestricted release. With conducting above requirements, we can strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation

H-8 In developing its relevant laws, regulations and standards, China makes efforts to stick to the principle of avoiding undue burden on future generations. Under the RSRWM, radioactive waste management shall ensure no undue burden to be imposed on future generations. IPCUMFTDSFNPP was issued in July 12, 2010 (see F.2.2.1). There have been two solid LILW disposal sites in operation in China. New ones are being under planning and construction according to needs of nuclear energy expansion in the country. The work on geological disposal of radioactive waste is also proceeding in an orderly way. The purpose of these efforts is to avoid undue risks and burdens imposed upon the future generations.

H.2 Existing Facilities and Past Practices (Article 12)

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 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;

(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.

H.2.1 Periodic Safety Review to Nuclear Facilities

H-9 Under HAD103/07 and HAD103/11, the 10-year periodic safety review has been conducted from 2014 to 2016 at China's operating NPPs, such as QNPP, QNPPII, QNPPIII, Daya Bay NPP, Ling'ao NPPI and Tianwan NPP covering solid radioactive waste management system review and radiation environmental impact assessment. During the process of solid radioactive waste management system review, the assessed were anti-seismic performance, shielding performance, operability, maintainability, heat removal measures, leakage prevention capability of waste resin storage tank; low level solid waste storage system safety, solidified forms storage system safety; stability of cemented forms during long-term storage; retrievability of low level solid waste and solidified forms; and durability of container. The review results indicated that the assessed systems, as a whole, are consistent with the current safety basic requirements.

H-10 Under HAD103/11, the first 10-year periodic safety review was conducted from 2013 to 2014 at CNNC Shannxi Uranium Enrichment Co. Ltd. and CNNC Lanzhou Uranium Enrichment Co. Ltd., respectively. This review encompasses safety analysis; actual status of structure, system and parts; disaster analysis; and radiation environment impact assessment, etc. As has been stated by the review results, the technical modifications and specific actions taken in past many years have made the relevant systems consistent with the specification requirements as a whole, like waste treatment system and radiation protection system.

H.2.2 Safety Inspection to Nuclear Facilities

H-11 MEP/NNSA and its regional branch stations conduct nuclear safety inspection on day-to-day, routine and non-routine basis.

H-12 MEP/NNSA carries out its responsibility for routine nuclear safety inspection to nuclear facilities. This inspection, after to a NPP overhaul and prior to the first criticality, is focused on the management of radioactive waste generated both from previous fuel cycle and during overhaul. Regional branch stations have a responsibility for developing oversight plan and implementing day-to-day and specific nuclear safety oversight and inspection.

H-13 Under the MEP/NNSA's guidance, regional branch stations carried out, in 2014, regulatory inspection to 54 nuclear facilities distributed in 31 provinces (regions and municipalities) with respect to control funds implementation an capability building. Traceability inspection was made to the temporary radioactive waste repository for nuclear technology applications in Ningxia and specific inspection was to the capability building in Tibet. From August to October 2015, MEP/NNSA implemented a major inspection to nuclear safety at NPPs and research reactors. From September to November 2015, MEP/NNSA took the lead in efforts to harmonize regulatory inspection activities with regard to nuclear and radiation safety at such nuclear facilities as nuclear technology application, nuclear equipment fabrication, and uranium mining and milling. and to coordinate the comprehensive inspection activities conducted in eight provinces, such as Liaogning, Jiangxi, Henan, etc. In 2016, MEP/NNSA took the lead in comprehensive and specific regulatory inspections, took regulatory control on nuclear technology application based on the similar activities conducted in six provinces such as Zhejiang and Heilongjiang, etc.

H.3 Siting of Proposed Facilities (Article 13)

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 the 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.

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.

H.3.1 Siting of Facilities

H-14 China attaches high priority to the siting of radioactive waste management facilities, with the relevant regulations and standards being developed to guide the siting of different radioactive waste management facilities.

H.3.1.1 Siting of Nuclear Facility-affiliated Radioactive Waste Management Facility

H-15 A radioactive waste management facility, for a nuclear facility, shall be sited in compliance with the same requirements as shall be met in siting such a nuclear facility.

H-16 During the process of siting, account was taken of the requirements said above, such as geographical location, population distribution, natural resources (like mineral reserves, food, economic crops, aquatic products, etc.) industry, transportation, meteorology (like tropical cyclone, tornadoes, thunderstorms, etc.) hydrology, geology , earthquake and so on.

H-17 During the process of siting a facility, evaluation was made of annual individual dose equivalents and annual collective dose equivalents to workers of such a facility on different jobs, like operation, maintenance, waste handling and in-serve inspection, etc.; possible impacts of such a facility on the ambient environment in normal and accidental conditions were evaluated to demonstrate the acceptability of site conditions and safety facility.

H-18 No impact could be created on any other Contracting Party from China's existing nuclear facility-affiliated radioactive waste management facilities.

H.3.1.2 Siting of Radioactive Waste Temporary Storage Facility associated with Nuclear Technology Application

H-19 The site-related factors were evaluated, as required by the *Technical Requirements for Siting, Design and Construction of Nuclear Technology Application Radwaste Temporary Storage Facility* (TRSDCNTARTSF) and the GB 14500-2002, the natural conditions and socioeconomic conditions at the site were evaluated during the siting of nuclear technology applications' radioactive waste temporary storage facility. The results are:

(1) natural conditions at site are relatively flat topography, small slope, relatively simple geological structure, low seismic intensity, deep underground water level, far from the surface water; stable geological conditions (there is no debris flow, landslide, collapse, as well as the erosion surface phenomenon), poor permeability of rock, enough bearing capacity of foundation soil, and good meteorological conditions (like temperature, humidity, content of corrosive components in air, etc).

(2) the socioeconomic conditions around the site are characterized with no facility, having impacts on waste safety, likely to produce and store flammable and explosive and dangerous articles, no mineral area of important development value, no scenic tourist area, no drinking water sources, or no economic development zone, and there being convenient transportation and convenient water and power supply.

H-20 The impacts of such a facility on individuals, the society and the public were evaluated. Under TRSDCNTARTSF, the potential impacts on such facilities from the external and natural events and possible impacts on individuals and the environment from the releases of radioactive and hazardous materials were evaluated during siting to ensure providing adequate isolation and robust confinement of the public and the environment from radioactive waste, as required by the relevant regulatory bodies. .

H-21 No impact could be created on any other Contracting Party from China's existing radioactive waste temporary storage facilities associated with nuclear technology application.

H.3.1.3 Siting of solid radioactive waste disposal facilities

H-22 Under GB14500-2002, GB 9132-1988, *Siting of radioactive waste near surface disposal facility* (HAD401/05) and *Siting of high level radioactive waste geological facility* (HAD401/06), the site-related factors were evaluated during the siting of solid radioactive waste disposal facility, involving earthquake, regional stability, geological structure and lithology, engineering geology, hydrogeology, mineral resources, natural and cultural resources, population density, surface water and drinking water, urban, airports, and the distance away from the inflammable and explosive dangerous goods warehouse etc.

H-23 The impacts of such facilities on individual, the society and the public were evaluated, with account taken of the post-closure evolution of the site condition. Under GB 9132-1988 and GB 14500-2002, analyses were made, in the process of siting, of amounts and probability of migration of radionuclides into human environment, associated mechanisms, pathway, and velocity of radionuclide into human body, together with estimating initially the individual dose equivalent and collective dose equivalent under normal conditions, natural and artificial events, and also preliminarily analyzing and evaluating the environmental impacts of disposal facilities during construction, operation and post closure, and the possible impacts of the surrounding environment on disposal facilities.

H-24 Under RSRWM, other relevant standards and guides, the siting of Goungdong Beilong Solid LILW Disposal Site and Northwest Solid LILW Disposal Site were completed in full compliance with the requirements of regional survey, site characterization and site determination. Sufficient investigation and demonstration were conducted of around-the-site geological structure, hydrogeology as well as other natural and socioeconomic conditions. Both Sites have already now entered operation phase, which were identified during regional screening survey based on the local conditions of natural environmental setting, population, economy, and communications, etc. Gathering and comparison of data lead to candidate areas to be determined. On the basis of field reconnaissance on these two sites, the site characterization was conducted at several candidate sites. Subsequently, the environmental impact assessment statements and the safety analysis reports for siting phase were

developed. At last, the two sites were approved by the MEP/NNSA based on the provided scrutiny and advice.

H-25 CAEA had the lead in efforts to site HLW disposal repository is focused on the candidate Beishan site located in Gansu province following the initial comparison between the pre-selected regions, such as in East China, South China, Southwest China, Inner Mongolia and Xinjiang. Emphases were on geology, hydrogeology, seismic geology and socioeconomic conditions. Bore drilling activities were partly conducted to obtain the in-depth samples of rock core and water and other relevant information, thus developing the preliminary approach to evaluation of granite site. China's study and development efforts will continue in the years ahead. The work that will be completed around 2020 are the early laboratory-based research and development in the related disciplinary fields, preliminary site selection of disposal repository and the safety review of underground laboratory construction.

H-26 No impact could be created on any other Contracting Party from China's existing Solid LILW Disposal Sites.

H.3.2 Public Communication and Information Publicity

H-27 Under GIOGEIACP (trial), prior to submitting the environmental impact statement to the MEP/NNSA, the applicants of construction projects, including the projects of radioactive waste management facility, should legally disclose the full text of information. Having accepted the said environmental impact statement, the MEP/NNSA should make the full text of information available to the public legally and should make its comment public on either approving or disapproving the environmental impact statement. After having approved such project, the MEP/NNSA shall open to the society the licensing process.

H-28 The MEP/NNSA issued in 2015 the *Work Program on Public Communication of Nuclear and Radiation Safety* and the *Work Guidance on Public Communication of Nuclear Technology Application* (trial), with a view to enhancing popular science dissemination, information disclosure and public involvement. Science 2015, MEP/NNSA, NEA and CAEA provide every year the periodic guidance on the activity of nuclear industry Open Days.

H-29 The building of information publicity channel is underway. The major platforms are the MEP/NNSA's information website and CAEA's and NEA's websites. Additional channels include China Environmental Status Bulletin, China Environmental Yearbook, NNSA's Annual Report, Annual Report on Environmental Radiation Monitoring, China Environmental Paper, radio and

television, network website, as well as other media and channels.

H.4 Design and Construction of Facilities (Article 14)

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.

H-30 A wide spectrum of legal instruments on radioactive waste management have been issued in China, such as GB 14500-2002, GB 6249-2011, *The technical rules about solid radioactive waste processing system for light water reactor plants* (GB 9134-1988), *The technical rules about radioactive waste processing system for light water reactor plants* (GB 9135-1988), *The technical rules about gaseous radioactive waste processing system for light water reactor plants* (GB 9136-1988), GB 9132-1988, *Design of Radioactive Waste Management System for Nuclear Power Plant*（HAD401/02）, TRSDCNTARTSF and GB/T 19597-2004. These are intended to govern the design and construction of nuclear facility-affiliated radioactive waste management facilities , the waste temporary storage facility for nuclear technology application and the LILW repository.

H.4.1 Design and Construction of Nuclear Facility-affiliated Radwaste Management Facilities

H-30 To limit possible radiological impacts to individuals, the society and the environment, the following measures were mainly considered and taken in accordance with GB 9134-1988, GB 9135-1988, GB 9136-1988 and HAD401/02:

(1) radioactive waste management systems are separated from those of non-radioactive waste management system;

(2) zone division has been made of radioactive waste management facility and comprehensive measures taken, based on radiation level and contamination extent, covering appropriate radiation shielding and radiation monitoring meters;

(3) the technological processes of classification, collection and treatment of radioactive waste were designed according to the origin and nature of them, including well-designed waste treatment technology (filtration, adsorption and washing, flocculation sedimentation, centrifugal separation, evaporation, ion-exchange, membrane technology, super-compression, solidification) and well-installed waste gas treatment system, and ventilation system in radioactive work zone, for which gas flow direction, a certain amount of negative pressure and/or air changes are maintained and electric-gas interlocks are installed.

(4) suitable materials are selected in line with operational conditions and consideration is taken of corrosion, decontamination and radiation effects;

(5) for the systems that need to be maintained and examined after decontamination, their inner surface is designed smooth and to have washing or cleaning connectors.

(6) sampling points are designed to set at appropriate part of system, using as short sampling pipeline as possible and installing concurrently-used-with-system pipelines for frequent sampling activities; continuous monitoring is carried out of gaseous and liquid radioactive effluents prior to release; the monitored items may be gross alpha and gross beta radioactivity and concentrations of radionuclides in terms of source terms within facility; flow measuring equipment is set to control release of effluents; as activity concentrations in effluent are in excess of relevant limits or once discharge valves to control effluents fail to obtain driven power, the effluent discharge will be stopped automatically.

(7) for the design and layout of buildings, additional loading that could be created during or after its decommissioning is considered, with account taken of several factors, such as the place and space required for decommissioning;

(8) the necessary precautionary measures are considered in attempt to reduce the impacts potentially from the major risks discovered in safety analysis, such as earthquake, floods, air crash, natural and artificial events; these measures include main system equipment, fittings, supports, and ability of equipment to endure the impact from the operating basis earthquake; and

(9) functions to detect explosive gas, automatically control and alarm, and

prevent explosion are designed to avoid the potential of explosion.

H-31 Conceptual plan is considered for the decommissioning of radioactive waste management facilities except for disposal facilities. Under HAF102-2016, GB/T 19597-2004 and the *Rules on the Management of Civilian Nuclear Facilities Decommissioning* (RMCNFD) under development, the operator of a nuclear facility shall take into account of future decommissioning in its design phase and develop preliminary decommissioning plans. Such plans should incorporate the considerations of basic safety concerns, expected decommissioning strategy, safety and feasibility of technology currently available or to be developed in the course of decommissioning practices, decommissioned waste management, decommissioning costs and financing means, and guarantee institutions.

H-32 The technical specifications, as incorporated in the design and construction documents of radioactive waste management facilities, all cited the relevant national standards and nuclear safety laws and regulations that have been issued and in effect. These specifications have also drawn on the experiences of operation and management experience gained over the past.

H-33 Prior to granting construction license, the NNSA organized review and evaluation of the environmental impact assessment report, the preliminary safety report and the QA program submitted by the operators for license application in construction phases. In the process of nuclear facility construction, the MEP/NNSA and its regional branches dispatch nuclear safety inspectors or groups of inspectors to the fabrication and construction fields for implementation of the following oversight missions:

(1) reviewing whether the safety data submitted is consistent with the reality;

(2) supervising whether the construction process is consistent with the approved design requirements; and

(3) supervising whether the management process is consistent with the approved QA program etc.

H-34 The radioactive waste treatment facilities for the concurrent use by multiple nuclear units on-site were designed using well-proven technologies at both Sanmen NPP and Haiyang NPP under construction. As an additional one to nuclear islands' waste treatment systems, such facility can treat all sorts of wastes that are generated, but can't be directly treated, by all on-site nuclear islands, thus avoiding unnecessary duplication of equipment at multiple units. Radioactive waste treatment facility on site is divided into three zones, waste

processing building, laundry and interim storage facility. Its functions are to treat solid radioactive waste and chemical waste liquid , wash work clothes and shoes for reuse, and provide interim storage of waste packages. The design of radiation protection associated follows the ALARA principles. The facility employs compaction and extra-compression technologies to achieve volume reduction and waste minimization. In addition, the treated liquid waste is going to be discharged after sample measurement and continuous monitoring.

H.4.2 Design and Construction of Radioactive Waste Temporary Storage Facility for Nuclear Technology Application

H-35 To limit possible radiological impacts to individuals, the society and the environment, the following measures were mainly considered and taken in accordance with the TRSDCNTARTSF:

(1) the entire area of the facility is divided into storage area, office area and isolation zone, with a certain distance span existing between storage area and office area to a certain degree. Isolation zone should be around the temporary storage facility;

(2) building layout is designed to regulate flow of personnel and material in such way as to minimize potential for cross-contamination;

(3) process design should meet the requirements for the systems, equipment, instruments and handling devices required for the acceptance, transfer, storage, retrievability, transportation, decontamination and removal activities conducted during the operation, maintenance and decommissioning of such a temporary storage facility; specific measures include categorization of disused sealed sources and their storage in groups in shielded pits with lids with some distance between each other;

(4) the facility is installed with proper ventilation equipment to direct the proper airflow and to ensure adequate number of ventilation changes;

(5) necessary radiation monitoring means and meters are provided such as potable dose rate meters, surface contamination monitors, potable air samplers to monitor the contamination level of workers, at workplaces and in air; and

(6) necessary personal dose meters and personal protective articles, such as protective clothes, gloves, shoes and masks are provided for workers involved in handling, lifting, inspection, storage and monitoring of radioactive waste;

H-36 Conceptual plan was considered, in phase of design, for radioactive waste temporary storage facility associated with nuclear technology applications. Under the TRSDCNTARTSF:

(1) source term estimating for nuclear facilities to be decommissioned;

(2) goals of decommissioning and radiation measurement requirements at termination of decommissioning;

(3) proposed decommissioning plan (such as characterization, removal of radioactive materials and disused sealed sources, decontamination, demolition and termination radiation measurement) and the potentials for safety of decommissioning using available technologies;

(4) resources and conditions required for facility decommissioning and resulted waste management; and

(5) requirements for continued evaluation, elaboration and renewal of decommissioning plan in construction and operation phases.

H-37 technical measures available for decommissioning of waste temporary storage facility are employed during design, mainly including:

(1) the floor, wall and worktable surface that could to be likely contaminated is made of smooth and seamless materials from which contaminants are difficultly absorbed contaminants or from which contaminants are easily removed;

(2) buildings, equipments and pipelines are arranged to allow sufficient channel and space to enable operating workers and instruments used to access for decontamination and dismantling operation;

(3) equipment and pipeline are arranged to avoid radioactive material deposition in system and in local part, with further account being taken of possibility of in-situ decontamination; and

(4) due consideration are given to ventilation to prevent the potential contamination being spread in the course of operation, decommissioning, decontamination, and dismantling.

H-38 The principles followed in the design of radioactive waste temporary storage facility associated with nuclear technology applications is to use the technology, process, equipment and instrumentations that have proven in practices to be safe, reliable and effective. All of the technical specifications incorporated in the facilities' design and construction documents cited the relevant national standards and nuclear safety laws and regulations that have been issued and in effect.

H.4.3 Design and Construction of LILW Disposal Site

H-39 To limit possible radiological impacts to individuals, the society and

the environment, the following measures were mainly considered and taken, in accordance with the GB 14500-2002 and GB 9132-1988, in the design and construction of LILW disposal sites:

(1) multiple barriers, consisting of engineering barrier (waste forms, container, disposal structure, and backfilling materials) and natural barrier, are developed and provided;

(2) proper waterproof and drainage systems are set; the engineering barrier is set to prevent the infiltration of groundwater and surface water in such a way as to minimize the contact of waste with water; waterproof design is focused on preventing surface water and rainwater from infiltration into disposal units; permeability and absorbability of rocks, surface runoff and ground water table and other site characteristics are considered in design of site waterproof; the design of drainage system can ensure the timely drainage of impounded water on the ground at site and in disposal units;

(3) in addition to drainage and waterproof, the design of disposal site also involves unit backfilling, overburden structure, surface treatment, and plantation; the holes and channels to monitor groundwater are installed in the vicinity of disposal units and proper locations onsite;

(4) disposal units are arranged in line with the overall plan, including access, walkways, contaminated area and non-contaminated area;

(5) waste acceptance zones are equipped with detection instrumentations for measuring dose rate, surface contamination, cargo certificate of vehicle and cask; inspection device for unloaded waste drum (box); radiation monitoring and warning systems; installations to treat damaged containers: devices for transportation equipment decontamination, and facility to treat waste generated from decontamination; and

(6) laboratories are established for conducting routine analysis of water, soils, air and plant samples; individual decontamination, individual and environmental monitoring, instrumentation and equipment maintenance, and equipment decontamination.

H-40 Under GB 9132-1998, the LILW treatment facilities currently in operation have been provided in design phase with technical preparation measures to enable such facilities to be closed. These includes buffer areas between disposal unit and disposal site boundary, underwater monitoring wells set in an appropriate locations in buffer areas, on-site laboratories for analysis of samples from water, soils, air, animal and plant. In so doing, the analysis of

on-site and ambient environmental safety may become available. Additionally, in accordance with design requirements, the enough distance should be left between the top level of disposed waste and disposal facility overburden layer. If necessary, anti-intrusion barrier needs to be established where protection can be provided to an unintentional intruder within institutional controls period. Overburden layer shall be designed so as to control water seepage to as low as practically feasible and as to lead infiltrated or surface water to the outside of disposal unit and to protect them from erosion due to geological process and biological activities.

H-41 Guangdong Beilong disposal site and Northwest disposal site both meet the design requirements (GB 9132-1988). At Guangdong Beilong disposal site, 8 disposal units have been completed with the structure of all-above-ground grave mound. The disposal units are constructed with reinforced concrete structure, and space between waste drums would be backfilled with sand and cement grout. Each unit, when it is full, would be covered with reinforced cement cap. After closure, such site will be covered with 5 m thick overburden. In order to reduce entry of rainwater into disposal unit, drainage ditches are designed around the disposal facility with each unit being installed with mobile active water shed. Below the unit bottom, a drainage collecting system was established. In the case of the Northwest disposal site, Disposal unit for such site is designed to use reinforced cement structure without bottom. Between waste drums and between waste drum and disposal unit would be backfilled with sandy soil, when a disposal unit is full ,it will be poured with reinforced cement to form top plate. After closure, the top of each disposal unit will be finally covered with a 2 m thick overburden. During the process of disposal facility construction, reinforced bottom plate was added for higher safety.

H.5 Assessment of Safety of Facilities (Article 15)

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 an environmental assessment for the period following closure shall be carried out and the results evaluated against the criteria established by the regulatory body;

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).

H-42 Under the LPCRP and HAF001, proper safety analyses and environmental assessments were completed before the construction of the current radioactive waste management facilities.

H-43 Under GB 14500-2002, The *Requirements on Safety Analysis Report for Solid LILW Interim Storage* (EJ 532-1990), TRSDCNTARTSF and GB 9132-1988, the safety analyses and environmental assessments were completed to some extent before the construction of the current radioactive waste management facilities, here considering possible accident spectrum during the operation of facility (like ventilation system failure, waste lifting malfunction, waste transfer incident, container leakage, earthquake, floods, sandstorm, fire, mis-operation, and inadvertent intrusion); defining the model, parameter, assumption and rationale envisioned in the analyses and assessments, analyzing possible environmental and human impacts under normal and abnormal conditions; calculating maximum annual effective dose equivalent, annual average effective dose equivalent and annual collective dose equivalent in assessed area under the accidental condition; comparing with performance criteria established; drawing on the conclusions on safety analysis and environmental impacts of concern; making clear the problems existing in current facilities and the countermeasures to be taken to improve safety quality.

H-44 Before construction of a disposal facility, a systematic safety assessment and an environmental assessment for the period following closure

were carried out. Under GB 9132-1988, focuses were on predication, analysis and assessment of possible environmental impacts of the existing disposal sites during their construction, operation and post-closure phases and the potential for surrounding environment impact on disposal sites, etc. The assessment results of the existing disposal sites show that the disposal site was chosen in a closed environment with low population and good regional stability. Natural disaster such as typhoon, flooding and earthquake would not lead to destructive threat to the disposal site. Local geological media, with low permeation rate and strong adsorption onto radionuclides, is in line with national requirements on LILW disposal. In the normal conditions after closure of the disposal site, the release of radionuclides through groundwater may result in annual maximum individual dose to the public far below the national limits. Even in the case of inadvertent intrusion after closure of disposal site, the dose to the intruder will below the national limits. Therefore, the disposal sites will not lead to any unacceptable impacts on the environment.

H-45 As has been already pointed out by the GB 14500-2002, the environmental impact assessment should be revised and updated according to the relevant national or departmental provisions and requirements and then submitted to the regulatory bodies.

H.6 Operation of Facilities (Article 16)

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

(i) the licence 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 programme 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 procedures. 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 segregation of radioactive waste are applied;

(vi) incidents significant to safety are reported in a timely manner by the holder of the licence to the regulatory body; programmes to collect and analyse relevant operating experience are established and that the results are acted upon, where appropriate;

(vii) 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;

(viii) 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.

H-46 Under the LPCRP, the radioactive waste management facility, associated with a nuclear facility, should be constructed simultaneously with the main project in their design, construction and operation. According to the requirements of completion acceptance system of environmental protection,

after completion of the main project, the application report for trial operation shall be submitted to the MEP/NNSA. No trial operation can be started without approval. After completion of trial operation, the checking and acceptance after completion for environmental protecting facilities shall be performed by the MEP/NNSA. After being qualified, these facilities can be put into operation.

H.6.1 Operation of Nuclear Facility-affiliated Radwaste Management Facilities

H-47 Under the LPCRP，HAF001 and MMLSDSRW, before operation of a nuclear facility，its operator should submit the written application for nuclear facility operation to the NNSA, together with the final safety analysis report and other related documents. The NNSA shall review these documents and grant operation licenses to the qualified. The existing radioactive waste treatment and storage facilities equipped for NPPs, research reactors and nuclear fuel cycle facilities are only responsible for treatment and storage of wastes generated by the facilities themselves, therefore there being no need for obtaining license.

H-48 Operational limits and conditions were set by the operators of all nuclear facilities for radioactive waste management facilities under HAF103, HAD103/01, HAF202, HAD202/01 and HAF301, together with other documents relating to NPPs' radioactive waste treatment systems, including evaporation and concentration limits, continuous workload of immobilization or solidification process, alarming limits and detectable limits of radiation monitoring meters (including effluent monitoring). These limits and conditions are reviewed and updated in keeping with experience gained and technological progress.

H-49 Under HAF103, HAF202, HAF301, HAD103/06, and HAD202/01, the operators of all nuclear facilities prepared operational program, maintenance program, environmental monitoring program, oversight program, and waste management program, etc. According to these programs, additional operating procedures are prepared covering system process, main equipment, valve manipulation, and preset operation; besides, the maintenance plans and procedures for radioactive waste management facility are prepared, along with radioactive effluence controlling and monitoring procedures. And non-radioactive simulation test and inspection procedures on engineering scale are prepared including operating model and parameters related to radioactive waste management system and equipment. The operators of nuclear facilities all follow strictly the above programs and procedures.

H-50 Under the HAD103/06, the maintenance workers are allowed to taken

turns to attend training, on a regular basis, held by construction contractors or equipment manufacturers during the entire operational lifetime of a nuclear facility's radioactive waste management facility; professional advices are available from the external expert institutions with respect to operational experiences of the facility, failure and malfunction analysis; the QA-related review can be performed independently by qualified external experts; consultations about radioactive effluent release and on-field waste treatment may be obtained from professional institutions. The operators are able to receive appropriate medical service and bioassay establishments, along with recommendations and guidance on in-service inspection. In similarity, the engineering and technology support relating to the safety field is also available for the entire operating period of the radioactive waste management facilities built for other nuclear facilities.

H-51 The operators of NPPs classify usually radioactive wastes generated at NPPs into process waste, technical waste and other types of waste according to their origin. Furthermore, according to physical behavior, the operators classify process wastes into evaporated residual liquid, waste resins, sediment and filter core, etc; classify technical wastes into compressible and incompressible waste and combustible and incombustible waste. The operators developed radioactive waste segregation procedures to characterize all classes of wastes.

H-52 Under *Methods for Management of Experience Feedback at Operational Nuclear Power Plants* (MMEFONPP), the operators of NPPs employ the analytical methods recommended by MEP/NNSA to investigate and study operating events, if occurred, and report to MEP/NNSA. The operators submit periodically to MEP/NNSA the lists and abstracts of internal events, together with the reports deemed necessary. As required by MEP/NNSA, they also prepare and effectively implement the program or management procedures of experience feedback for their own respective NPPs.

H-53 Under GB/T 19597-2004, after a period of operation of a nuclear facility, the operator of such a facility shall prepare the mid-term decommissioning plan, which should provide a detailed description of how to treat radioactively contaminated or exposed structures, systems and components during its radioactive waste management facility maintenance, in order to develop the decommissioning plan of the radioactive waste management facility. Under *Rules on the Management of Civilian Nuclear Facilities Decommissioning* (RMCNFD) that is currently under development, the operator of a nuclear facility since operation should make revision of its

decommissioning plan at a 10 year interval. When a decommissioning plan is in need of substantial revision in response to a major change, event or accident taking place at a nuclear facility, a timely revision to this plan is necessary.

H.6.2 Operation of Radioactive Waste Temporary Storage Facility associated with Nuclear Technology Application

H-54 Under the MMLSDSRW, the operators of all radioactive waste temporary storage facilities associated with nuclear technology application have obtained the operation licenses.

H-55 Operational conditions are set for the radioactive waste temporary storage facilities associated with nuclear technology applications, such as surface dose rate limits of disused sealed source storage containers and of variable locations at such facilities, and number of ventilation change in different areas, etc.

H-56 A full range of management operational procedures have been established and implemented strictly by the operators of radioactive temporary waste storage facilities associated with nuclear technology applications, such as those for equipment operation and manipulation, for acceptance, inspection and validation of disused sealed sources, for packaging and conditioning of disused sealed sources, for workers' body surface contamination inspection and decontamination, for vehicle and tools contamination inspection and decontamination, for operational monitoring plan and radiation environmental monitoring plan, and for periodic equipment inspection and testing, as well as operational monitoring plan and radiation environmental monitoring plan, etc.

H-57 Radioactive waste temporary storage facilities associated with nuclear technology application can be provided with engineering and technical assistance and support in all areas related to safety during their entire operating lifetime.

H-58 Procedures for radioactive waste characterization and segregation are prepared by the operators of radioactive waste temporary storage facilities associated with nuclear technology application.

H-59 A safety-related accident, if occurred, shall be reported timely to the relevant regulatory bodies under the RSRWM, which points out that the operator of a radioactive waste temporary storage facility shall identify causes, take protective measures and report to the environmental protection departments of provinces, autonomous regions or municipalities where such a facility is located when discovering potential safety hazards and environmental

radioactivity in excess of relevant national limits; a radiation accident, if occurred, should be reported to the relevant departments by law, and emergency response should be activated.

H-60 Under the TRSDCNTARTSF (trial), the decommissioning plan proposed for an operational nuclear technology application facility continue to undergo the evaluation, elaboration and updating during its operation.

H.6.3 Operation of LILW Disposal Facility

H-61 Operation licenses were granted in 2011 by the MEP/NNSA to Guangdong Beilong Solid LILW disposal site and Northwest Solid LILW disposal site, specifying the category of waste, radionuclides inventory, waste disposal activity and licensed period.

H-62 Operational conditions and limits were established for operation of both disposal sites under GB 9132-1988 and GB 16933-1997 in respect to radionuclide content in radioactive waste packages, radiation level on container surface, surface contamination limits, mechanical stability, leaching resistance, free liquid, chemical composition, heat and radiation stability, resistance to ignitability, anti-microbial destructivity of waste forms, package container and loaded amount.

H-63 Operation procedures were developed under the RSRWM and GB 9132-1988 and implemented strictly for the management of both disposal sites, involving operational procedures for waste disposal, QA program, procedures of operation and manipulation, radiation protection program, environmental monitoring plan, accident emergency plan, procedures for periodic equipment testing, etc. Consistent with disposal site surveillance and management requirements, operational monitoring plan and environmental radiation monitoring plan, in addition to facility safety inspection, the radiation monitoring was conducted of groundwater, surface water, rocks and soils, plant, and air in the surrounding environment. Monitoring and inspection data were recorded truthfully. The summary report of the previous year is reported to the MEP/NNSA before March 31 every year. Monitoring results indicate that no significant variations were found in the environmental situation at both sites before and after waste acceptance.

H-64 Radioactive waste disposal facilities can obtain engineering and technical support in all areas relating to safety during their entire operating lifetime.

H-65 Procedures for radioactive waste characterization and segregation are

prepared by the operators of radioactive waste disposal facilities.

H-66 A safety-related accident, if occurred, shall be reported timely to the relevant regulatory bodies under the RSRWM, which points out that the operator of a radioactive waste disposal facility shall identify causes, take protective measures and report to the environmental protection departments of provinces and nuclear industry authority, when discovering potential safety hazards and environmental radioactivity levels in excess of relevant national limits; a radiation accident, if occurred, should be reported to the relevant departments by related requirements, and emergency response should be activated.

H.7 Institutional Measure after Closure (Article 17)

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.

H-67 In China, there has not yet been any activity or practice related to the closure of a disposal facility. However, the relevant requirements have been provided for in the existing relevant laws, regulations and standards.

H-68 For record keeping, the operator of solid radioactive waste disposal facility shall, under the RSRWM, establish archives for solid radioactive waste disposal to faithfully and completely record issues concerning disposal activities such as origin, quantity, characteristics, and emplacement of solid radioactive wastes. The archives on solid radioactive waste disposal shall be permanently preserved.

H-69 On institutional controls, Under the RSRWM, a solid radioactive waste disposal facility shall be closed complying with the relevant laws and regulations and subsequently permanent marks should be set in the designated areas. After closure of a disposal facility, the operator of such a disposal facility shall carry out institutional control according to the approved institutional control program. Under GB/T 15950-1995, groundwater monitoring should

continue to focus on the analyses of chemical indicators and radioactive materials early after closure. If finding that groundwater has reached at ground surface and eventually enter into stream, river or lake, these waters should be monitored. Plant and burrowing animal, along with their excrement, should be sampled to analyze, so as to determine radionuclide absorption on them and to demonstrate whether biological barrier continue to be effective.

H-70 It is required by GB 9132-1988 that the post-closure surveillances, for example, environmental monitoring, access restriction, facility maintenance, archive keeping and likely emergency actions, shall be carried out, in combination with the involvement of national and local environmental protection departments. Under the *Regulations on radioactive waste safety* (HAF401), post-closure institutional controls shall be carried out so that the necessary remedial actions can be implemented.

I. TRANSBOUNDARY MOVEMENT (Article 27)

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 the 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 international 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 (iii) are met prior to transboundary movement;

(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.

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

Nothing in this 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 is 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 At the time of joining the Joint Convention, China has expressed its comprehension of transboundary movement from a Contracting Party as referred in Articles 2 (u) and 27 of the Joint Convention. Namely, prior to consenting to the transboundary movement from another Contracting Party, a Contracting Party as a State of destination should confirm, to the State of transit, that the State of origin has authorized such a transboundary movement.

I-2 Under Article 47 of the LPCRP, both radioactive waste and goods contaminated with radioactivity are prohibited from being imported into, or moved through, China's territory. However, radioactive waste and goods contaminated with radioactivity which is generated from the products exported from the People's Republic of China can be returned to the country's territory by law, if they are required under relevant regulations to return for treatment and disposal at home. Article 16 of RSPRRI requires the competent foreign trade authority under the State Council, in conjunction with the competent environmental protection authority under the State Council, General Administration of Customs, the administration of quality supervision, inspection and quarantine of the State Council and the competent authority of radioisotopes producers, to develop and issue both the catalog of limited radioisotopes for imported and exported and the catalog of prohibited radioisotopes for import and export. The radioisotopes being currently listed in the catalog of limited radioisotopes for import and export can not be imported unless they have underwent the review and obtained the approval from the competent environmental protection authority under the State Council and the foreign trade competent authority under the State Council has granted import license in accordance with relevant national foreign trade regulations. The radioisotopes other than the above-specified can be imported after implementing the national foreign trade regulations.

I-3 Under the *Regulation for the safe transport of radioactive material* (GB 11806-2004), transboundary movement of radioactive materials shall be subject to the regulations issued by State of transit and/or State of destination concerning transportation of dangerous goods. Some types of packages shall be subject to permit of each of such States. The overall safety level during transportation shall be at least equivalent to the total safety level that should

be met after all applicable requirements could have been met.

I-4 China takes the appropriate steps to ensure that the transboundary movements are undertaken in a manner consistent with the provisions of the Joint Convention and relevant binding international instruments. As a State of origin, China requires the involved State of destination to confirm that such a transboundary movement has been authorized by China, and wants the involved consigner to have obtained the prior notification of such a State of destination. China shall legally approve and regulate any transboundary movement of radioactive waste within its boundary. China, as a State of destination, affirm to have the administrative and technical capacity, together with the regulatory system needed to manage spent fuel and radioactive waste in a manner consistent with the Joint Convention and shall examine and approve any transportation activities in territory on radioactive waste in a manner consistent with this Convention.

I-5 As of 31st December 2016 the typical transboundary movement was 2766 disused sealed sources return to the original countries.

I-6 As of 31st December 2016 China has never shipped spent fuel or radioactive waste to any area south of latitude 60°degrees South for storage or for disposal.

J. DISUSED SEALED SOURCES (Article 28)

1. Each Contracting Party shall, in the framework of its national law, take the appropriate steps to ensure that the possession, remanufacturing or disposal of disused sealed sources takes place in a safe manner.

2. A Contracting Party shall allow for reentry 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 Requirements for Disused Sealed Sources Management

J-1 China attaches great importance to the safety of radioactive sources management during their entire lifetime. In recent years, a number of regulations and rules were issued, such as RSPRRI, MLRRIS, RSRWM, and MMSPRRI. These set forth the requirements for the production, distribution, use, transfer, import and export, use in different areas, storage, disposal, recycle and clearance of radioactive sources during their entire lifetime.

J-2 These also make clear stipulations to the management of disused sealed sources:

(1) a producer or importer of radioactive sources who intends to sell Category I, II and III sources should sign return agreement with the buyer of such sources.

(2) a user of Category I, II or III radioactive sources who intends to transfer his radioactive source to another user should sign return agreement of disused sealed sources with such user. If an imported radioactive source is transferred, the user to receive such radioactive source should obtain the copy of return agreement from the original exporter.

(3) an user of Category I, II or III radioactive sources should, within 3 months after the sources become disused, return the disused sealed sources to manufacturer or original exporter in accordance with the signed return agreement. Those radioactive sources under these categories that can not be returned to the original manufacturer or exporter should be brought to the licensed solid radioactive waste storage facility or directly to the licensed solid radioactive waste disposal facility.

(4) a user of Category IV or V radioactive sources should carry out conditioning and packaging of such sources in accordance with the provisions of competent environmental protection department concerned and

then transfer them to the licensed storage or disposal facility.

(5) a user of radioactive source who intends to send disused sealed source to licensed solid radioactive waste storage or disposal facility shall bear the relevant costs.

(6) a user of radioactive source should make a registration to the competent provincial environmental protection departments within 20 days after completion of the activities such as the return and transfer of disused sealed source to the manufacturer or original exporter, or to solid radioactive waste storage or disposal facility.

(7) a disused sealed source, but still has value, which has been transferred to the storage facility or returned to the original manufacturer can be reused after finishing related register according to the requirements of RSPRRI.

(8) a solid radioactive waste storage facility shall store and clear the disused sealed sources, in terms of the Categories, which have been received according to the relevant national standards and the provisions of the MEP/NNSA , and provide them timely clearance, or otherwise, send them to licensed solid radioactive waste disposal facility.

(9) a scrap metal recovery or smelting firm shall send orphan source, if discovered during its operation, to licensed radioactive waste storage facility associated with nuclear technology applications in the locality where the firm is located.

J.2 Recovery of Exported Source

J-3 Abiding by the *Code of Conduct for the Safety and Security of Radioactive Sources* and the *Guidelines on the Import and Export of Radioactive Sources*, China promises to recover the radioactive sources exported from China.

J-4 Under RSPRRI and MLRRIS, the MEP/NNSA shall exercise the relevant procedures according to the related international conventions and agreements contracted or signed by Chinese government. An exporter of radioactive sources shall submit related Radioactive Source Export Forms to the MEP, along with copies of effective agreement signed between exporter and importer. There is a column in the form to be marked with whether or not such sources shall be returned to the importer.

K. GENERAL EFFORTS TO IMPROVE SAFETY

K.1 Measures Taken to Suggestions and Challenges Identified at the last Review Meeting

K-1 Specific to the Challenges identified by the Country Group where China presented at the last Review Meeting, China has taken many measures to response to these challenges since the last Review Meeting.

K.1.1 Improving Radioactive Waste Management Laws and Rules

K-2 Under LPCRP, China has launched the top-level design and research on the legislation and regulation system of radioactive waste management and developed the specific plan for implementation, which is underway.

K-3 Since the last Review Meeting, a number of departmental rules were issued, such as PMMFTDSFNPP, RRNSSFDSSN (trial), MPIEP, the *Management Methods for Oversight of Radioactive Article Transportation Safety* (MMORATS), and revised *Regulations on NPP design safety*. Additionally, a nuclear safety guideline *Radioactive Waste Minimization at Nuclear Facilities* (HAD 401/08-2016) was issued.

K-4 Since the last Review Meeting, continued efforts were focused on developing and revising more departmental rules on radioactive waste classification, safety on radioactive waste management and management of civilian nuclear facilities decommissioning. Future emphases will be on developing 18 safety guidelines, covering safety case and safety assessment for near-surface disposal of radioactive waste, minimization of radioactive waste arising from nuclear technology application, safety assessment of nuclear and radiation facilities decommission, decommissioning of nuclear fuel cycle facilities, as well as decommissioning of nuclear power plants and research reactors and so on.

K-5 Since the last Review Meeting, the paces have been expedited to develop *Nuclear Safety Act* and *Atomic Energy Act*. MEP/NNSA took the lead in drafting *Nuclear Safety Act* in 2013, which has been submitted to the National People's Congress Environmental and Resources Committee and listed in the plan of National People's Congress on the second type of legislation in the same year. In 2014, under the joint effort of the Environmental and Resource Committee, Legislative Affairs Committee of the NPC, Legal Affairs Office of the State Council, MEP/NNSA, a mission to IAEA and France was organized for purpose of investigation and research activities on nuclear safety legislation. In the second half of 2014, IAEA

dispatched an advisory mission to China to provide nuclear safety legislation advisory. In October 2015, the draft *Nuclear Safety Act* passed the review of 18th session of the Environmental and Resource Committee of the 12th NPC and was, from 14 November to 31 December 2016, made public on the NPC website (www.npc.gov.cn) for public consultation after reviewed by 24th session of the Standing Committee of the 12th NPC.

K-6 By the end of 2014, the CAEA completed draft *Atomic Energy Act* (AEA) for approval, which was made into the formal acceptance procedure of the State Council in this year. In 2015, the Legal Affairs Office of the State Council (LAOSC) solicited the views from relevant departments and organizations with regard to the draft. The LAOSC mandated Chinese Nuclear Society (CNS) and China Law Society (CLS) to take lead in convening expert meeting for discussion. On these basis, the CAEA had a compilation of legislative basic materials completed and a legislative investigation plan developed in 2016. Meanwhile, the CAEA took the efforts to organize the compilation of the latest nuclear laws and regulations, thus forming the *Collection of Chinese Nuclear-Related Laws and Regulations* and the *Collection of Chinese Nuclear-related Departmental Rules.* The LAOSC has made the draft AEA into the 2017 Legislation Plan and proposed to initiate a investigation for revision and improvement of the draft AEA.

K.1.2 Improving Regulatory Control Capabilities

K-7 Since the last Review Meeting, the management of regulatory staff of nuclear and radiation safety has been further normalized. In March 2014, China began to implement *Certification Management Methods for Nuclear and Radiation Safety Regulatory Staff.* The MEP/NNSA exercise identification, training and examination of the nuclear and radiation safety regulatory staff who applied for receiving relevant certificates, involving spent fuel, radioactive waste and disused sealed source.

K-8 Since the last Review Meeting, a broad range of nuclear and radiation regulatory measures have been further elaborated. The MEA/NNSA has conducted classification, analysis and assessment of the full range of existing regulations and rules, procedures and management practices, by reference to the latest IAEA safety standards and good practices implemented by international counterparts. The MEP/NNSA organized to prepare and issue, in 2015, a *Comprehensive Management Manual on Nuclear and Radiation Oversight.* This Manual elaborated the basic

requirements for the nuclear and radiation safety regulatory headquarter and its regional branches, as well as relevant technical support forces, to establish, implement, assess and continue to improve their safety management systems and made clear the structure and key elements of such a system, with a description given to MEP/NNSA's organizational structure, management responsibilities, stakeholders and their interface. By means of this Manual, it will be possible to efficiently identify and manage the diverse range of resources and to plan and control MEP/NNSA's core work and support process in a manner that will ensure its management system to be in an effective operation concurrently with high quality and that can provide vigorous support to its fulfillment of regulatory responsibility.

K-9 The work to conduct training on nuclear and radiation safety regulation has been sustained in an attempt to improve the quality of nuclear and radiation safety regulation staff. During 2014 to 2016, the MEP/NNSA issued *MEP/NNSA's Directive Opinion on the Training of Nuclear and Radiation Safety Regulation*, indicating the current and future emphasis and direction of enhancing training task. MEP/NNSA's Training Plan was also worked out, according to which qualification training and on-job training shall be carried out for nuclear and radiation safety regulatory staff. In this period, the MEP/NNSA launched a total number of 23 primary occupation training courses for regulatory staff on nuclear and radiation were carried out. There were a total of 1263 staff having passed the training and obtained the course-completion certificates; another 796 staff participated in middle-class occupational training and obtained course-completion certificates. Furthermore, 518 staff participated in and completed the provincial-level training of radiation safety oversight and obtained the certificates. Additionally, more than 8200 staff accepted the on-job training. Apart from these, post-graduate classes for engineering master were initiated in collaboration with Tsinghua University in the fields of nuclear energy and technology with regard to radiation protection and environmental protection in a way as to raise knowledge and management levels.

K-10 Since the last Review Meeting, a project of National Technology Research and Development Base (NTRDB) in relation to nuclear and radiation safety regulation has been under development, covering a diverse range of capability building in respect of radioactive waste safety management and nuclear facility decommissioning safety demonstration, radiation environmental monitoring technique, as well as nuclear and radiation safety surveillance and emergency response. By configuring

necessary research means and technical equipment, the NTRDB project will form a relatively independent and comprehensive capability to encompass the functions of analysis, assessment, validation, calculation and testing verification in relation to nuclear and radiation safety.

K-11 Since the last Review Meeting, environmental monitoring capability building were conducted. In 2014, the MEP/NNSA launched a wide range of capability building, which includes national mobile radiation level emergency monitoring, laboratory-based emergency analysis and monitoring, Beijing radiation environmental automatic monitoring station, and deployment of monitoring equipment in Tebit environmental radiation monitoring station.

K.1.3 Ensuring Spent Fuel Capacity Meets Nuclear Program Needs

K-12 Now, the CAEA has led the relevant agencies to develop capability building plan for spent fuel storage system at NPPs. Dependent on the present situation and demand of spent fuel generation, transportation and storage in the country, this plan will explicit the program and assurance measures in relation to spent fuel transportation and storage capacibility building and put forward the approaches of spent fuel management suitable for nuclear power expansion.

K-13 In March 2014, the CAEA issued the PMMFTDSFNPP, which made clear the fund-management responsibility of the CAEA, together with project contractors and their lead agencies. It defines the procedures for project application and approval and for annual project planning and budget, along with the procedures for project organization/implementation and financial management. It shall further normalize the management methods of project funds, in order to bring spent fuel treatment and disposal well under way.

K-14 In December 2015, the MEP/NNSA issued the RRNSSFDSSN (trial), which makes, for spent fuel dry storage facility newly built at a NPP, the following provisions, such as (1) compliance with the effective laws and regulations on environmental protection and nuclear safety in aspects of its design, construction, operation and decommissioning, (2) referrible internationally advanced regulatory guidelines, technical documents and industry standards, (3) recommended procedures and requirements for project application, (4) required format and contents of safety analysis report, and (5) suggested contents of safety review and evaluation.

K-15 Since the last Review Meeting, the newly built nuclear reactors in

operation were all configuated each with spent fuel storage facility in China. see L.1.1. Spent fuel dry storage facility construction has been launched at Daya Bay NPP and Tianwan NPP. The effort to construct a large spent fuel reprocessing plant has been under going envisioned.

K.1.4 Promoting Public Acceptance of Radioactive Waste Disposal Site

K-16 By the joint effort of several lead agencies, the *Policy Statement on Nuclear Safety Culture* (PSNSC) was issued in December 2014 and the *Methods of the Public Involvement in Environmental Protection* (MPIEP) in July 2015, which specify the two documents required to ensure the public to have access to information right, participation right and oversight right in many ways. Through opinion gathering, questionaries, open dialogue, expert meeting, public hearings, it may be possible for relevant lead agencies to solicit the public comments and suggestions from citizens, legal persons and other organizations with regard to environmental protection affairs or proposed actions. Citizens, legal persons and other organizations may give their comments and suggestions to the environmental protection departments through phone, mail, fax, and internet. Conversely, these comments and suggestions shall be taken into account in decision-making, timely with the feedback returned to them. Furthermore, on 14 November 2016, the draft *Nuclear Safety Act* was made public on the NPC official website for consultation. This Act includes the Chapter and Section on information open and the public involvement, specially specifying nuclear facility information open and radioactive waste disposal information open and the public involvements.

K-17 Relevant lead agencies construct open and transparent information release channels to enlarge the transparency of information related to increase to radioactive waste disposal sites and to further enhance the public acceptance. The MEP/NNSA has the special column on radioactive waste disposal set at its website. This column to describe the objective, mission and waste acceptance process of radioactive waste disposal site, so as to enable the public to have more knowledge and understanding about radioactive waste disposal. It also announces the operation licenses newly issued and the response to the problems existing in the operational disposal sites. These enables the public to believe the safety of disposal site and the effectiveness of regulation of disposal site.

K.1.5 Developing Specific Regulatory Requirements for Decommissioning

K-18 Since the last Review Meeting, a 13th five-year plan to develop the laws and regulations on nuclear and radiation safety for nuclear facility decommissioning was established. These include *Rules on the Management of Civilian Nuclear Facilities Decommissioning* (RMCNFD), *Safety Guidelines on Decommissioning of Nuclear Power Plants and Research Reactors* (SGDNR), *Safety Guidelines on Decommissioning of Nuclear Fuel Cycle Facilities* (SGDNFCF) and *Assessment Guideline on Safety of Nuclear and Radiation Facilities Decommissioning* (AGSNRFD). Currently, the relevant documents are under preparation on the schedule.

K-19 The draft RMCNFD has been completed now. This document is applicable to decommissioning management of NPPs, research reactors, and other nuclear fuel cycle facilities. The content covers categorization of decommissioning activities, decommissioning strategy and termination, subdivided into decommissioning plan and investigation, decommissioning technology selection, decommissioning process, waste management, records and reports.

K-20 The studies were initiated of department rules on the management of nuclear facility decommissioning funds. These studies are focused on the calculation methods on decommissioning funds and the requirements for management and uses. The internal financial management system for decommissioning funds was enhanced at levels of national nuclear power groups and operational organizations.

K.2 Existing Safety Issues, Faced Challenge and Proposed Actions

K.2.1 Development of PWR Spent Fuel Dry Storage Container

K-21 The CAEA is taking the lead to develop the PWR spent fuel dry storage container as a urgent task.

K-22 The studies in relation to the design of spent fuel dry storage container shall be launched involving design standards, structure design and optimization.

K-23 The studies in relation to the fabrication of spent fuel dry storage container shall be launched involving fabrication process, neutron shielding material and performance degradation, sealing technology, and automatic welding technology.

K-24 The studies in relation to the use of spent fuel dry storage container,

together with post-lifetime issues, shall be launched, encompassing safety analysis, radioactive and non-radioactive parameter measurement and testing, spent fuel retrieval, post-lifetime performance test, and examination and assessment.

K.2.2 LILW Disposal Site Selection

K-25 LILW disposal site selection needs to be accelerated further.

K-26 LILW disposal site selection process will be advanced by enhancing the multi-agency coordination between CAEA, NEA and MEP/NNSA, making local governments and relevant national nuclear power groups clearly responsible for their own functions, expediting development of radioactive waste treatment and disposal fund management methods and establishing trans-regional fund disposition compensation mechanism.

K-27 Under OTNSPRC and TFP 2020 VNSRPC, the site-selection plan of LILW disposal site shall be studied and developed so as to expedite siting process on the basis of NPP geographical distribution and of current progress of LILW siting process.

K.2.3 Decommissioning of Research Reactors

K-28 Decommissioning technology of research reactors needs to be developed in depth.

K-29 The final end state of research reactors shall be studied in depth. With a comprehensive account taken of technical, economic and social considerations, the end state objectives of research reactor decommissioning will be studied, including unrestricted or restricted uses together with their public dose constrains, the measures that should be taken in case of postulated surveillance measures failure and variable public dose constrains and in case of such both proposed end state objectives being in unpractical situation.

K-30 The management of radioactive waste from decommissioning of research reactors will be further studied. The studied scope will encompass waste origination, category, amount or volume, characterization; treatment, conditioning, storage and disposal option and technology; and radioactive material recycle, reuse and clearance.

K.3 Policy, Practice and Plan in Response to IRRS Mission to China

K-31 China recognizes that the importance of international peer review in the areas involving nuclear and radiation safety, including the safety of spent fuel management and the safety of radioactive waste management. China welcomes the IRRS mission for exchange with us. As pointed out clearly in the *Policy Statement on Nuclear Safety Culture* (PSNSC) issued in 2014, China pursues the international peer review and encourages the Third Party review activity in developing nuclear safety culture and practice, learning from successful experience, and identifying potential weakness and problems for correction and improvement.

K-32 In order to further improve nuclear and radiation safety regulation in China, an IAEA international team of senior safety experts conducted a follow-up IRRS mission, at the request of China, to the country's nuclear and radiation safety regulatory system from 28 August to 8 September 2016. Emphasis was on inspecting the implementation of recommendations and suggestions as raised in the 2010 IRRS mission report. This follow-up IRRS mission included two additional parts, namely "nuclear safety modification after Fukushima accident" and "radiation environmental monitoring". It has shown that significant progress has been achieved in nuclear and radiation safety regulation in the country, featuring continued increase in regulatory resources, sustained enhancement of independency, authority and effectiveness in regulatory capability. Out of 79 recommendations and suggestions referred to in the 2010 IRRS mission report, 71 were considered closed. Other 8 remain open that include development of *Nuclear Safety Act* (NSA) and development of national policy on spent fuel and radioactive waste management. Additionally, at the time of the 2016 follow-up IRRS mission, more three recommendations and suggestions were made, one of which is that waste minimization plan developed for radiation devices other than nuclear facilities shall be deemed as a part of license application.

K-33 In response to the above suggestions and recommendations, the MEP/NNSA developed action plan, covering action goal, basic principles, action scope, responsibility implementation and assurance measures. the plan also included the tasks to be completed, the measures to be taken, time table needed an responsible agencies.

K.4 Measures to Strength the Openness and Transparency of JC Fulfillment

K-34 China attaches great importance to and strengthen the openness and transparency of various activities taken during JC fulfillment as a whole. For this purpose, a National Report Writing Group (NRWG) and a National Report Review Committee (NRRC) were established. The NRRC consisted of experts from multiple agencies and organizations, such as MEP/NNSA, CAEA, MoFA, MoPS, National Health and Family Planning Commission (NHFPC), NEA, national nuclear power groups, operators of some nuclear facilities and relevant research institutions. In the process of developing National Report, the NRWG gathered information/data from the NRRC's subsidiary organizations. After completion of the draft National Report, the NRRC conducted review of the draft and made recommendations and suggestions to revise it, followed by NRWG's once-again revision to the draft so as to form final National Report based on the proceeding recommendations and suggestions. In the process of answering the written questions asked by other Contracting Parties, the NRWG first gave the preliminary answers to the asked questions and then completed the revision to the written answers, preceded by NRRC's review of written answers, together with giving recommendations and suggestions. During the National Report compilation and question answering, the report contents and discussion process are all open and transparency to all of the agencies and organizations involved in these processes. After the National Report was finalized, both the Chinese and English version of previous National Reports are made available to the public on MEP/NNSA website (http://nnsa.mep.gov. cn/gjhz_9050/gjgybg/). Therefore, the text of National Report is open and transparent to the Public.

K-35 Furthermore, the information related to China's participation with Organizational Meetings, Review Meetings and Extraordinary Meetings of Contracting Parties was made available to the public on MEP/NNSA government website, CAEA website and Annual Reports of NNSA.

K.5 International Cooperation Measures

K-36 China will continue to pay attention to the platform role that the IAEA has played in promoting international cooperation in respect of the safety of spent fuel management and the safety of radioactive waste management. China actively participates in IAEA sponsored international and regional training courses, forums or workshops and meetings. In

addition, China will continue to seriously implement the obligations under the Joint Convention, participate with research and development of coherent international standards, carry out perspective study and discussion and to promote international cooperation and exchange.

K-37 China will steadily push forward cooperation with the United States, France, Britain, Japan, Russia, Spain, the European Union countries and relevant regional organizations in aspect of the safety of spent fuel management and the safety of radioactive waste management. This aspect of input will be included while signing the cooperative agreement and memorandum on nuclear safety with other relevant countries. At the same time, China will increase international peer review frequency, enhance peer review information openness, pay attention to emergency response and assistance, and strengthen bilateral and multilateral cooperation in the field of technical import and joint research.

K-38 China will actively participate in regional nuclear safety cooperation. This includes China-Japan-Korea Senior Officials Meeting on Nuclear Safety Supervision, Global Nuclear Safety and Security Network (GNSSN), Asian Nuclear Safety Network (ANSN) and Forum for Nuclear Cooperation in Asia (FNCA). Through these platforms, relevant member states would commonly share experiences and lessons learnt in respect of the safety of spent fuel management and the safety of radioactive waste management, and these platforms would promote member states to maintain and achieve a high level of safety in aspects of spent fuel management and radioactive waste management. Pursuant to “One Belt and One Road” initiative, China will make unremitting effort to achieve the goal of Joint Convention by extending capability construction, information feedback and experience exchange with the countries around the One Belt and One Road in the field of the safety of spent fuel management and the safety of radioactive waste management.

L. ANNEXES

L.1 List of Spent Fuel Management Facilities

L.1.1 Spent Fuel Storage Facilities at NPPs

No.	Facility Name	Affiliation	Design Capacity（tHM）	Time to Commission
1	Spent fuel pool 1	Qinshan NPP	184	1991
2	Spent fuel pool 2	Qinshan NPP	231	1991
3	Spent fuel pool of 1# reactor	Fangjiashan NPP	554	2015
4	Spent fuel pool of 2# reactor	Fangjiashan NPP	554	2015
5	Spent fuel pool of 1# reactor	Qinshan Phase II NPP	317	2001
6	Spent fuel pool of 2# reactor	Qinshan Phase II NPP	317	2002
7	Spent fuel pool of 3# reactor	Qinshan Phase II NPP	317	2010
8	Spent fuel pool of 4# reactor	Qinshan Phase II NPP	317	2011
9	Spent fuel pool of 1# reactor	Qinshan Phase III NPP	941	2002
10	Spent fuel pool of 2# reactor	Qinshan Phase III NPP	941	2003
11	Spent fuel interim dry storage facility	Qinshan Phase III NPP	8251	2009
12	Spent fuel pool of 1# reactor	Fuqing NPP	458	2013
13	Spent fuel pool of 2# reactor	Fuqing NPP	458	2014
14	Spent fuel pool of 3# reactor	Fuqing NPP	458	2015
15	Spent fuel pool of 1# reactor	Daya Bay NPP	345	1992
16	Spent fuel pool of 2# reactor	Daya Bay NPP	319	1993
17	Spent fuel pool of 1# reactor	Ling’ao Phase I NPP	554	2001
18	Spent fuel pool of 2# reactor	Ling’ao Phase I NPP	554	2002
19	Spent fuel pool of 1# reactor	Ling’ao Phase II NPP	554	2010
20	Spent fuel pool of 2# reactor	Ling’ao Phase II NPP	554	2010
21	Spent fuel pool of 1# reactor	Tianwan NPP	236	2007
22	Spent fuel pool of 2# reactor	Tianwan NPP	236	2007
23	Spent fuel pool of 1# reactor	Changjiang NPP	317	2015
24	Spent fuel pool of 2# reactor	Changjiang NPP	317	2015
25	Spent fuel pool of 1# reactor	Hongyanhe NPP	554	2012
26	Spent fuel pool of 2# reactor	Hongyanhe NPP	554	2013
27	Spent fuel pool of 3# reactor	Hongyanhe NPP	554	2014
28	Spent fuel pool of 4# reactor	Hongyanhe NPP	554	2015

No.	Facility Name	Affiliation	Design Capacity（tHM）	Time to Commission
29	Spent fuel pool of 1# reactor	Ningde NPP	433	2012
30	Spent fuel pool of 2# reactor	Ningde NPP	433	2013
31	Spent fuel pool of 3# reactor	Ningde NPP	433	2014
32	Spent fuel pool of 4# reactor	Ningde NPP	433	2015
33	Spent fuel pool of 1# reactor	Yangjiang Npp	554	2013
34	Spent fuel pool of 2# reactor	Yangjiang Npp	554	2014
35	Spent fuel pool of 3# reactor	Yangjiang Npp	554	2015
36	Spent fuel pool of 1# reactor	Fangchenggang NPP	554	2016
37	Spent fuel pool of 2# reactor	Fangchenggang NPP	554	2016

Note：As of 31 December 2016.

L.1.2 Spent Fuel Storage Facilities at Research Reactors

No.	Facility Name	Operator	Location
1	Spent fuel pool of CIAE	China Institute of Atomic Energy	Beijing
2	Spent fuel pool of Tsinghua University	Tsinghua University	Beijing
3	Spent fuel pool of NPIC	Nuclear Power Institute of China	Sichuan Province

Note：As of 31 December 2016.

L.2 Inventory of Spent Fuel

L.2.1 Inventory of Spent Fuel at NPPs

No.	Facility Name	NPP	Existing Fuel（tHM）
1	Spent fuel pool 1	Qinshan NPP	124.8
2	Spent fuel pool 2	Qinshan NPP	68.8
3	Spent fuel pool of 1# reactor	Fangjiashan NPP	46.5
4	Spent fuel pool of 2# reactor	Fangjiashan NPP	46.3
5	Spent fuel pool of 1# reactor	Qinshan Phase II NPP	211.0
6	Spent fuel pool of 2# reactor	Qinshan Phase II NPP	180.0
7	Spent fuel pool of 3# reactor	Qinshan Phase II NPP	85.6
8	Spent fuel pool of 4# reactor	Qinshan Phase II NPP	84.6
9	Spent fuel pool of 1# reactor	Qinshan Phase III NPP	653.8
10	Spent fuel pool of 2# reactor	Qinshan Phase III NPP	631.1
11	Spent fuel interim dry storage facility	Qinshan Phase III NPP	1348.4
12	Spent fuel pool of 1# reactor	Fuqing NPP	25.7
13	Spent fuel pool of 2# reactor	Fuqing NPP	23.9
14	Spent fuel pool of 3# reactor	Fuqing NPP	0.0
15	Spent fuel pool of 1# reactor	Daya Bay NPP	251.8
16	Spent fuel pool of 2# reactor	Daya Bay NPP	221.5
17	Spent fuel pool of 1# reactor	Ling’ao Phase I NPP	288.6
18	Spent fuel pool of 2# reactor	Ling’ao Phase I NPP	306.9
19	Spent fuel pool of 1# reactor	Ling’ao Phase II NPP	183.8
20	Spent fuel pool of 2# reactor	Ling’ao Phase II NPP	213.2
21	Spent fuel pool of 1# reactor	Tianwan NPP	197.6
22	Spent fuel pool of 2# reactor	Tianwan NPP	213.2
23	Spent fuel pool of 1# reactor	Changjiang NPP	14.7
24	Spent fuel pool of 2# reactor	Changjiang NPP	0.0
25	Spent fuel pool of 1# reactor	Hongyanhe NPP	77.2

No.	Facility Name	NPP	Existing Fuel（tHM）
26	Spent fuel pool of 2# reactor	Hongyanhe NPP	47.8
27	Spent fuel pool of 3# reactor	Hongyanhe NPP	23.8
28	Spent fuel pool of 4# reactor	Hongyanhe NPP	0.0
29	Spent fuel pool of 1# reactor	Ningde NPP	64.3
30	Spent fuel pool of 2# reactor	Ningde NPP	57.0
31	Spent fuel pool of 3# reactor	Ningde NPP	31.2
32	Spent fuel pool of 4# reactor	Ningde NPP	0.0
33	Spent fuel pool of 1# reactor	Yangjiang Npp	64.3
34	Spent fuel pool of 2# reactor	Yangjiang Npp	31.2
35	Spent fuel pool of 3# reactor	Yangjiang Npp	31.2
36	Spent fuel pool of 1# reactor	Fangchenggang NPP	0.0
37	Spent fuel pool of 2# reactor	Fangchenggang NPP	0.0
Amount of wet-storage at reactor			4501.4
Amount of interim dry-storage facility			1348.4
Total			5849.8

Note：As of 31 December 2016.

L.2.2 Inventory of Spent Fuel at Research Reactors

No.	Facility Name	Operator	Existing Fuel（tU）
1	Spent fuel pool of CIAE	China Institute of Atomic Energy	1.14 E-01
2	Spent fuel pool of Tsinghua University	Tsinghua University	0
3	Spent fuel pool of NPIC	Nuclear Power Institute of China	4.13 E-01

Note：As of 31 December 2016.

L.3 List of Radioactive Waste Management Facilities

L.3.1 Radioactive Waste Treatment and Storage Facilities at NPPs

No.	Facility Name	Affiliation	Time to Commission
1	21# LILW storeroom	Qinshan NPP	1991
2	22# solidification workshop	Qinshan NPP	1991
3	24# solid waste storeroom	Qinshan NPP	1991
4	9 TES cementation system	Fangjiashan NPP	2014
5	Waste treatment auxiliary workshop (QS)	Fangjiashan NPP	2014
6	Waste storeroom (QT)	Fangjiashan NPP	2014
7	Radioactive oil temporary storeroom (QR)	Fangjiashan NPP	2014
8	9TES cementation system	Qinshan Phase II NPP	2002
9	8TES cementation system	Qinshan Phase II NPP	2002
10	Solid waste temporary storeroom (QT)	Qinshan Phase II NPP	2002
11	New solid waste temporary storeroom (new QT)	Qinshan Phase II NPP	2011
12	Radioactive oil temporary storeroom (QT2)	Qinshan Phase II NPP	2002
13	Waste temporary storeroom	Qinshan Phase III NPP	2002
14	Solid waste temporary storeroom (QT)	Fuqing NPP	2014
15	Waste treatment auxiliary workshop (QS)	Fuqing NPP	2014
16	Radioactive oil temporary storeroom (QR)	Fuqing NPP	2014
17	Solid waste treatment system (TES)	Fuqing NPP	2014
18	Cement barrel storeroom used by two reactors	Tianwan NPP	2005
19	1# technical radwaste storeroom	Tianwan NPP	2005
20	1# bulky radwaste storeroom	Tianwan NPP	2005
21	1# radioactive oil temporary storeroom	Tianwan NPP	2005
22	1# filter element storeroom	Tianwan NPP	2005
23	2# technical radwaste storeroom	Tianwan NPP	2007
24	2# bulky radwaste storeroom	Tianwan NPP	2007
25	2# radioactive oil temporary storeroom	Tianwan NPP	2007
26	2# filter element Storeroom	Tianwan NPP	2007
27	1# solid radwaste treatment system	Tianwan NPP	2005
28	2# solid radwaste treatment system	Tianwan NPP	2007
29	1# liquid radwaste cementation system	Tianwan NPP	2005

No.	Facility Name	Affiliation	Time to Commission
30	2# liquid radwaste cementation system	Tianwan NPP	2007
31	QS workshop	Changjiang NPP	2015
32	QT workshop	Changjiang	2015
33	NX workshop (part of TES)	Changjiang	2015
34	TES system (NX)	Daya Bay NPP	1994
35	TES system (DQS)	Daya Bay NPP	1994
36	Solid waste temporary storeroom (DQT)	Daya Bay NPP	1994
37	TES system (NX)	Ling'ao Phase I NPP	2002
38	TES system (LQS)	Ling'ao Phase I NPP	2002
39	TES system (NX)	Ling'ao Phase II NPP	2013
40	Solid waste temporary storeroom (KQT)	Ling'ao Phase II NPP	2011
41	Cement solidification facility (9TES)	Hongyanhe NPP	2013
42	Cement solidification facility (8TES)	Hongyanhe NPP	2013
43	Sorting and compressing facility (0TES)	Hongyanhe NPP	2013
44	Storeroom（QT）	Hongyanhe NPP	2013
45	Waste solvent storeroom (QR)	Hongyanhe NPP	2013
46	Waste oil storeroom (QV)	Hongyanhe NPP	2016
47	Cement solidification facility (9TES1 & 9TES3)	Ningde NPP	2013
48	Cement solidification facility (8TES1 & 8TES3)	Ningde NPP	2014
49	Sorting and compressing facility (0TES2)	Ningde NPP	2013
50	Storeroom（QT）	Ningde NPP	2013
51	Waste oil storeroom (QR)	Ningde NPP	2013
52	9TES system	Yangjiang NPP	2013
53	8TES system	Yangjiang NPP	2015
54	QS workshop	Yangjiang NPP	2013
55	QT workshop	Yangjiang NPP	2014
56	9TES system (NX)	Fangchenggang NPP	2015
57	0TES system (QS)	Fangchenggang NPP	2015
58	Solid waste temporary storeroom (QT)	Fangchenggang NPP	2016

Note：As of 31 December 2016.

L.3.2 Radioactive Waste Treatment and Storage Facilities at Research Reactors

No.	Facility Name	Operator
1	Liquid waste temporary storage room	CIAE
2	Liquid waste treatment system	CIAE
3	Solid waste temporary storage room	CIAE
4	Solid waste conditioning facility	CIAE
5	Liquid waste treatment system	Tsinghua University
6	Cement solidification system	Tsinghua University
7	Compressor	Tsinghua University
8	Liquid waste treatment system	NPIC
9	Cement Solidification workshop	NPIC
10	Waste temporary storage room	NPIC
10-1	Temporary storage section	NPIC
10-2	Conditioning section	NPIC
10-3	Compressing section	NPIC

Note：As of 31 December 2016.

L.3.3 Radioactive Waste Treatment and Storage Facilities at Nuclear Fuel Cycle Facilities

No.	Facility Name	Operator
1	Liquid waste pool	Shaanxi Uranium Enrichment Plant
2	Liquid waste treatment facility	Shaanxi Uranium Enrichment Plant
3	Solid waste temporary storage room	Shaanxi Uranium Enrichment Plant
4	Ventilation system	Shaanxi Uranium Enrichment Plant
5	Liquid waste treatment facility	Gansu Uranium Enrichment Plant
6	Solid waste temporary storage room	Gansu Uranium Enrichment Plant
7	Ventilation system	Gansu Uranium Enrichment Plant
8	Liquid waste treatment facility	Northern China Nuclear Fuel Assembly Plant
9	temporary storage room	Northern China Nuclear Fuel Assembly Plant
10	Ventilation system	Northern China Nuclear Fuel Assembly Plant
11	Liquid waste treatment facility	China Jianzhong Nuclear Fuel Co., LTD
12	Bearing uranium waste temporary storeroom	China Jianzhong Nuclear Fuel Co., LTD
13	Ventilation system	China Jianzhong Nuclear Fuel Co., LTD

Note：As of 31 December 2016.

L.3.4 Nuclear Technology Application Radwaste Temporary Storage Facilities

No.	Facility Name	Location	Design Capacity（m^3）	Start of Operation
1	Anhui Radioactive Waste Storage Facility	Anhui	800	2007
2	Beijing Radioactive Waste Storage Facility	Beijing	2300	2009
3	Fujian Radioactive Waste Storage Facility	Fujian	600	2010
4	Gansu Radioactive Waste Storage Facility	Gansu	800	2009
5	Guangdong Radioactive Waste Storage Facility	Guangdong	600	2001
6	Guangxi Radioactive Waste Storage Facility	Guangxi	800	2013
7	Guizhou Radioactive Waste Storage Facility	Guizhou	600	2010
8	Hainan Radioactive Waste Storage Facility	Hainan	400	2010
9	Hebei Radioactive Waste Storage Facility	Hebei	800	2011
10	Henan Radioactive Waste Storage Facility	Henna	800	2008
11	Heilongjiang Radioactive Waste Storage Facility	Heilongjiang	800	2009
12	Hubei Radioactive Waste Storage Facility	Hubei	500	2000
13	Henna Radioactive Waste Storage Facility	Hunan	800	2003
14	Jilin Radioactive Waste Storage Facility	Jilin	1200	1998
15	Jiangsu Radioactive Waste Storage Facility	Jiangsu	1200	2010
16	Jiangxi Radioactive Waste Storage Facility	Jiangxi	600	2012
17	Liaoning Radioactive Waste Storage Facility	Liaoning	800	2012
18	Inner Mongolia Radioactive Waste Storage Facility	Inner Mongolia	800	2009
19	Ningxia Radioactive Waste Storage Facility	Ningxia	400	2009
20	Qinghai Radioactive Waste Storage Facility	Qinghai	400	2012
21	Shandong Radioactive Waste Storage Facility	Shandong	900	2004
22	Shanxi Radioactive Waste Storage Facility	Shanxi	800	2010
23	Shaanxi Radioactive Waste Storage Facility	Shaanxi	800	2013
24	Shanghai Radioactive Waste Storage Facility	Shanghai	1785	2010
25	Sichuan Radioactive Waste Storage Facility	Sichuan	940	2016
26	Tianjin Radioactive Waste Storage Facility	Tianjin	800	2004

No.	Facility Name	Location	Design Capacity（m^3）	Start of Operation
27	Tibet Radioactive Waste Storage Facility	Tibet	200	2010
28	Xinjiang Radioactive Waste Storage Facility	Xinjiang	600	2007
29	Yunnan Radioactive Waste Storage Facility	Yunnan	800	1998
30	Zhejiang Radioactive Waste Storage Facility	Zhejiang	800	2009
31	Chongqing Radioactive Waste Storage Facility	Chongqing	600	2010
32	National Centralized Disused Sealed Sources Storage Facility	Gansu	2600	2011

Note：As of 31 December 2016.

L.3.5 Radioactive Waste Disposal Facilities

No.	Facility name	Location	Status
1	Northwestern China LILW Disposal Site	Gansu	In Operation
2	Guangdong Beilong LILW Disposal Site	Guangdong	In Operation

Note：As of 31 December 2016.

L.4 Inventory of Radioactive Waste

L.4.1 Inventory of NPP Conditioned Radioactive Waste

（Unit: m^3）

No.	NPP Name	Radioactive Waste Volume					
		Concentration	Spent ion exchange resin	Sludge	Water filter	Technical waste	Total
1	Qinshan NPP	1315.8	0.0	0.0	0.0	441.0	1756.8
2	Qinshan Phase II NPP	554.0	812.8	0.0	213.6	1879.6	3460.0
3	Qinshan Phase III NPP	0.0	112.3	0.0	85.4	612.6	810.3
4	Daya Bay NPP	91.0	292.0	14.0	52.1	1377.8	1826.9
5	Ling'ao Phase I NPP	88.0	352.0	4.0	85.3	756.1	1285.4
6	Ling'ao Phase II NPP	58.8	93.2	0.0	23.2	350.4	525.6
7	Tianwan NPP	399.5	1046.0	46.1	0.0	659.4	2151.0
8	Hongyanhe NPP	8.4	26.4	0.0	28.0	301.2	364.0
9	Ningde NPP	28.8	12.0	0.0	31.2	276.0	348.0
10	Yangjiang NPP	31.6	24.4	0.0	7.6	0.0	63.6
11	Fuqing NPP	16.0	3.2	0.0	4.8	14.0	38.0
12	Fangjiashan NPP	29.2	1.6	0.0	14.2	77.8	122.8
13	Changjiang NPP	0.0	0.0	0.0	3.8	6.2	10.0
14	Fangchenggang NPP	0.0	0.0	0.0	0.0	0.0	0.0
Total		2621.1	2775.9	64.1	549.2	6752.1	12762.4

Note：As of 31 December 2016.

L.4.2 Inventory of Radioactive Waste Other Than NPPs

(Unit: m^3)

No.	Type	Radioactive Waste Volume				
		Intermediate level liquid waste	Intermediate level solid waste	Low level liquid waste	Low level solid waste	Total
		Waste Package	Waste Package	Waste Package	Waste Package	Waste Package
1	Research Reactors	883.0	883.0	295.0	646.6	2707.6
2	Uranium Enrichment Facilities	0.0	0.0	0.0	0.0	0.0
3	Fuel Fabrication Facilities	0.0	0.0	0.0	408.9	408.9
Total		883.0	883.0	295.0	1055.5	3116.5

Note：As of 31 December 2016.

L.4.3 Inventory of Disused Sealed Sources in Nuclear Technology Application Radwaste Temporary Storage Facilities

No.	Province	Disused Sealed Source
1	Anhui	1216
2	Beijing	6866
3	Fujian	839
4	Gansu	1332
5	Guangdong	2436
6	Guangxi	750
7	Guizhou	867
8	Hainan	261
9	Hebei	1832
10	Henan	3191
11	Heilongjiang	1101
12	Hubei	1424
13	Hunan	1221
14	Jilin	967
15	Jiangsu	1409
16	Jiangxi	648
17	Liaoning	635
18	Inner Mongolia	1186
19	Ningxia	337
20	Qinghai	213
21	Shandong	1736
22	Shanxi	1173
23	Shaanxi	745
24	Shanghai	707
25	Sichuan	1301
26	Tianjin	1869
27	Tibet	53
28	Xinjiang	0
29	Yunnan	1163
30	Zhejiang	2369

No.	Province	Disused Sealed Source
31	Chongqing	494
32	Gansu	84448
Total		124789

Note：As of 31 December 2016.

L.4.4 Inventory of Waste for Disposal

No.	Disposal Site	Waste Received (m^3)	Total Activity (Bq)
1	Northwestern China LILW Disposal Site	11408.36	4.81 E+14
2	Guangdong Beilong LILW Disposal Site	2116.04	1.00 E+14
Total		13524.40	5.81 E+14

Note：As of 31 December 2016.

L.5 Relevant Laws, Regulations, Rules, Guidelines and Standards

L.5.1 Relevant Laws

Title	Issued by	Entry into force
The Law of the People's Republic of China on Environmental Protection	the Standing Committee of the National People's Congress	Revised, 2015
The Law of the People's Republic of China on Prevention and Control of Water Pollution	the Standing Committee of the National People's Congress	Revised, 2008
The Law of the People's Republic of China on Prevention and Control of Air Pollution	the Standing Committee of the National People's Congress	Revised, 2016
The Law of the People's Republic of China on Marine Environment Protection	the Standing Committee of the National People's Congress	Revised, 2016
The Law of the People's Republic of China on Safety of Operation	the Standing Committee of the National People's Congress	Revised, 2014
The Law of the People's Republic of China on Environmental Impact Assessment	the Standing Committee of the National People's Congress	Revised, 2016
The Law of the People's Republic of China on Prevention and Control of Radioactive Pollution	the Standing Committee of the National People's Congress	2003
The Law of the People's Republic of China on Prevention and Control of Solid Waste Pollution	the Standing Committee of the National People's Congress	Revised, 2005
The Law of the People's Republic of China on Prevention and Control of Occupational Disease	the Standing Committee of the National People's Congress	Revised, 2016

L.5.2 Relevant Administrative Regulations

Title	Issued by	Entry into force
Regulations of the People's Republic of China on the safety control of civilian nuclear installations	the State Council	1986
Regulations of the People's Republic of China on nuclear materials	the State Council	1987
Regulations of the People's Republic of China on NPP accident emergency management	the State Council	1993
Regulations of the People's Republic of China on nuclear export management	the State Council	Revised, 2006
Regulations of the People's Republic of China on nuclear dual-use item and relevant technologies management	the State Council	Revised, 2007
Regulations on safety and protection of radioisotope and ray-generating installations	the State Council	2014
Regulations on surveillance and management of civil nuclear safety equipment	the State Council	2008
Regulations on safety of radioactive material transport management	the State Council	2010
Regulations on safety of dangerous chemical material management	the State Council	Revised, 2011

Title	Issued by	Entry into force
Regulations on safety of radioactive waste management	the State Council	2012

L.5.3 Relevant Rules

Title	Issued by	Entry into force
1 Generic Series		
Detailed rules (i) of the People's Republic of China on regulating civil nuclear facility safety - application and granting of NPP safety licenses	NNSA	1993
Annex 1 of the detailed rules (i) of the People's Republic of China on regulating civil nuclear facility safety - granting and management procedures of NPP operator license	NNSA	1993
Detailed rules (ii) of the People's Republic of China on regulation of civil nuclear facility safety – regulation of nuclear facility safety	NNSA	1995
Annex 1 of the detailed rules (ii) of the People's Republic of China on regulation of civil nuclear facility safety – reporting system of NPP operators	NNSA	1995
Annex 2 of the detailed rules (ii) of the People's Republic of China on regulation of civil nuclear facility safety – reporting system of research reactor operators	NNSA	1995
Annex 3 of the detailed rules (ii) of the People's Republic of China on regulation of civil nuclear facility safety ii – reporting system of nuclear fuel cycle facilities	NNSA	1995
Detailed rules (iii) of the People's Republic of China on regulation of civil nuclear facility safety - provisions on application and procedure for reactor safety license	NNSA	2006
Detailed rules (i) for regulations on NPP accident emergency management – emergency preparedness and response of NPP operators	NNSA	1998
Regulations on NPP quality assurance safety	NNSA	1991
Temporary regulations on road transport of NPP spent fuel	CAEA, MPS, MoT and MoH	2003
Regulatory procedures on transfer and transboundary movement of nuclear products (trial)	NNSA	2000
Certificate management methods for regulatory inspection staff of nuclear and radiation safety	MEP/NNSA	2013
2 Nuclear Power Plant Series		
Regulations on NPP siting safety	NNSA	1991
Regulations on NPP design safety	NNSA	Revised, 2016
Regulations on NPP operation safety	NNSA	2004
Annex 1 of the regulations on NPP operation safety – management of NPP during refueling, modification, and accidental shutdown	NNSA	1994
Methods for management of experience feedback at operational nuclear power plants	NNSA	2012

Title	Issued by	Entry into force
General Technical Requirements for Modification Action of Nuclear Power Plants after Fukushima Daiichi Nuclear Power Station Accident (trial)	NNSA	2012
3 Research Reactor Series		
Regulations on research reactor design safety	NNSA	1995
Regulations on research reactor operation safety	NNSA	1995
4 Nuclear Fuel Cycle Installation Series		
Regulations on civil nuclear fuel cycle safety	NNSA	1993
5 Spent Fuel and Radioactive Waste Management Series		
Assumptions on the potential accident at spent fuel reprocessing plant	NNSA	1995
Design safety guidelines on spent fuel reprocessing plant	NNSA	1995
Regulations on radioactive waste safety	NNSA	1997
Rules for categorization of radioactive sources	SEPA	2005
Technical requirements on siting, design and construction of nuclear technology application radwaste storage facility	SEPA	2004
Provisions on decommissioning management of nuclear facilities and radioactive waste	CAEA	2010
Interim procedures on collection, utilization and management of the funds for treatment and disposal of spent fuel from nuclear power plants	MoF，NDRC，CAEA	2010
Projects management methods of the funds for treatment and disposal of spent fuel from nuclear power plants	CAEA	2014
Management measures for licensing the storage and disposal of solid radioactive waste	MEP	2014
6 Emergency Series		
Regulations on transboundary emergency management for radiation impacts of nuclear accident	CAEA	2002
Intervention principles and levels for the public protection in an event of a nuclear emergency	NNSA, SEPA	1991
Derived intervention levels for the public protection in the event of a nuclear emergency	NNSA, SEPA	1991
Emergency preparedness and response for radioactive sources and radiation technology applications	CAEA, MoH	2003
Regulations on management of special revenue for NPP accident emergency preparedness	MoF, CAEA	2007
Decision-making on protection measures and rehabilitation against serious accident in later stage	CAEA	2000
Emergency preparedness and response on radioactive materials transport accident	CAEA	2000
Regulations on the management of nuclear emergency exercises	NNAECC	2015
Management methods on nuclear emergency training	NNAECC	2015

Title	Issued by	Entry into force
Management Methods for Nuclear Accident Information Release	NNAECC	2015
Management methods for national nuclear emergency on-shift network operation	NNAERO	2015
Management methods on nuclear accident emergency reporting	NNAECC	2016
Management methods on national nuclear emergency technical support center and rescue team	NNAECC	2016
Code of building national radiation monitoring technical support team for on-site nuclear emergency rescue	NNAECC	2016
Code of national air radiation monitoring team for nuclear emergency rescue	NNAECC	2016
Code of building national maritime radiation monitoring technical support center for nuclear emergency and national maritime radiation monitoring team for nuclear emergency rescue	NNAECC	2016
Code of building national radiation protection technical support team for on-site nuclear emergency rescue	NNAECC	2016
Code of building national medical rescue team for nuclear emergency	NNAECC	2016
Summarized Principles on Developing Nuclear Emergency Assistance Program	NNAERO	2016
7 Nuclear Series		
Detailed rules for the regulations of the People's Republic of China on regulating nuclear materials	NNSA, NEA, CAEA	1990
8 Civilian Nuclear Safety Equipment Regulatory Management Series		
Regulations on oversight of design, manufacture, installation and non-destructive detection of civilian nuclear safety equipment	SEPA	2007
Regulations on qualification management of non-destructive detection staff of civilian nuclear safety equipment	SEPA	2007
Regulations on qualification management of welding workers of civilian nuclear safety equipment	SEPA	2007
Regulatory provisions on import of civil nuclear safety equipment	SEPA	2007
9 Radioactive article transportation management series		
Management methods for licensing radioactive article transportation safety	MEP	2010
Management methods for oversight of radioactive article transportation safety	MEP	2016
10 Radioisotopes and Ray-generating Installations Regulatory Series		
Methods for licensing of radioisotopes and ray-generating installations safety	SEPA	Revised, 2008
Management measures on safety and protection against radioisotope and ray-generating installation	MEP	2011
11 Others		
Regulations on management of special revenue for NPP accident emergency Preparedness	MoH	2007

L.5.4 Relevant Guidelines

Name	Issued by	Entry into force
1 Generic Series		
Emergency preparedness and response for nuclear power plant，HAD 002/01	NNSA	2010
Emergency preparedness by local government for nuclear power plant，HAD 002/02	NNSA, SEPA, MoH	1990
Intervention principle and level for the public radiation protection in an event of nuclear emergency，HAD 002/03	NNSA,SEPA	1991
Derived intervention principle for the public radiation protection in an event of nuclear emergency，HAD 002/04	NNSA,SEPA	1991
Medical emergency preparedness and response in an event of nuclear accident，HAD 002/05	NNSA, MoH	1992
Research reactor emergency planning and preparedness，HAD 002/06	NNSA	1991
Emergency planning for operators of civil nuclear facilities，HAD 002/07	NNSA	2010
Quality assurance program for NPPs，HAD003/01	NNSA	1988
Quality assurance organization of NPPs，HAD003/02	NNSA	1989
Quality assurance for items serve and procurement for NPPs，HAD003/03	NNSA	1986
Quality assurance record system for NPPs，HAD003/04	NNSA	1986
Oversight and inspection of quality assurance for NPPs，HAD003/05	NNSA	1988
Quality assurance for design of NPPs，HAD003/06	NNSA	1986
Quality assurance during construction of NPPs，HAD003/07	NNSA	1987
Quality assurance during items manufacture for NPPs，HAD003/08	NNSA	1986
Quality assurance during commissioning and operation of NPPs，HAD003/09	NNSA	1988
Quality assurance during procurement, design and construction of nuclear fuel elements, HAD003/10	NNSA	1989
2 Nuclear Power Plant Series		
Seismic issues in design of siting NPPs，HAD101/01	NNSA，NEA	1994
Atmospheric dispersion problems in siting NPPs，HAD101/02	NNSA	1987
Population distribution problems in siting and assessment of NPPs，HAD101/03	NNSA	1987
External human-made event in siting NPPs，HAD101/04	NNSA	1989

Name	Issued by	Entry into force
Hydrological dispersion problems of radioactive materials in siting NPPs，HAD101/05	NNSA	1991
Relevance of NPPs siting to hydrology，HAD101/06	NNSA	1991
Site survey of NPPS，HAD101/07	NNSA	1989
Determination of design basis flooding for costal NPP site，HAD101/08	NNSA	1989
Determination of design basis flooding for costal NPP site，HAD101/09	NNSA	1990
Extreme meteorological event related to NPP siting，HAD101/10	NNSA	1991
Design basis tropical cyclone for NPPs，HAD101/11	NNSA	1991
Issues relating to safety of NPP base，HAD101/12	NNSA	1990
Safety principle of NPPs design，HAD102/01	NNSA	1989
Design and evaluation of anti-earthquake design for NPPs，HAD102/02	NNSA	1996
Safety function and graded components for BWRs, PWRs and pressurized tube reactors，HAD102/03	NNSA	1986
Flying object and secondary effect protection inside NPPs，HAD102/04	NNSA	1986
External human-made event relating to design of NPPs，HAD102/05	NNSA	1989
Design of NPP reactor containment system，HAD102/06	NNSA	1990
Design of NPP reactor core safety，HAD102/07	NNSA	1989
NPP reactor cooling system and related systems，HAD102/08	NNSA	1989
Final heal well of NPPs and directly related heat conduction system，HAD102/09	NNSA	1987
NPP protection system and related facilities，HAD102/10	NNSA	1988
Fire protection at NPPs，HAD102/11	NNSA	1996
Radiation protection design for NPPs，HAD102/12	NNSA	1990
NPP emergency power system，HAD102/13	NNSA	1996
NPP safety related instrument and control system，HAD102/14	NNSA	1988
Handling and storage system at NPPs，HAD102/15	NNSA	2007
Computer-based system software of safety significance for nuclear power plant，HAD102/16	NNSA	2004
Safety analysis and verification for nuclear power plant，HAD102/17	NNSA	2006
OL&C and operational procedure for nuclear power plant，	NNSA	2004

Name	Issued by	Entry into force
HAD103/01		
NPP commissioning procedures，HAD103/02	NNSA	1987
Management of core and fuel at NPPs，HAD103/03	NNSA	1989
Radiation protection during operation of NPP，HAD103/04	NNSA	1990
Staffing, recruitment, training and delegation at NPPs，HAD103/05	NNSA	2013
Organization and operational management of operators of NPPs， HAD103/06	NNSA	2006
In-commissioning examination of NPPs，HAD103/07	NNSA	1988
Repair and maintenance of NPPs，HAD103/08	NNSA	1993
Oversight of important safety items at NPPs，HAD103/09	NNSA	1993
Fire protection for NPPs，HAD103/10	NNSA	2004
Periodic safety review for NPPs，HAD103/11	NNSA	2006
Aging management for NPPs，HAD103/12	NNSA	2012
3 Research Reactor Series		
Format and contents of research reactor safety analysis report，HAD201/01	NNSA	1996
Research reactor operation management，HAD202/01	NNSA	1989
Management of criticality installation operation and experiment，HAD202/02	NNSA	1989
Application and modification of research reactor，HAD202/03	NNSA	1996
Decommissioning of research reactor and criticality installation，HAD202/04	NNSA	1992
Commissioning of research reactor，HAD202/05	NNSA	2010
Research reactor maintenance, regular testing and inspection，HAD202/06	NNSA	2010
Core management and fuel handling for research reactors，HAD202/07	NNSA	2012
4 Nuclear Fuel Cycle Installation Series		
Format and content of safety analysis report of uranium fuel fabrication installation，HAD301/01	NNSA	1991
Design of spent fuel storage installation，HAD301/02	NNSA	1998
Operation of spent fuel storage installation，HAD301/03	NNSA	1998
Safety assessment of spent fuel storage installation，HAD301/04	NNSA	1998
5 Radioactive Waste Management Series		
Management of radioactive effluents and waste arising from	NNSA	1990

Name	Issued by	Entry into force
nuclear power plant，HAD401/01		
Design of radioactive waste management system for nuclear power plant，HAD401/02	NNSA	1997
Design and operation of radioactive waste incineration installation，HAD401/03	NNSA	1997
Categorization of radioactive waste，HAD401/04	NNSA	1998
Siting of radioactive waste near surface disposal facility，HAD401/05	NNSA	1998
Siting of high level radioactive waste geological facility，HAD401/06	NNSA	2013
Decommissioning of gamma-ray irradiation installations，HAD401/07	NNSA	2013
Radioactive Waste Minimization at Nuclear Facilities HAD 401/08	NNSA	2016
6 Nuclear Materials Regulation Series		
Nuclear fuel balance budget for low enriched uranium conversion and element fabrication plant，HAD501/01	NNSA	2008
Guidelines on physical protection for nuclear power plant，HAD501/02	NNSA	2008
Alarming system against intrusion to nuclear facility，HAD501/03	NNSA	2005
Access control of nuclear facility，HAD501/04	NNSA	2008
Physical protection of nuclear materials transportation，HAD501/05	NNSA	2008
Format and content of safety analysis report of physical protection and nuclear materials accountancy and control，HAD501/06	NNSA	2008
Nuclear materials accountability for nuclear power plant，HAD501/07	NNSA	2008
7 Civil Nuclear Safety Equipment Regulatory Management Series		
Civil Nuclear safety simulated machinery and equipment parts production（trial），HAD601/01-2013	NNSA	2013
Technical requirements on civil nuclear safety equipment installation and license applicant（trial），HAD601/02-2013	NNSA	2013
8 Radioactive article transportation management series		
Standard format and content of safety assessment (analysis) report of radioactive article transportation container design, HAD701/01-2010	NNSA	2010
Standard format and content of nuclear and radiation safety analysis report of radioactive article transportation,	NNSA	2014

Name	Issued by	Entry into force
HAD701/02-2014		

L.5.5 Relevant Standards

Name	Issued by	Entry into force
1 Generic Series		
Basic standards for protection against ionizing radiation and for the safety of radiation sources，GB 18871-2002	AQSIQ	2002
Regulation of radiation protection for handling non-sealed radioactive material，GB 11930-2010	NTSB	2011
Glossary of nuclear science and technology terms—Part 3:Nuclear fuel and nuclear fuel cycle，GB/T 4960.3-2010	AQSIQ	2010
Glossary of terms: Nuclear science and technology -Radiation protection and safety of radiation sources，GB/T 4960.5-1996	NTSB	1996
Glossary of nuclear science and technology terms—Part 7:Nuclear materials control and safeguards，GB/T 4960.7-2010	AQSIQ	2010
Glossary of term: nuclear science and technology - Part 8: Radioactive waste management，GB/T 4960.8-2008	AQSIQ, NSMC	2008
Regulations for the safe transport of radioactive material, GB11806-2004	AQSIQ, NSMC	2005
Quality assurance for packaging used in transport of radioactive material, GB/T 15219-2009	AQSIQ, NSMC	2009
Activity concentration for material not requiring radiological regulation，GB 27742-2011	AQSIQ, NSMC	2012
2 Nuclear Power Plant Series		
Regulations for environmental radiation protection of nuclear power plant，GB 6249-2011	MEP,AQSIQ	2011
Safety design rule for spent fuel dissolving system of nuclear fuel reprocessing plant， EJ/T 1142-2002	CAEA	2002
Design criteria for pressurized water reactor spent fuel storage facilities at nuclear power plant， EJ/T883-2006	CAEA	2006
Design criteria for spent fuel storage pool away from reactor, EJ/T878-2011	CAEA	2011
3 Radioactive Waste Management Series		
3.1 Fundamental Document		
Regulations for radioactive waste management，GB 14500-2002	AQSIQ	2002
Classification of radioactive waste，GB 9133-1995	SEPA，AQSIQ	1996
3.2 Generation, Pre-treatment, Treatment and Discharge		
The technical rules about solid radioactive waste processing system for light water reactor plants，GB 9134-1988	SEPA	1988

Name	Issued by	Entry into force
The technical rules about radioactive waste processing system for light water reactor plants，GB 9135-1988	SEPA	1988
The technical rules about gaseous radioactive waste processing system for light water reactor plants，GB 9136-1988	SEPA	1988
Authorized limits for normalized releases of radioactive effluents from nuclear fuel cycle，GB 13695-1992	NTSB	1993
Technical requirements for discharge of radioactive liquid effluents from nuclear power plant，GB 14587-2011	MEP、AQSIQ	2011
The general regulation for environmental radiological assessment，GB 11215-1989	SEPA	1990
General requirements of quality assurance program for effluent and environmental radioactivity monitoring at nuclear facilities, GB 11216-1989	SEPA	1990
Graphical signs for environmental protection--Discharge outlet(source)，GB 155621.1-1995	SEPA	1997
Radiological protection management for medical radioactive waste，GBZ 133-2009	MoH	2009
Radioactive source term of PWR nuclear power plant for operational states，GB/T 13976-2008	AQSIQ, NSMC	2008
Decontamination of radioactively contaminated surfaces - Part 1: Method for testing and assessing the ease of decontamination，GB/T 14057.1-2008	AQSIQ, NSMC	2008
Decontamination of radioactively contaminated surface—Part 2:Testing method of decontamination agents for textiles，GB/T 14057.2-2011	AQSIQ, NSMC	2011
Characterization of radioactive waste forms and packages，EJ 1186-2005	NDSTC	2005
Technical regulations on LILW volume reduction system，EJ/T 795-1993	CNNC	1993
3.3 Waste Conditioning		
Standard test method for leachability of low and intermediate level solidified radioactive waste forms，GB/T 7023-2011	SEPA	2011
Standard of safety for low and intermediate-level solid radioactive wastes packages，GB 12711-1991	NTSB	1991
Performance requirements for low and intermediate level radioactive waste form-Cemented waste form ， GB 14569.1-2011	MEP、AQSIQ	2011
Characteristic requirements for solidified waste of low-and intermediate-level radioactive waste--Bitumen solidified waste，GB 14569.3-1995	NTSB	1996
Packaging container for low - and intermediate - level radioactive solid wastes steel drum，EJ 1042-1996	CNNC	1996
Container for low-and intermediate - level radioactive solid wastes Steel box，EJ 1076-1998	CNNC	1998
Concrete container for low-and intermediate-level radioactive solid wastes，EJ/T 914-2000	CNNC	2000
3.4 Waste Storage		

Name	Issued by	Entry into force
Regulations for interim storage of low-and intermediate-level radioactive solid wastes，GB 11928-1989	NTSB	1989
Regulations for designing storage building of high level radioactive liquid waste，GB 11929-2011	AQSIQ, NSMC	2012
Technical rules for interim storage of low and inter-mediate level solid radioactive waste from nuclear power plant，GB 14589-1993	NTSB	1993
Requirements on safety analysis report for solid LILW interim storage，EJ/T 532-1990	CNNC	1990
3.5 Waste Disposal		
Regulations for near surface disposal of solid low and intermediate-level radioactive wastes，GB 9132-1988	SEPA	1988
Regulations for disposal of solid low-and intermediate level radioactive wastes in rock cavities，GB 13600-1992	NTSB	1992
Acceptance criteria for near surface disposal of radioactive waste，GB 16933-1997	NTSB	1997
Graphical signs for environmental protection solid waste storage (disposal) site，GB 15562.2-1995	SEPA	1995
General requirements for environmental radiation monitoring around near surface disposal site of low-intermediate level radioactive solid waste，GB/ T 15950-1995	SEPA	1995
Regulations for design of near surface disposal facilities of low and Intermediate level radioactive wastes - disposal except in rock caverns，EJ/T 1109.1-1999	CNNC	1999
Environmental protection regulation guidelines for nuclear facilities. Standard format and content of environmental impact reports for shallow ground disposal of solid radioactive waste，HJ/T 5.2-1993	SEPA	1993
Siting of near surface disposal facilities of low-and intermediate-level radioactive wastes，HJ/T 23-1998	SEPA	1998
Landfill disposal for very low level radioactive waste，GB/T 28178-2011	AQSIQ, NSMC	2012
Activity measurements of solid materials considered for recycling re-use, or disposal as non-radioactive waste, GB/T 17947-2008	AQSIQ, NSMC	2008
3.6 Nuclear Facility Decommissioning and Environmental Reclamation		
Technical regulations for environmental management of reactor decommissioning，GB 14588-2009	AQSIQ	2009
Clearance levels for recycle and reuse of steel, aluminum, nickel and copper from nuclear facilities，GB 17567-2009	AQSIQ, NSMC	2009
Safety requirements for decommissioning of nuclear facilities，GB/T 19597-2004	AQSIQ, NSMC	2005
Provisions of decommissioning nuclear fuel reprocessing radiation protection，EJ 588-1991	CNNC	1992
Technical guidelines on decontamination during reactor decommissioning，EJ/T 941-1995	CNNC	1995
Standard format and content for the decommissioning environmental impact report of uranium processing and fuel fabrication facilities，EJ/T 1037-1996	CNNC	1997

Name	Issued by	Entry into force
Interim regulation for acceptable levels of residual radionuclides in soil of site considered for release，HJ 53-2000	SEPA	2000
3.7 Management of Radioactive Waste from Uranium Mining and Milling		
Regulations for safe management of radioactive wastes from the mining and milling of uranium and thorium ores，GB 14585-1993	SEPA, NTSB	1994
Technical regulations of the environmental management of decommissioning of uranium mining and milling facilities，GB 14586-1993	SEPA, NTSB	1994
Regulation for radiation environmental monitoring in uranium mine and mill，GB 23726-2009	MEP, AQSIQ	2010
Regulations for radiation and environment protection in uranium mining and milling，GB 23727-2009	AQSIQ, NSMC	2009
Regulation for radiation environmental impact assessment in uranium mine and mill，GB/T 23728-2009	MEP, AQSIQ	2009
Regulations on radiation protection technique for uranium heap leaching and in-suit leach mining，EJ 1007-1996	CNNC	1996
Regulations for uranium mine and processing plant site selection，EJ/T 1171-2004	CAEA	2004

L.6 NPP Occupational Exposure

items (unit) / NPP Name / year			Annual average individual effective dose (mSv)	Annual maximum individual effective dose (mSv)	Annual collective effective dose (Man.Sv)	Normalized collective effective dose (man·mSv/GWh)
Qinshan NPP		2014	1.43E-01	4.04E+00	2.53E-01	9.60E-05
		2015	2.01E-01	4.28E+00	4.05E-01	1.57E-04
		2016	1.33E-01	3.44E+00	2.81E-01	1.09E-04
Daya Bay NPP		2014	4.62E-01	6.91E+00	1.51E+00	9.99E-05
		2015	3.31E-01	7.09E+00	1.04E+00	6.71E-05
		2016	3.03E-01	8.28E+00	1.03E+00	6.81E-05
Qinshan Phase II NPP		2014	3.36E-01	8.95E+00	1.11E+00	5.50E-05
		2015	2.04E-01	7.91E+00	6.83E-01	3.40E-05
		2016	3.07E-01	7.17E+00	1.09E+00	5.20E-05
Ling'ao NPP	Uint 1 & 2	2014	3.00E-01	7.73E+00	8.58E-01	5.43E-05
		2015	5.02E-01	8.51E+00	1.62E+00	1.05E-04
		2016	3.48E-01	6.07E+00	1.12E+00	7.02E-05
	Uint 3 & 4	2014	1.85E-01	4.10E+00	6.24E-01	3.72E-05
		2015	1.93E-01	4.05E+00	5.97E-01	3.53E-05
		2016	3.05E-01	6.83E+00	1.03E+00	6.34E-05
Qinshan Phase III NPP		2014	3.42E-01	7.19E+00	7.21E-01	6.20E-05
		2015	3.66E-01	4.96E+00	8.04E-01	7.20E-05
		2016	4.74E-01	7.17E+00	1.01E+00	9.30E-05
Tianwan NPP		2014	1.80E-01	2.99E+00	4.97E-01	2.97E-05
		2015	1.69E-01	2.87E+00	5.20E-01	3.13E-05
		2016	2.97E-01	6.03E+00	1.01E+00	6.57E-05
Hongyanhe NPP		2014	2.98E-01	8.08E+00	1.00E+00	8.40E-02
		2015	2.95E-01	5.62E+00	1.03E+00	7.10E-02
		2016	2.74E-01	5.40E+00	9.00E-01	4.52E-02
Ningde NPP		2014	3.11E-01	6.06E+00	7.86E-01	6.80E-02
		2015	6.39E-01	1.20E+01	1.82E+00	1.19E-01
		2016	3.99E-01	7.54E+00	1.49E+00	6.01E-02
Yangjiang NPP		2014	9.00E-03	1.02E+00	1.78E-02	2.24E-06
		2015	1.76E-01	6.72E+00	6.70E-01	5.17E-05
		2016	4.43E-01	1.31E+01	2.12E+00	9.22E-05

items (unit) / NPP Name / year		Annual average individual effective dose (mSv)	Annual maximum individual effective dose (mSv)	Annual collective effective dose (Man.Sv)	Normalized collective effective dose (man·mSv/GWh)
Fangjiashan NPP	2014	1.20E-01	2.53E+00	1.63E-02	—
	2015	3.89E-01	6.90E+00	1.10E+00	7.10E-05
	2016	2.34E-01	6.60E+00	7.23E-01	4.50E-05
Fuqing NPP	2014	1.60E-02	3.32E+00	2.76E-02	1.75E-05
	2015	2.58E-01	6.07E+00	7.87E-01	9.44E-05
	2016	2.39E-01	8.76E+00	9.20E-01	5.69E-05
Changjiang NPP	2014	—	—	—	—
	2015	5.00E-03	1.16E+00	7.86E-03	5.00E-06
	2016	1.10E-02	9.45E-01	1.80E-02	3.10E-05
Fangchenggang NPP	2014	2.89E-02	4.90E-02	1.24E-03	—
	2015	4.50E-03	5.40E-01	8.96E-03	—
	2016	1.09E-02	4.32E-01	2.20E-02	2.26E-06

L.7 NPP Radioactive Effluents

Percent of Radioactive Effluents to the Discharge Limits（％）

（From 2014to 2016）

NPP Name \ category / items / year		Gaseous Effluents			Liquid Effluents	
		Noble gas	Halogen	Aerosol	Tritium	Other Nuclides
Qinshan NNP	2014	1.002	0.027	0.656	87.988	2.404
	2015	1.049	0.030	1.821	96.847	2.019
	2016	1.123	0.026	1.151	88.589	1.298
Daya Bay NNP	2014	0.133	0.033	0.090	17.368	0.141
	2015	0.129	0.021	0.086	14.788	0.207
	2016	0.155	0.027	0.100	19.695	0.149
Qinshan Phase II NNP	2014	0.231	0.900	0.179	58.636	3.369
	2015	0.266	0.305	0.329	75.727	1.367
	2016	0.214	0.272	0.303	67.364	2.145
Ling'ao NNP	2014	0.255	0.046	0.214	41.869	0.289
	2015	0.243	0.047	0.199	48.217	0.309
	2016	0.250	0.039	0.203	44.117	0.315
Qinshan Phase III NNP	2014	1.405	0.212	0.058	13.333	3.133
	2015	2.223	0.684	0.065	11.488	5.150
	2016	0.838	0.098	0.061	19.683	5.883
Tianwan NNP	2014	5.020	4.081	1.092	45.303	14.324
	2015	3.591	1.032	2.025	46.818	11.284
	2016	18.349	0.938	1.558	41.818	12.284
Hongyanhe NNP	2014	0.170	0.218	0.057	19.365	0.476
	2015	0.144	0.191	0.109	21.190	0.469
	2016	0.187	0.115	0.113	38.492	0.264
Ningde NNP	2014	0.528	0.258	0.107	24.628	0.538
	2015	0.369	0.111	0.075	25.257	0.301
	2016	0.603	0.180	0.086	36.914	0.341

NPP Name / year / items / category		Gaseous Effluents			Liquid Effluents	
		Noble gas	Halogen	Aerosol	Tritium	Other Nuclides
Yangjiang NNP	2014	0.127	0.116	0.206	11.311	0.147
	2015	0.176	0.072	0.125	16.130	0.497
	2016	0.365	0.199	0.178	26.098	0.536
Fangjiashan NPP	2014	0.698	1.144	4.441	1.603	0.492
	2015	7.242	13.916	89.944	30.000	7.095
	2016	1.802	1.519	17.737	54.444	4.565
Fuqing NPP	2014	0.076	0.062	0.592	0.579	0.629
	2015	0.286	0.177	0.672	11.270	0.586
	2016	1.132	10.543	1.455	14.444	0.914
Changjiang NPP	2014	—	—	—	—	—
	2015	0.305	0.030	0.219	2.587	0.245
	2016	1.338	9.378	6.092	10.765	1.409
Fangchenggang NPP	2014	—	—	—	—	—
	2015	0.087	0.050	0.082	0.584	0.051
	2016	0.295	0.067	0.287	15.904	0.105

Notes:

1. The release amount of radioactive effluents is dependent on power of nuclear units.

2. For each NNP, the Discharge Limits of radioactive Effluents are respectively approved by NNSA.

L.8 References

L.8.1 Documents

No.	References
1	The sixth national report of the People's Republic of China to the Convention on Nuclear Safety, 2013.
2	The seventh national report of the People's Republic of China to the Convention on Nuclear Safety, 2016.
3	Nuclear Emergency in China, The State Council Information Office of the People's Republic of China, 2016.
4	Outline of Thirteenth Five-Year Plan of National Economic and Social Development of the People's Republic of China (OTNSPRC), 2016.
5	Annual report of nuclear safety, NNSA，2013
6	Annual report of nuclear safety, NNSA，2014
7	Annual report of nuclear safety, NNSA，2015
8	Self-assessment Report on China's Nuclear and Radiation Safety Regulation for IAEA Follow-up IRRS Mission, MEP/NNSA, 2016.
9	INTEGRATED REGULATORY REVIEW SERVICE (IRRS) FOLLOW-UP REPORT TO CHINA, IAEA, 2016.

L.8.2 Websites

More Information can be available at the following websites:

No.	Agency Name	Website
1	MEP	www.mep.gov.cn
2	CAEA	www.caea.gov.cn
3	CNNC	www.cnnc.com.cn
4	NEA	www.nea.gov.cn
5	MPS	www.mps.gov.cn
6	NHFP	www.nhfpc.gov.cn
7	SWAS	www.chinasafety.gov.cn

L.9 Abbreviation

No.	Abbreviation	Full name
1	ALARA	As Low As Reasonably Achievable
2	AQSIQ	Administration of Quality Supervision, Inspection and Quarantine
3	Beilong Disposal Site	Guangdong Beilong LILW Disposal Site
4	BSS	Basic Safety Standard
5	CAEA	China Atomic Energy Authority
6	CGN	China General Nuclear Power Group
7	CIAE	China Institute of Atomic Energy
8	CNNC	China National Nuclear Corporation
9	CSDCNTARSF	Criteria on Siting, Design and Construction of Nuclear Technology Application Radwaste Storage Facility
10	CWGJCI	Chinese Working Group for Joint Convention Implementation
11	EPDNFO	Emergency Preparedness and Response of Nuclear Fuel Cycle Facility Operators
12	EPRNPO	Emergency Preparedness and Response of NPP Operators
13	EU	European Union
14	HIC	High Integrity Containers
15	HLW	High level waste
16	IAEA	International Atomic Energy Agency
17	ICRP	International Commission on Radiological Protection
18	ILW	Intermediate level waste
19	IPCUMFTDSFNPP	Interim Procedures on Collection, Utilization and Management of the Funds for Treatment and Disposal of Spent Fuel at Nuclear Power Plants
20	Joint Convention	The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management
21	LDEE	Law of People's Republic of China on Dealing with Emergency Event
22	LLRPC	Legislation Law of the People's Republic of China
23	LLW	Low level waste
24	LPCOD	Law of the People's Republic of China on Prevention and Control of Occupational Disease
25	LPCRP	Law of the People's Republic of China on Prevention and Control of Radioactive Pollution
26	MEP	Ministry of Environmental Protection, P. R. of China
27	MIIT	Ministry of Industry and Information Technology
28	MLRRIS	Methods for Licensing of Radioisotopes and Ray-generating Installations Safety

No.	Abbreviation	Full name
29	MMLSDSRW	Management Measures for Licensing the Storage and Disposal of Solid Radioactive Waste
30	MMSPRRI	Management Measures on Safety and Protection against Radioisotope and Ray-generating Installation
31	MoF	Ministry of Finance
32	MoH	Ministry of Health
33	MoT	Ministry of Transport
34	MPS	Ministry of Public Security
35	NDRC	National Development and Reform Commission
36	NEA	National Energy Administration
37	NHFPC	National Health and Family Planning Commission
38	NNAECC	National Nuclear Accident Emergency Coordination Committee
39	NNAEO	National Nuclear Accident Emergency
40	NNEP	National Nuclear Emergency Planning
41	NNSA	National Nuclear Safety Administration
42	NORMs	Naturally Occurring Radioactive Materials
43	Northwestern Disposal Site	Northwestern China LILW Disposal Site
44	NPCSC	National People's Congress Standing Committee
45	NPIC	Nuclear Power Institute of China
46	NPPs	Nuclear Power Plants
47	QA	Quality Assurance
48	RNAEMN	Regulations on Nuclear Accident Emergency Management at Nuclear Power Plant
49	RSPRRI	Regulations on Safety and Protection of Radioisotope and Ray-generating Installations
50	RSRWM	Regulations on Safety of Radioactive Waste Management
51	SAMG	Serious Accident Management Guides
52	SRTF	Site Radioactive Treatment Facility
53	TRRQNSE	Temporary Regulations on Registration qualifications for Nuclear Safety Engineer

PART 2

A Introduction

A.1 Overview

Hong Kong Special Administrative Region (HKSAR) does not produce spent fuel. There are also no facilities related to spent fuel management. Hence, the articles under Chapter 2 of the *Joint Convention* concerning the safety of spent fuel management are not applicable to HKSAR.

To realise and maintain a high standard of radiation protection so as to safeguard the health of the public and workers as well as the safety of the society and environment, HKSAR has established a proper and effective radiation protection system and regulatory regime to manage the use of radioactive substances and to deal with the resultant wastes. In HKSAR, radioactive substances are primarily used in medical services, industry, education and scientific research, etc. All radioactive wastes arising from such uses belong to the class of low level or low to intermediate level radioactive wastes.

The management of radioactive substances in HKSAR is founded on the basis of international principles of radiation protection, with legislation and a licensing system as the regulatory instruments. A permanent statutory regulatory authority is established as the policy formulation and law enforcement agency. The entire system is complemented by collaboration amongst the various professional bodies that provide advice and services on radiation protection and practical radiation protection technology and instrumentations. In formulating and reviewing the policies on radiation protection, the regulatory authority has made extensive reference to national and international standards and recommendations to facilitate the application and development of radiation technology.

A.2 Waste Facility

In addition, a purpose-built Low-level Radioactive Waste Storage Facility (“Storage Facility”) was commissioned in HKSAR in mid-2005. It is a crucial facility to enable a holistic and effective management of radioactive wastes in conformance to the high standard of management culture on radiation safety.

B Policies and Practices

B.1 Definition of Radioactive Wastes

The *Radiation Ordinance* (Cap. 303 of the Laws of Hong Kong) (please refer to Appendix I.2 Reference[1]) and the associated licensing system form the legal basis for the control of radioactive substances and radioactive wastes in HKSAR. The Hong Kong Radiation Board ("the Board") is established as the regulatory authority under the *Radiation Ordinance*.

As defined in the *Radiation Ordinance*, all disused radioactive substances or wastes contaminated by radioactive substances should be regarded as radioactive wastes. Any person who works and undertake activities involving radioactive substances (including radioactive wastes) are required to be covered by a valid licence issued by the Board.

Any premises where radioactive substances are handled are subject to radiation safety assessment and on-site inspection of the Board to ensure that legal requirements and conditions of licence are fully met before a licence is granted. The Board will also conduct review assessment at such premises during the licence period and before the renewal of licence to ensure that requirements on radiation safety are effectively maintained.

B.2 Criteria for the Categorization of Radioactive Wastes

Radioactive wastes produced in HKSAR are classified into the following basic categories according to their properties –

i) solid waste;

ii) liquid waste;

iii) gaseous waste; and

iv) exempt waste.

Solid radioactive waste mainly includes disused sealed sources and solid wastes contaminated by radioactive substances, etc. Sealed sources are used primarily in medical and industrial sectors. Sealed sources in medical applications include the higher activity Category 1 and Category 2 sources under the *Categorization of Radioactive Sources* of the International Atomic Energy Agency (IAEA), such as caesium-137 in blood irradiator systems and cobalt-60 in gamma knife radiosurgery system, as well as Category 3 or lower category sources that are used in brachytherapy and calibration of radiation detectors. Sealed sources for industrial applications include Category 2 and

Category 3 sources such as iridium-192 and cobalt-60, etc., that are used in non-destructive testing, as well as sealed sources of lower categories that are used in quality inspection instruments, such as americium-241/beryllium neutron sources in the measurement of moisture and density in concrete, strontium-90 and thallium-201 β-sources in the measurement of material thicknesses as well as nickel-63 β-sources in electron capture devices.

Sealed sources for scientific research and educational purposes primarily belong to the lower radioactivity Category 5. Radioactive substances used in other products include americium-241 in lightning conductors and smoke detectors as well as tritium in luminous watches and directional signs, etc.

Liquid radioactive waste mainly refers to disused liquid or solution containing radioactive substances. Liquid radioactive substances include radio-pharmaceuticals used in nuclear medicine for the treatment and diagnosis of diseases, such as iodine-131, technetium-99m, thallium-201, strontium-90, fluorine-18, and phosphorus-32; as well as radioactive compounds used in clinical tests and scientific research, such as iodine-125, phosphorus-32, carbon-14 and uranium-238, etc.

Gaseous radioactive waste mainly refers to waste radioactive gases, vaporised radioactive liquid and radioactive aerosols, such as krypton-85 and technetium-99m vapour, etc.

Exempt waste refers to waste that is exempted from regulatory control in accordance with exemption principles.

C Radioactive Waste Management Policies and its Practices

C.1 Radioactive Waste Management Policies

The fundamental principle of HKSAR's radioactive waste management policy is to minimise the waste arising at source. The Board adopts the following management policies commensurate with the properties and categories of radioactive wastes –

i) Sealed sources: the licensed user is required to return disused sealed sources to their original manufacturer. With prior approval from the Board, the licenced user could also return disused sealed sources to alternative suppliers or manufacturers of the same type of sealed sources outside Hong Kong. In case that there are justifiable reasons proving that the foregoing measures are impracticable, the licensed user may seek approval from the Board for transferring the waste sources to the Storage Facility;

ii) Solid contaminated wastes: the licensed user is required to store such wastes to allow for radioactive decay for a period of time as specified in the conditions of licence, after which the wastes should be disposed of as exempt wastes. Subject to the conditions of licence, some wastes that present biological hazards may be disposed of by incineration. Subject to the approval of the Board, wastes exceeding the permitted discharge level after delay storage may be transferred to the Storage Facility;

iii) Liquid wastes: the licensed user is required to store such wastes to allow for radioactive decay for a period as specified in the conditions of licence, after which the wastes should be disposed of as exempt liquid wastes. Subject to the approval of the Board, wastes exceeding the permitted discharge level after delay storage may be solidified and transferred to the Storage Facility for suitable processing and storage; and

iv) Gaseous wastes: the licensed user is required to collect such wastes or discharge them through a purpose-designed exhaust system according to the principles specified in the conditions of licence.

C.2 Discharge of Effluents

The permitted discharge level of different wastes is determined with reference to the Annual Limit on Intake of the individual radionuclide. The user concerned should record in detail the date on which the waste is produced, its activity, storage duration and the date of discharge. Any disposal of wastes exceeding the limit permitted by the licence shall only be carried out after satisfactory assessment of the impact on the public and environment caused by the proposed disposal method in conjunction with the radioactivity and the radiation level of such wastes and subject to the approval of the Board.

D Safety of Radioactive Waste Management (Articles 11-17)

D.1 Safety Management Practices of the Storage Facility

As stated in paragraph C.1, the basic principle for the management of radioactive wastes of HKSAR is to proactively minimise the quantity of wastes at the source of waste arising. This is further complemented by the formulation and implementation of relevant disposal policies and regulations commensurate with the properties of various categories of wastes so as to minimize the risks caused by such wastes on humans, society and the environment.

The Storage Facility, with a designed storage capacity of 140m^3, has been commissioned in HKSAR since mid-2005. Presently the total volume of waste in store is about 76m^3. It is estimated that the storage capacity will meet the waste storage requirement of HKSAR in the coming 100 years. Apart from this facility, HKSAR does not have any other proposed radioactive waste facilities.

The siting and planning of the Storage Facility were studied and examined in detail by the Environmental Protection Department ("EPD") of the HKSAR Government, which included risk and environmental assessment. The Storage Facility was designed and constructed under the supervision of independent professional consultants according to high standards and advanced technology in radiation safety design specified by EPD. Having satisfactorily passed the Board's in-depth licensing assessments to confirm that legal requirements and terms of licence are met, the Storage Facility is now operated by EPD's contractor.

The Storage Facility is located at Siu A Chau, a small remote island located at the southwest of Lantau, which is far away from residential areas. Its core design comprises a central waste storage vault, a waste processing area equipped with glove boxes and fume cupboard, a radiation laboratory which provides various radioactivity analysis and measurement equipment, a continuous radiological surveillance system which monitors the gaseous discharge as well as the radiation level inside and outside the facility and a central control room for overall management of the facility, etc. The Storage Facility is also equipped with an all round weather-proof security surveillance system, which is directly connected to a 24-hour monitoring centre located at the urban area through a dedicated data network. The safe operation of the Storage Facility is therefore stringently ensured.

The radiation levels inside and outside the Storage Facility are continuously monitored and controlled to be within the range specified by the licence and in

accordance with the operation manual, with due regard to the principle of optimisation of radiological protection. The contractor is also required to conduct regular analysis and assessment on the impact of the Storage Facility to its surrounding environment, so as to ensure that high standards of radiation protection are effectively maintained. Radioactive wastes generated during the operation of the Storage Facility are required to be properly disposed of in accordance with the methods and discharge limits approved under the relevant policies of the Board.

D.2 Inventory of Wastes

At present, the majority of the low-level radioactive wastes produced in HKSAR, including those arising from medical, industrial and educational origins, has already been transferred to the Storage Facility. An inventory list of these wastes is given in Appendix I.1.

E Legislative and Regulatory Framework (Articles 18-20)

E.1 Regulatory Framework

The *Radiation Ordinance* establishes the Board as the statutory authority to exercise the powers conferred by the *Ordinance*, which include granting of licence and imposing conditions of licence. Section 3 of the *Radiation Ordinance* provides that the Board shall consist of three *ex-officio* members (the Director of Health being the *ex-officio* Chairman) and such persons not exceeding 10 in number as the Chief Executive may appoint from time to time. Under section 13 of the *Radiation Ordinance* and subject to the approval of the Legislative Council, the Board may by regulation provide for a series of matters related to radiation safety that comes under the jurisdiction of the *Ordinance*. In addition, the Board may from time to time appoint persons by name or office to be inspectors to exercise the powers of inspection stipulated under section 16 of the *Ordinance*.

The Board has established an effective licensing system according to the regulatory framework. It has also formulated policies and corresponding conditions of licence in accordance with principles and requirements of radiation protection for different practices involving the use of radioactive substances. Any person who is engaged in work or activity relating to radioactive substances or wastes should obtain a valid licence issued by the Board. During the evaluation of licence application, appropriate and comprehensive radiation safety assessment will be conducted on the applicant, premises and equipment, etc. to confirm the compliance of the requirements stipulated in relevant legislations and licence conditions.

E.2 Licensing System

Licence applicants are required to submit detailed technical specifications of the radioactive source or irradiating apparatus, the applicable safety standards, certification and record of safety tests, radiation safety design of the premises and equipment, etc. to facilitate the assessment of the Board. All radioactive substance licences will have specific prescriptions about the concerned radioactive nuclides and the approved purposes of use and activity limits. Inspectors of the Board, as part of the assessments of the application, will conduct on-site inspection of the concerned premises. The inspection assessment will cover the following aspects –

i) radiation level surveys;

ii) radiological protection facilities and equipment;

iii) effective operation of monitoring equipment;

iv) contamination control facilities and procedures;

v) records of purchase and storage of radioactive substances;

vi) records of disposal of radioactive wastes;

vii) inventory list and safety management of sealed sources;

viii) radiation monitoring programme and working instructions;

ix) appointment of supervising persons;

x) health surveillance of radiation workers; and

xi) contingency plan, etc.

The licensee is required to report any changes in the licence particulars to the Board for approval and updating and to submit regular reports on testing of sealed sources and radiation monitoring equipment, as well as sale and purchase records of sealed sources, etc. Inspectors of the Board will conduct on-site audit visit at the premises to ensure that radiological safety is effectively maintained. The Board will proactively initiate investigation into any suspected irregularities and, if such irregularities are substantiated, the parties concerned could be prosecuted or warned according to the provisions of the Ordinance and licence conditions. Review and follow-up on the improvement measures will also be conducted.

E.3 Radioactive Sources Information Management

To facilitate the effective implementation of the *Code of Conduct on the Safety and Security of Radioactive Sources* issued by the IAEA, the Board has set up a comprehensive information management system to maintain the register of sealed sources in HKSAR. The licensing system has been accredited with *ISO 9001:2000 Quality Management System* certification since 2004 and successfully upgraded to conform to the latest *ISO 9001:2008* quality management standards in 2009, which reflects the quality of the management system and the commitment to continual improvement. The entire licensing system and the associated radioactive sources database information system have been successfully converted to a fully electronic work flow system in 2010 to enhance the information analysis and data handling capability and to facilitate a "cradle to grave" lifecycle management of radioactive sources.

E.4 Emergency Response

In the event of radiological incidents, inspectors of the Board will, depending on the nature and category of the incident and in accordance with established emergency procedures, take appropriate response actions in collaboration with relevant departments such as the Security Bureau, Fire Services Department and the Police, etc. The response actions will consist of evaluating the risks of the radiation hazards, carrying out emergency countermeasures including decontamination, as well as managing radioactive wastes arising from the incident, so as to limit the impact arising from possible radiation exposure and contamination on individuals, society and the environment.

F General Safety Provisions (Articles 21-26)

F.1 Responsibility of the Licence Holder (Article 21)

According to the *Radiation Ordinance*, the licensees who are authorized to handle radioactive substances are required to manage and dispose of their radioactive wastes properly in accordance with the requirements stipulated in the *Radiation Ordinance* and the relevant conditions of licence. Such requirements include method of storage, radiation level at the storage site, method of waste management, record of waste discharge and safety standards of transportation, etc. Inspectors of the Board will regularly inspect the premises at which radioactive substances are used to ensure that requirements of the law and conditions of licence are met. The licensees are liable for contraventions to the *Radiation Ordinance*, and may be subject to the prescribed penalties upon conviction by the court.

F.2 Human and Financial Resources (Article 22)

Any licensee who is engaged in work involving the handling of radioactive substances is required to employ qualified supervising persons who have received proper training on radiation protection to supervise the work. The approved supervising persons are listed in the licence.

The Storage Facility is the property of and fully funded by the HKSAR Government. Hence, human and financial resources required for the operation of the Storage Facility, including staff training and management, can be reliably maintained. Every staff working at the Storage Facility has completed proper training and professional assessments as required by the work.

F.3 Quality Assurance (Article 23)

The contractor of the Storage Facility is required, according to the conditions of licence, to set up and maintain an effective quality management system, so as to ensure the safety and security of radioactive substances.

The Storage Facility is operated and managed in accordance with *ISO 14000 Environmental Management Standards*, which reflects the Government's commitment to management quality and environmental protection.

F.4 Operational Radiation Protection (Article 24)

The conditions of licence of the Storage Facility require the radiation level inside and outside the facility to be controlled within the specified range commensurate with the principle of optimisation. Under normal operation of the Storage Facility, the radiation exposure of workers and the public are required to

be controlled within the relevant dose limits applicable to occupational exposure and public exposure stipulated in the *Radiation Ordinance*, i.e. no more than 20mSv and 1mSv in any one year respectively.

The Storage Facility is equipped with high standard radiation safety design: the structure of the storage vault provides shielding of radiation and prevents the release of radioactive substances from the Facility. The specially designed wastewater treatment system and high performance air filtration system can effectively reduce the discharge of liquid and gaseous radioactive substances. Data from the continuous radiation monitoring systems inside and outside the Storage Facility are directly transferred to a 24-hour monitoring centre located in the urban area through dedicated network to ensure that these radiation levels are controlled within the regulatory requirements. Furthermore, environmental monitoring with the collection of relevant environmental samples for radiation monitoring and radioactivity analysis is conducted regularly to ensure that the operation of the Storage Facility will not result in any adverse impact on the environment.

F.5 Facility Emergency Preparedness (Article 25)

The contractor of the Storage Facility has, as required by the Board, set up corresponding contingency plans and mechanisms for the various foreseeable emergency scenarios. Under such mechanisms, the contractor should carry out appropriate response measures jointly with relevant government departments for the various emergency scenarios, so as to safeguard the safety of workers and the public as well as protecting the environment. The contractor is required to conduct regular exercises to test the contingency plans under the supervision of the EPD.

F.6 Decommissioning (Article 26)

At the planning stage of the Storage Facility, the HKSAR Government has given serious considerations to its decommissioning requirements. As there remains a long period of time to go before decommissioning of the Storage Facility takes effect, the HKSAR Government will formulate detailed plans, provide the funds and take charge of the decommissioning work at an appropriate time.

G Transboundary Movement (Article 27)

G.1 Import and Export Control

HKSAR does not produce any sealed sources or radioactive substances and, therefore, the transboundary movement of radioactive substances, in general, is confined to transhipment operations, import of radioactive substances for local use and return of disused sealed sources to their places of origin. According to the existing regulations, any import of radioactive substances into HKSAR is required to be covered by a valid import licence issued under the *Import (Radiation) (Prohibition) Regulations* (Cap. 60K of the Laws of Hong Kong) (please refer to Appendix I.2 Reference[2]) and a radioactive substance licence issued by the Board under the *Radiation Ordinance*. The assessment of import licence application will include a comprehensive evaluation of the export and transport approvals for the particular radioactive substances or sealed sources, their categories and properties, radioactivity, safety tests, the radiation safety of the proposed stowage or storage sites, etc. The licensee is required to regularly submit their records of import and sale activities to the Board for auditing.

G.2 Transport Management

The transportation of radioactive substances in HKSAR should comply with the *Regulations for the Safe Transport of Radioactive Material* and the *Guidance on the Import and Export of Radioactive Sources* issued by the IAEA and is required to be covered by a valid licence and conveyance permit issued by the Board. The transportation should be conducted under the personal supervision of the approved supervising persons prescribed by the licence. The licensee is required to submit to the Board the reports and records of the transportation activities after they have been completed.

H Disused Sealed Sources (Article 28)

H.1 Disused Sealed Sources

As stated in paragraph G.1, HKSAR does not produce any sealed sources or radioactive substances. Therefore, article 28 "Disused sealed sources" of the *Joint Convention* does not apply to HKSAR.

I Appendices

I.1 Inventory of wastes stored in the Storage Facility

List of Major Isotopes in Store

Isotope	Total Activity (MBq)	Weight (kg)	Major Sources of Wastes
Caesium-137	6.2×10^5	9.6×10^2	Medical radiation sources
Radium-226	7.1×10^4	1.0×10^4	Lightning conductor heads, luminous watch dials and hands, medical radiation sources
Cobalt-60	4.7×10^4	6.0×10^2	Radioactive check sources
Promethium-147	4.0×10^4	8.3×10^3	Luminous watch dials and hands
Strontium-90	3.1×10^4	3.8×10^2	Medical radiation sources
Gadolinium-153	1.1×10^4	1.0×10^0	Medical radiation sources
Americium-241	7.2×10^3	4.9×10^2	Radioactive check sources, smoke detectors
Thorium-232	1.2×10^3	8.0×10^3	Rayon mantles for kerosene lanterns

Total volume of waste in store = $76m^3$ (as at June 2017)

I.2 References

[1] Radiation Ordinance (Cap. 303 of the Laws of Hong Kong)

[2] Import (Radiation) (Prohibition) Regulations (Cap. 60K of the Laws of Hong Kong)

[3] INTERNATIONAL ATOMIC ENERGY AGENCY, Guidance on the Import and Export of Radioactive Sources, IAEA, Vienna (2012)

[4] INTERNATIONAL ATOMIC ENERGY AGENCY, Code of Conduct on the Safety and Security of Radioactive Sources, IAEA, Vienna (2004)

[5] INTERNATIONAL ATOMIC ENERGY AGENCY, Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, INFCIRC/546, Vienna (1997)

[6] INTERNATIONAL ATOMIC ENERGY AGENCY, Categorization of Radioactive Sources, IAEA Safety Standards Series No. RS-G-1.9, IAEA, Vienna (2005)

[7] INTERNATIONAL ATOMIC ENERGY AGENCY, Radiation Protection & Safety of Radiation Sources: International Basic Safety Standards, IAEA Safety Standards Series No.GSR Part 3, IAEA, Vienna (2014)

[8] INTERNATIONAL ATOMIC ENERGY AGENCY, Regulations for the Safe Transport of Radioactive Material, 2012 Edition, IAEA Safety Standards Series No. SSR-6, IAEA, Vienna (2012)

[9] INTERNATIONAL ATOMIC ENERGY AGENCY, IAEA Safety Glossary, 2007 edition, IAEA, Vienna (2007)