



The People's Republic of China
National Nuclear Safety Administration
2019 Annual Report



China's Nuclear Safety Strategy

Equal Emphasis on Development and Safety

Equal Emphasis on Rights and Obligations

Equal Emphasis on Independent Efforts and Coordination

Equal Emphasis on Symptoms and Root Causes



Message from the Administrator



The year 2019 marks the 70th anniversary of the founding of the People's Republic of China; it is also the key year for building a moderately prosperous society in all respect. Under the strong leadership of the CPC Party Central Committee and the State Council, the National Nuclear Safety Administration (NNSA) has strictly implemented the basic policy of “putting safety and quality first”, and followed the regulatory principles of “independence, openness, rule of law, rationality, and effectiveness”. It has worked in a serious, prudent, rigorous and pragmatic way, upholding the concept that nuclear safety is of utmost importance, and that strict regulation, unity and cooperation will ensure its continuous improvement. As a responsible nuclear and radiation safety regulator, it has worked on cultivation of nuclear safety culture, advanced the campaign of “Year of Standardized Management” and ensured nuclear and radiation safety in China.

Positive development has been made throughout the year in nuclear and radiation safety regulation.

First, the safety of nuclear facilities was strictly supervised. Safety surveillance was performed for nuclear power plants (NPPs), research reactors, nuclear fuel cycle facilities, radioactive waste treatment and disposal facilities, nuclear safety equipment and special personnel; AP1000, EPR and other 3rd generation nuclear power projects were regulated and supervised according to law; overall safety inspection was conducted prior to reactor loading; the safety of “Hualong-1” and other newly designed nuclear power units was actively reviewed; operational and construction events were handled properly; resolute actions were taken against fraudulence and violations; common problems related to operational events were studied and experience communicated; and the safety information on NPPs was disclosed.

Second, prevention and control of radioactive pollution was promoted. The strengthened

safety action plan of radioactive sources was implemented; the security of urban radioactive waste repositories was upgraded; an online monitoring platform for high-risk mobile sources was set up; the associated radioactive minerals was investigated during the Second National Pollution Source Survey; and radioactivity level of the nuclear power base was investigated. Progress was also made in the decommissioning of early-phase nuclear facilities and uranium mining and milling facilities and in the transportation and disposal of disused radioactive sources and radioactive waste derived from nuclear facilities.

Third, policies and regulations system was improved. The white paper Nuclear Safety in China was published for the first time. It has highlighted the image of China as a responsible big country, improved the top-level design of China's system of nuclear and radiation safety regulations and standards and systematically described the road-map for the establishment of such a standard regulation system in China.

Fourth, the regulatory system was improved. The first and second-level documents on the nuclear and radiation safety management system were issued, and the third-level on-site regulation and law enforcement procedures were established with a view to making the regulation more standardized.

Fifth, regulatory capacity was strengthened. The first-phase project of the regulatory

technology R&D base of national nuclear and radiation safety was completed and the Frontier Laboratory and the Emergency Headquarters of Changbaishan Mountain Radiation Environment Surveillance were built and put into operation. Efforts were made to build state key laboratories, advance R&D of nuclear safety technologies and strengthen the basic support for nuclear safety.

Sixth, international obligations on nuclear safety were fulfilled. Multilateral and bilateral cooperation on nuclear safety was strengthened; and the Agreement on Practical Arrangement of Cooperation in the Field of Nuclear and Radiation Safety was signed with the International Atomic Energy Agency (IAEA), which has opened up new prospects for international cooperation.

Seventh, focusing on the general requirements of "Remain the Original Aspiration, Undertake the Mission, Identify the Gap, and Effort to the Implementation", an "Nuclear Safety Iron Army" was developed through internal reform and in-depth analysis, strength consolidation, weakness mitigation and continuous improvement.

Through pragmatic and joint efforts with the industry, China has maintained good performance in nuclear and radiation safety. The 47 operating nuclear power units around the country enjoyed good safety performance, and the average operating incidents per unit were reduced to less than one. The overall commissioning of four AP1000 units and two

EPR units was completed; they were already put into commercial operation. China has become the leading country in the world to master the commissioning and operation technologies of the new generation NPPs. No incidents or accidents at or above level 2 on the International Nuclear and Radiological Event Scale (INES) occurred in operating the NPPs, research reactors, nuclear fuel cycle facilities, facilities for radioactive waste storage, treatment and disposal, and transportation of radioactive materials. The quality of the 15 NPPs under construction was under control. The annual incidence rate of radiation accidents was less than 1.0 event per 10000 radioactive sources. The quality of national radiation environment was good. The Annual Report of the National Nuclear Safety Administration, as a faithful witness of the development of nuclear safety in China, has fully recorded the great efforts made by China over the years to ensure high nuclear safety and its continuous improvement, and has played an important role in protecting the public right to information, right to participate and right of supervision over nuclear safety. On behalf of NNSA, I would like to express my sincere thanks to all who have contributed to nuclear safety and friends from all walks of life for their concern and support over the years.

The year 2020 is the deciding year for China to build a moderately prosperous society in all respect; it is also the critical year for comprehensively promoting the modernization of nuclear safety governance

as it is the last year of the 13th Five-Year Plan for nuclear safety and the year to lay the foundation of the 14th. Under the guidance of Xi Jinping's Thought on Socialism with Chinese Characteristics for a New Era, and keeping in mind Xi Jinping's ecological civilization thought, overall national security outlook, and rational, coordinated and balanced nuclear safety strategy, NNSA will carry out the campaign of "Year of Promoting the Modernized Governance of Nuclear Safety", prevent and control risks, build capacity in regulation and develop an "iron army" according to the principle of "Rule of Law, Standard Management, Strict Regulation, and Risk Control". It will focus on "Four Transformations" to strengthen internal and external coordination, build the "Eight Regulatory Systems", comprehensively promote the modernization of the nuclear safety governance system and capacity, guarantee high nuclear and radiation safety, and protect public health and environmental safety. In addition, NNSA is always committed to international cooperation in nuclear safety, and is willing to share China's experience in nuclear and radiation safety regulation and contribute its wisdom and strength to the governance of nuclear safety around the world.

Vice Minister of Ministry of Ecology and Environment
Administrator of National Nuclear Safety Administration

Liu Hua

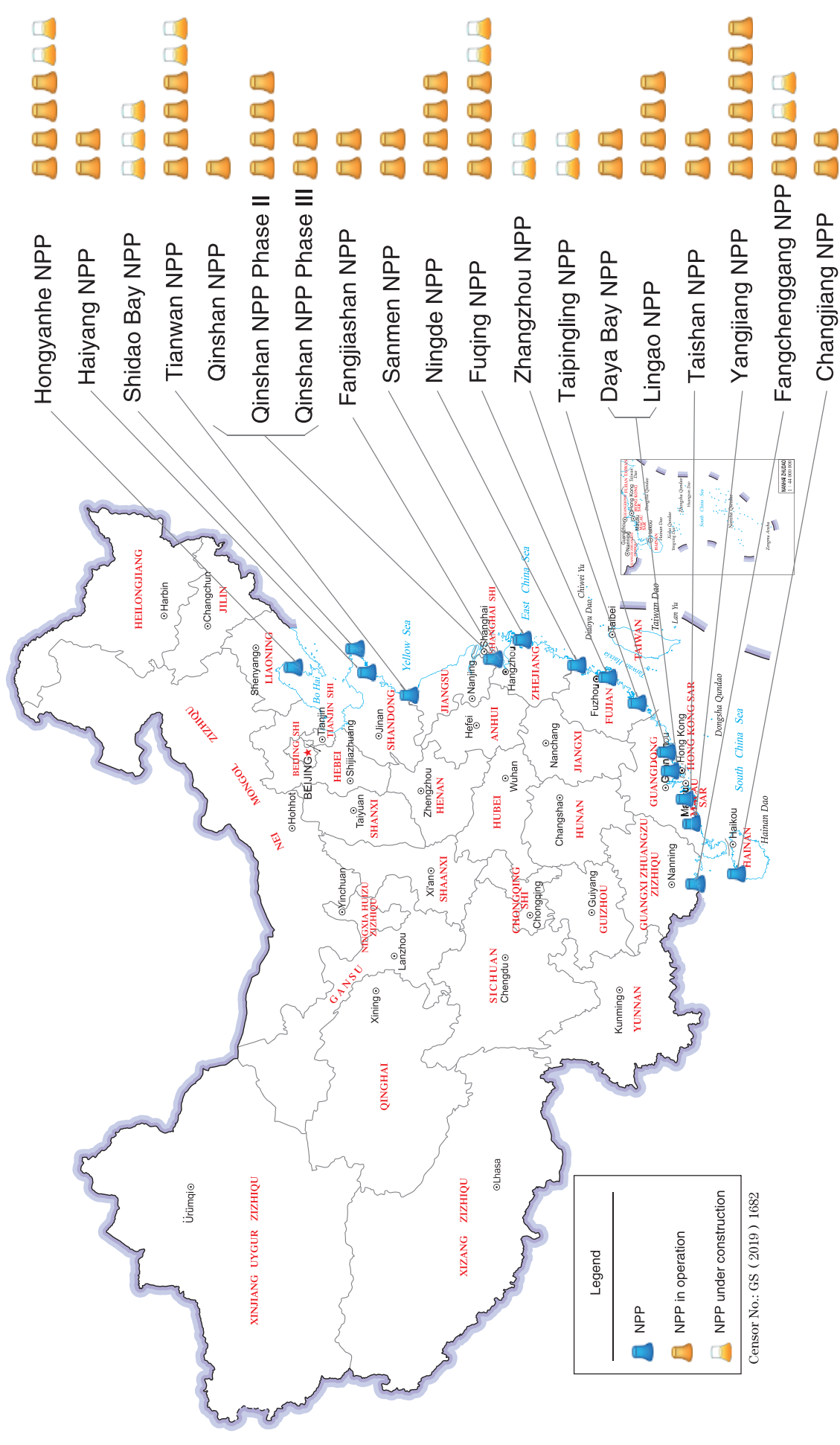
May 28th, 2020





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A map of nuclear power plants in mainland China (As of December 30, 2019)

1 Introduction

In 2019, the operation safety and construction quality of China's civilian nuclear facilities continued to perform well, and no incidents or accidents at or above level 2 on the International Nuclear and Radiological Event Scale (INES) occurred in operating nuclear power plants (NPPs), research reactors, fuel cycle facilities, radioactive waste repositories and disposal facilities, and radioactive material transportation. All events related to operating and constructing nuclear facilities were handled properly. *

The quality of the radiation environment nationwide was generally good in 2019. There were no evident changes in the level of environmental ionizing radiation around nuclear facilities and radiation level around electromagnetic radiation emission facilities.

Nuclear Safety in China White Paper

On September 3rd, 2019, the State Council Information Office published the *Nuclear*

* This report does not contain relevant data of Hong Kong, Macao, and Taiwan of the People's Republic of China.

Safety in China white paper. It was the first time China's government has introduced the development course of China's nuclear safety by means of a white paper. The white paper explains the basic principles and policy of nuclear safety, shares the concepts and practices of nuclear safety regulation, effectively responds to the public's concerns about nuclear safety, and comprehensively clarifies China's determination and actions for building a community of shared future for nuclear safety. It highlights the image of China as a responsible big country, enhances the understanding, support and confidence in nuclear safety by the public, and plays an important role in strengthening nuclear safety regulation, improving nuclear safety level and promoting global governance in nuclear safety.

The Ministry of Ecology and Environment (National Nuclear Safety Administration) [MEE(NNSA)] proactively promoted the implementation and interpretation of the white paper, participated in the "Minister's Teahouse" and media interviews, and published articles to further interpret the

white paper, so as to deepen the public's understanding of its contents, and issued the *Notice on the Implementation of Learning and Publicity of "Nuclear Safety in China" White Paper*, to further strengthen the guiding role of the white paper on the regulation of nuclear and radiation safety.

Rule by Law

According to the requirements of the *Nuclear Safety Law*, and on behalf of the State Council, Li Ganjie, Minister of the Ministry of Ecology and Environment (MEE), presented the report on annual nuclear safety to the Standing Committee of the National People's Congress. The annual implementation results of the nuclear safety laws were summarized and compiled as a special report—the *Annual Activities of the Ministry of Ecology and Environment to Implement Nuclear Safety Law and to Effectively Guarantee Nuclear Safety*. The validation, coordination, review, discussion, and other legislation affairs of the *Atomic Energy Law* were conducted. The *Top-Level Design Plan of Nuclear and Radiation Safety Regulations and Standards System* was issued, to accelerate the revision of key laws and regulations. The establishment of National Technical Committee for Nuclear Safety Standardization was promoted. It has passed the defense of the Standardization Administration of China and publiced. Four special training courses on nuclear and radiation safety regulations and standards as

well as administration by law were conducted to improve the ability of regulation according to law.

System Establishment

In 2019, the MEE(NNSA) released the *Nuclear and Radiation Safety Management System* (Management System), containing a first-level document *General Introduction*, 49 working guidelines and technical management programs—the second-level documents, and more than 400 procedures for regulatory inspection, law enforcement and technical support—the third-level documents, which will be updated timely. The MEE(NNSA) continued to promote the establishment of the Management System, and improved the standardization and scientific level of regulations. In addition, the *General Introduction* and 49 working guidelines and technical management programs has been translated to English. To effectively promote the implementation of the management system, training coursewares were prepared and uploaded to the special online training platform for study and reference by various nuclear safety regulation institutes.

Refer to the safety standards issued by the International Atomic Energy Agency (IAEA), the Management System catalogs, promotes, and summarizes China's more than 30 years of practical experience in nuclear and radiation safety regulation, and systematically explains

the nuclear and radiation safety management system. It innovates management concepts and methods, optimizes the management process, improves regulation efficiency, and promotes the participation and continuous improvement by all staff, so as to provide all-round support to the nuclear and radiation safety regulation system.

Capability Building

In 2019, the phase I projects of the national nuclear and radiation safety regulatory technology research and development base were completed and put into operation. The projects' monitoring, emergency response and database development received financial support from national special funds, and the projects achieved phase wise capacity building results with respect to independent verification calculation and test verification. The construction of the national automatic radiation environment monitoring network station progressed efficiently, with stable data acquisition rate higher than 98%. The provincial-level radiation monitoring capacity was as per standards except for Tibet, and radiation accident emergency exercises were conducted in all provinces. The Changbai Mountain Radiation Environmental Monitoring Frontier Laboratory and Emergency Headquarters was successfully built and put into operation.

Nuclear Safety Culture Cultivation

The characteristics and laws for nuclear safety culture cultivation in different fields were further explored. To learn from international experience, nuclear safety culture relevant technical documents on international were translated. With the publicity and implementation of the *Nuclear Safety Law*, China's achievements in nuclear safety culture cultivation were introduced at international and domestic exchange activities. In April, Liu Hua, the Vice Minister of the Ministry of Ecology and Environment and Administrator of the National Nuclear Safety Administration, gave a special lecture on nuclear safety culture to the China National Nuclear Corporation (CNNC). In June, China's practices on nuclear safety culture cultivation were discussed at the International Nuclear Energy Cooperation Framework Meeting, and in November, nuclear safety culture exchanges were conducted at the Fourth Sino-German Nuclear Safety Regulatory Dialogue.

In order to guide the industry on nuclear safety culture cultivation, and conduct special research, summarize and promote good practices across the industry, and advance the implementation of the main responsibilities of enterprises, the 2019 Experience Exchange Meeting on Nuclear Safety Culture Building was convened in November.

Strengthening Regulation

The Probabilistic Safety Analysis (PSA) pilot project was deeply promoted, along with the risk-informed regulation, and the application in the optimization of relevant NPP technical specifications, the revision of periodic test regulation requirements, and online maintenance were approved. *The Technical Policy for Configuration Risk Management of NPPs (on Trial)* was published to guide the construction and optimization of the configuration risk management system of NPPs. The pilot project on improving the maintenance effectiveness of NPPs was carried out, and three working group meetings on maintenance rules for NPPs were convened to coordinate and standardize the implementation of maintenance rules. The peer reviews on maintenance rules, serious accident management and nuclear safety culture were organized, to effectively promote NPP operators to implement relevant work. *The Principles for Nuclear Safety Review of "Hualong-1" Nuclear Power Project* were published, and onsite supervision was strengthened, to ensure high quality review and supervision of "Hualong-1" and other newly designed nuclear power units. Technical policy studies on NPP network safety, floating reactors, and small reactors were conducted. The operational and construction events related to nuclear facilities, as well as experience feedback on major non-conformance in nuclear equipment were

included in the daily Minister's Office Meeting, and independent evaluation of typical events were performed to strengthen the research and experience feedback on common problems. The requirements for information disclosure of nuclear safety law were implemented, safety performance indicators of NPPs were released, and the information on overall safety of NPPs was published.

As of the end of December 2019, China had a total of 47 commercial nuclear power units, 15 nuclear power units under construction, and 19 civilian research reactors (critical assembly). In 2019, the NPP operators reported a total of 31 operational events and 18 construction events; and research reactor operators reported a total of 17 operational events. In general, the operation of nuclear power units and research reactors was normal, and the three safety barriers were intact, without any radioactive incidents that endangered the safety of the public and the environment. The construction quality of the under-construction nuclear power units was also as per standards.

An action plan was implemented to strengthen the safety of radioactive sources, and to promote the safety upgrade of urban radioactive waste repositories. An online monitoring platform for high-risk mobile sources was built, which can receive data from 10 provinces. The survey on associated radioactive minerals of the second national

survey of pollution sources was completed, and 466 enterprises exploiting and utilizing associated radioactive minerals were under regulation. All sub-reports on the special investigation of nuclear bases were compiled. Substantial progress was made in the removal of radioactive waste left in the Shenxian Cave. Excellent results were achieved in the transportation of disused radioactive sources and radioactive waste from nuclear facilities. In 2019, a total of 6 radiation accidents were reported, all of which were classified as general accidents. The incidence rate of radiation accidents continued to remain below 1.0 event per 10,000 sources.

Technical Support

In 2019, the Nuclear and Radiation Safety Center, MEE (NSC) continued to provide comprehensive technical support for nuclear and radiation safety regulation. It undertook more than 5,000 tasks, completed more than 1,000 review tasks, proposed more than 3,000 review opinions, and provided onsite regulatory inspection technical support more than 300 times. It established the Hualong-1 Review Principle and promoted the standardization of the review of newly designed nuclear power units. It established a technical support management model for project team review and regulation and strengthened the technical support for regional offices of nuclear and radiation safety inspection. The NSC deepened policy and

technological research and development, and promoted the construction of key laboratories, the National Engineering Research Center, and the Hualong-1 Test Bench, thus comprehensively improving its capacity for technical support. On July 25th, 2019, the new members of the National Nuclear Safety Expert Committee [the former Nuclear Safety and Environment Expert Committee of Ministry of Environmental Protection (National Nuclear Safety Administration)] were elected, and the Nuclear Safety Strategy and Policy Sub-Committee was established to provide better consulting services for China in preparing nuclear safety plans and standards, and on technical decision-making related to major safety issues of nuclear facilities.

In 2019, the Radiation Environment Monitoring Technology Center, MEE (RMTC) continued to provide technical support for national radiation environment monitoring and regulatory monitoring around key nuclear and radiation facilities as per the *National Radiation Environment Monitoring Plan*. It completed real-time and continuous monitoring of air absorption dose rates in 120 prefecture-level and above cities, monitoring of cumulative doses in 234 prefecture-level and above cities, aerosol monitoring in 115 prefecture-level and above cities, monitoring of sediments, air, tritium in atmospheric precipitations and gaseous radioiodine isotopes in municipalities directly under the central government and provincial capitals, monitoring of surface water

in major river basins and lakes (reservoirs), centralized monitoring of drinking water source water in 336 prefecture-level and above cities, monitoring of groundwater in 31 cities, monitoring of coastal seawater in 11 provinces, monitoring of soil in 337 prefecture-level and above cities, and electromagnetic radiation monitoring in municipalities directly under the central government and provincial capitals. There were 46 key nuclear and radiation facilities in 6 categories and 41 electromagnetic radiation facilities in 4 categories under regulatory monitoring.

Special Campaign on Nuclear and Radiation Safety in Production

In 2019, in order to thoroughly implement the important instructions on production safety issued by President Xi Jinping, Premier Li Keqiang and other leading comrades of the CPC Central Committee, and the relevant requirements of the *Notice on the Issuance of the Centralized Remediation Plan for National Production Safety* published by the Work Safety Commission of the State Council, the MME (NNSA) formulated the implementation plan for consolidated nonroutine inspection of nuclear and radiation safety, to conduct nonroutine inspections of nuclear and radiation safety of national NPPs and research reactors, nuclear fuel cycle facilities, radioactive waste treatment, storage and disposal facilities, and key nuclear technology utilization operating units and uranium

tailings (slag) repositories. The plan aims to implement centralized remedial measures for the emergency system and capacity building, supervision of special process activities of civil nuclear safety equipment installation operators, and nuclear and radiation safety guarantees during holidays and festivals, etc. The plan also proposed 681 specific remedial measures for nuclear facility operators and nuclear technology utilization operators, 608 of which have already been implemented. The other remedial measures are progressing on schedule, effectively ensuring high safety of production activities related to nuclear facilities and nuclear technology utilization.

International Cooperation

To implement Xi Jinping Thought on Diplomacy and initiatives proposed on the Nuclear Security Summit, and practice the “Rational, Coordinated and Balanced” nuclear safety strategy, the MEE(NNSA) proactively participated in global nuclear security governance, sharing nuclear safety regulatory experiences and supported the efforts to make China’s nuclear safety regulation system more international. Li Ganjie, Minister of MEE, witnessed the signing of an MoU between the Nuclear and Radiation Safety Center with the French Institute for Radiation Protection and Nuclear Safety. Liu Hua, Vice Minister of MEE and Administrator of NNSA, led the Chinese government delegation to attend the 63rd IAEA General Conference and the Senior Safety

and Security Regulators' Meeting, the 5th International Conference on Effective Nuclear and Radiation Regulatory Systems, the 13th Policy Group Meeting of the Multinational Design and Evaluation Program of NPPs, and the 3rd Meeting of the NNSA/ONR Bilateral Steering Group. A Practical Arrangements between IAEA and NNSA on Cooperation in the Area of Nuclear and Radiation Safety was signed with IAEA, creating a new era of cooperation. The MEE(NNSA) sponsored the Sino-Russia Nuclear Safety Regulation Working Conference, the 12th Top Regulators' Meeting on Nuclear Safety among China, Japan and Korea, and the 2nd Summary Meeting of Sino-EU Nuclear Safety Cooperation Project, and comprehensively leveraged its home advantage and publicized

its regulation results. The MEE(NNSA) promoted the work of the HPR1000 Working Group under the Multinational Design Evaluation Program (MDEP), and successfully held working group meetings and technical subgroup meetings. The MEE(NNSA) steadfastly promoted cooperation with developed countries producing nuclear power such as the United States of America, Russia, the United Kingdom, and France, and strengthened nuclear safety cooperation with the countries along the "Belt and Road" such as Pakistan, Vietnam, South Africa, Czech Republic, Morocco, and the UAE. The MEE(NNSA) proactively fulfilled the *Nuclear Safety Convention*, and deployed personnel to work for one year at IAEA and the Nuclear Energy Agency of the OECD.

2 Policies, Plans, Regulations and Standards

Nuclear Safety Policy

The documents related to nuclear and radiation safety were prepared and approved by the Standing Committee of the National People's Congress (NPC) for the 2018 annual report on the state of the environment and the achievement of environmental protection targets. Special research on the modernization of the nuclear safety governance system and capacity as well as the effectiveness of nuclear safety regulation were conducted, to provide strong support for decision-making on nuclear and radiation safety regulation and to ensure scientific and efficient regulation of nuclear and radiation safety.

Nuclear Safety Planning

The mid-term evaluation of the implementation of the *13th Five-Year Plan and 2025 Long-Term Goals on Nuclear Safety and Radioactive Pollution Prevention and Control* was conducted, and the evaluation report was submitted to the State Council after it was approved by the relevant authorities such as the National Development and Reform

Commission, the Ministry of Finance, the National Energy Administration, and the State Administration of Science, Technology and Industry for National Defense. The planning and pre-research on the 14th Five-Year Plan on Nuclear Safety and Radioactive Pollution Prevention and Control was organized and conducted, and the work plan for the 14th Five-Year Plan was formulated, to determine the working direction and to establish a compilation organization. Forty-five special studies were conducted, and a Symposium on the 14th Five-Year Plan was convened for special research. The final evaluation plan of the *13th Five-Year Plan and 2025 Long-Term Goals on Nuclear Safety and Radioactive Pollution Prevention and Control* was prepared.

Top-level Design of Regulations and Standards System

With the objectives to establish a regulation and standard system that adopts scientific and systematic top-level design, realize the modernization of the nuclear and radiation

safety regulation system and capacity, keep up with the international advanced regulation and standard system of IAEA, and systematically summarize existing nuclear and radiation safety regulations and standards, the *Top-Level Design Plan for Nuclear and Radiation Safety Regulations and Standards* was formulated. The top-level design draft of China's nuclear and radiation safety regulations and standards was compiled based on an analysis of the deficiencies of the current system and international experience, laying the foundation for the establishment of a nuclear and radiation safety regulations and standards system in the new era. The safety standard system of IAEA was comprehensively studied to prepare the *Research Report on the Nuclear Safety Standard System of IAEA*, and to organize the systematic compilation and review of the *Terminology of Nuclear and Radiation Safety* and 73 International Atomic Energy Agency safety standards all of which accounted for a total of nearly 5 million words.

Preparations and Revisions of Nuclear Safety Regulations and Standards

A review mechanism for the regulations and standards was efficiently implemented. Four regulation and standard review meetings were convened throughout the year, and 19 regulation and standard documents were officially issued, such as the *Regulations*

on Safety Licensing Procedures for NPPs, Research Reactors and Nuclear Fuel Cycle Facilities, the Regulations for the Safe Transport of Radioactive Material, and the Guidelines for Environmental Impact Assessment of Cooling Water Intake and Discharge for NPPs (on Trial), including 3 departmental regulations, 8 nuclear safety guidelines, 5 standards (1 GB standard and 4 HJ standards), 2 technical documents, and 1 technical policy (Refer to Table 1 for details). Furthermore, 37 regulations and standards were reviewed, including 2 departmental regulations, 11 nuclear safety guidelines, 23 standards, and 1 technical document (Refer to Table 2 for details).

According to the regulation development and revision plan for the *Nuclear Safety Law*, the supporting guidelines of the *Safety Regulations for the Design of NPPs (HAF102)* were formulated and revised in an orderly manner. The *Decision on the Revisions of the Regulations on the Safety and Protection of Radioisotopes and Irradiation Devices (Draft)* was prepared, the revision of the *Regulations of the Safety and Protection of Radioisotopes and Irradiation Devices* was proactively promoted, and the revisions of the *Administrative Measures for the Safety Licensing of Radioisotopes and Irradiation Devices* and the *Administrative Measures for the Safety and Protection of Radioisotopes and Irradiation Devices*—two supporting departmental regulations, were initiated.

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The development and revisions of standards such as the *Regulations on Radiation and Environment Protection in Uranium Mining and Milling*, the *Technical Specifications of Radiation Environmental Protection for other Radioactive Material's Storage and Solid Waste's Landfill*, the *Environmental Radiation*

Limits for Development and Utilization of Other Radioactive Mines, and the *Monitoring Methods for Electromagnetic Radiation Environment of Medium Wave Broadcasting Transmitting Station*, were promoted. Pre-legislation work on special regulations on electromagnetic radiation were also prepared.

Table 1. List of regulations and standards issued in 2019

No.	Name	Category	Code	Release form	Release time
1	Regulations on Qualification Management of Civil Nuclear Safety Equipment Welding Personnel	Departmental regulations	HAF 603-2019	MEE Decree No.5	2019-06-12
2	Regulations on Qualification Management of Civil Nuclear Safety Equipment Nondestructive Testing Personnel	Departmental regulations	HAF 602-2019	MEE Decree No.6	2019-06-13
3	Regulations on Safety Licensing Procedures for NPPs, Research Reactors and Nuclear Fuel Cycle Facilities	Departmental regulations	Integrated HAF001/01 and HAF001/03	MEE Decree No.8	2019-08-26
4	Monitoring and Inspection of Radioactive Waste Disposal Facilities	Nuclear safety guidelines	HAD 401/09-2019	NNSA [2019] 58	2019-03-22
5	Emergency Preparedness and Response of NPP Operators	Nuclear safety guidelines	HAD 002/01-2019	NNSA [2019] 244	2019-11-29
6	Emergency Preparedness and Response of Research Reactor Operators	Nuclear safety guidelines	HAD 002/06-2019	NNSA [2019] 244	2019-11-29
7	Emergency Preparedness and Response of Nuclear Fuel Cycle Facility Operators	Nuclear safety guidelines	HAD 002/07-2019	NNSA [2019] 244	2019-11-29
8	Fire and Explosion Protection Design of NPPs	Nuclear safety guidelines	HAD 102/11-2019	NNSA [2019] 265	2019-12-31
9	Radiation Protection Design of NPPs	Nuclear safety guidelines	HAD 102/12-2019	NNSA [2019] 265	2019-12-31
10	Seismic Design and Evaluation of NPPs	Nuclear safety guidelines	HAD 102/02-2019	NNSA [2019] 266	2019-12-31

Policies, Plans, Regulations and Standards

continued

No.	Name	Category	Code	Release form	Release time
11	Protection Design for Internal Hazards (Excluding Fire and Explosion) of NPPs	Nuclear safety guidelines	HAD 102/04-2019	NNSA [2019] 266	2019-12-31
12	Regulations for the Safe Transport of Radioactive Material	Standard	GB 11806-2019	MEE Bulletin No. 7	2019-02-15
13	Technical Guidelines for Environmental Impact Assessment – Uranium Mining and Milling	Standard	HJ 1015.1-2019	MEE Bulletin No. 3	2019-01-21
14	Technical Guidelines for Environmental Impact Assessment – Uranium Mining and Milling Decommissioning	Standard	HJ 1015.2-2019	MEE Bulletin No. 3	2019-01-21
15	Guidelines for Environmental Impact Assessment of Cooling Water Intake and Discharge for NPPs (on Trial)	Standard	HJ 1037-2019	MEE Bulletin No. 33	2019-08-21
16	Analytical Method of ¹⁴ C in Liquid Effluent of NPP—Wet Oxidation	Standard	HJ 1056-2019	MEE Bulletin No. 41	2019-10-25
17	Guidelines for Cause Analysis of NPP Events (on Trial)	Technical document	NNSA-HAJ-0001-2019	-	2019-05-25
18	Qualification Assessment of Civil Nuclear Safety Equipment Welding Operators	Technical document	NNSA-HAJ-2019-002	NNSA [2019] 267	2019-12-24
19	Technical policy for Configuration Risk Management of NPPs (on Trial)	Technical policy	-	NNSA [2019] 262	2019-12-30

Table 2. List of regulations and standards reviewed in 2019

No.	Name	Category	Project progress	Meeting
Departmental regulations				
1	Regulations on the Qualification Management of Civil Nuclear Facility Operators	Revised	Draft for review Preliminary draft for approval	Two special meetings on regulation and standard in January
2	Reporting System for NPP Operators	Revised	Draft for review Preliminary draft for approval	Third meeting on regulation and standard

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continued

No.	Name	Category	Project progress	Meeting
Nuclear safety guidelines				
1	Emergency Preparedness and Response of NPP Operators	Revised	Preliminary draft for approval	First meeting on regulation and standard
2	Emergency Preparedness and Response of Research Reactor Operators	Revised	Preliminary draft for approval	First meeting on regulation and standard
3	Emergency Preparedness and Response of Nuclear Fuel Cycle Facility Operators	Revised	Preliminary draft for approval	First meeting on regulation and standard
4	Pre-Disposal Managements of Radioactive Waste in Nuclear Facilities	Formulated	Preliminary draft for approval	Second meeting on regulation and standard
5	Waste Minimization in Nuclear Technology Utilization	Formulated	Draft for review Preliminary draft for approval	First and second meetings on regulation and standard
6	Safety Requirements for Geological Disposal Facilities of Radioactive Waste	Formulated	Draft for review Preliminary draft for approval	First and second meetings on regulation and standard
7	Decommissioning of Nuclear Fuel Cycle Facilities	Formulated	Draft for review Preliminary draft for approval	Third and fourth meetings on regulation and standard
8	Technical Policy for Configuration Risk Management of NPPs	Formulated	Draft for review	Third meeting on regulation and standard
9	Storage of Radioactive Solid Waste	Formulated	Draft for review	Fourth meeting on regulation and standard
10	Requirements for Clearance of Sites after Practice Termination	Formulated	Draft for review Preliminary draft for approval	First and fourth meetings on regulation and standard
11	Decommissioning of Nuclear Technology Facilities	Formulated	Draft for review	Fourth meeting on regulation and standard
Standards				
1	Guidelines for Environmental Impact Assessment of Cooling Water Intake and Discharge for NPPs	Formulated	Preliminary draft for approval	First meeting on regulation and standard

Policies, Plans, Regulations and Standards

continued

No.	Name	Category	Project progress	Meeting
2	Radiation Protection and Safety Requirements in Nuclear Medicine Workplace	Formulated	Preliminary draft for approval	First meeting on regulation and standard
3	Technical Regulations for Site Selection, Design and Construction of Repositories for Storing Radioactive Waste in Nuclear Technology Utilization	Formulated	Preliminary draft for approval	First meeting on regulation and standard
4	Technical Guidelines for Environmental Impact Assessment- Power Transmission and Distribution Project	Formulated	Preliminary draft for approval	First meeting on regulation and standard
5	Regulations for Environment Protection in Electric Power Transmission and Distribution Project	Formulated	Preliminary draft for approval	First meeting on regulation and standard
6	Technical Guidelines for Environmental Impact Assessment – Radio and Television	Formulated	Preliminary draft for approval	First meeting on regulation and standard
7	Regulations for Radiation Protection and Radiation Environment Protection in Uranium Mining and Milling	Formulated	Draft for review	First meeting on regulation and standard
8	Characterization of Low Level Radioactive Waste Packages	Formulated	Drafts I and II for review Preliminary draft for approval	First, second and fourth meetings on regulation and standard
9	Limits and Monitoring Methods of Total Electric Field of DC Transmission Project	Formulated	Draft for review Preliminary draft for approval	First and second meetings on regulation and standard
10	Regulations for Radiation Protection and Radiation Environment Protection in Uranium Mining and Milling	Formulated	Preliminary draft for approval	Second meeting on regulation and standard
11	Technical Specifications of Radiation Environmental Protection for Other Radioactive Material's Storage and Solid Waste's Landfill	Formulated	Draft for review Preliminary draft for approval	Second and third meetings on regulation and standard

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continued

No.	Name	Category	Project progress	Meeting
12	General Regulation of Quality Assurance for Ionizing Radiation Monitoring	Formulated	Draft for review Preliminary draft for approval	Third and fourth meetings on regulation and standard
13	Analysis Method for Tritium in Water	Formulated	Draft for review Preliminary draft for approval	Third and fourth meetings on regulation and standard
14	Technical Specifications for Environmental Emergency Monitoring in NPP Accidents	Formulated	Draft for review Preliminary draft for approval	Third and fourth meetings on regulation and standard
15	Technical Specifications for Emergency Monitoring in Radiation Accidents	Formulated	Draft for review Preliminary draft for approval	Third and fourth meetings on regulation and standard
16	Technical Specifications on Determination of Gamma-ray Emitting Radionuclides in Environmental Samples for Emergency Monitoring	Formulated	Draft for review Preliminary draft for approval	Third and fourth meetings on regulation and standard
17	Technical Specifications for Determination of α -emitting Radionuclides in Soil by In-situ HPGe Spectrometer	Formulated	Draft for review Preliminary draft for approval	Third and fourth meetings on regulation and standard
18	Environmental Radiation Limits for Development and Utilization of Other Radioactive Mines	Formulated	Draft for review	Fourth meeting on regulation and standard
19	Format and Content of Monitoring Report for Acceptance of Completion on Radiation Environmental Protection for Development and Utilization Project of Other Radioactive Mines	Formulated	Draft for review	Fourth meeting on regulation and standard
20	Technical Guidelines for Environmental Impact Assessment – Satellite Up-link Earth Station	Formulated	Draft for review	Fourth meeting on regulation and standard
21	Technical Specifications for Acceptance of Environmental Protection Facilities for Completed Construction Projects – Radio and Television	Formulated	Draft for review	Fourth meeting on regulation and standard

Policies, Plans, Regulations and Standards

continued

No.	Name	Category	Project progress	Meeting
22	Environmental Monitoring Method for Electromagnetic Radiation of Medium Wave Broadcasting Transmission Station	Formulated	Draft for review	Fourth meeting on regulation and standard
23	Technical Specifications for Acceptance of Environmental Protection Facilities for Completed Construction Project – Electric Power Transmission and Distribution	Revised	Draft for review	Fourth meeting on regulation and standard
Technical documents				
1	Qualification Assessment for Welding Operators of Civil Nuclear Safety Equipment	Formulated	Draft for review Preliminary draft for approval	Third meeting on regulation and standard

Preparation for the Establishment of National Technical Committee for Nuclear Safety Standardization

Major progress was made in the establishment of the National Technical Committee for Nuclear Safety Standardization. The basis for the functional allocation of national standard committees related to nuclear safety was comprehensively studied, the nuclear standard systems were scientifically classified, the recognition relationship

between the International Organization for Standardization (ISO) and the International Atomic Energy Agency (IAEA) was fully investigated, the proposal of establishment of the National Technical Committee for Nuclear Safety Standardization was evaluated as per the international standard, and the expert reviews and online publicity organized by the State Administration for Market Regulation were successfully passed, laying an important foundation for the establishment of the National Technical Committee for Nuclear Safety Standardization.

3 Safety Regulation of Nuclear Power Plants

In 2019, China's operating NPPs had no event that endangered the safety of the public and the environment. The monitoring results indicate that for the entire year the integrity of the three physical barriers remained intact.

In 2019, the review opinions on siting of the Hainan Changjiang multi-purpose small modular reactor technology demonstration project and the construction licenses for National Nuclear Demonstration Project Units 1 and 2, Fujian Zhangzhou NPP Units 1 and 2, Guangdong Taipingling NPP Units 1 and 2, Changjiang NPP Units 1 and 2, Taishan NPP Units 1 and 2, Yangjiang NPP Units 3, 4, 5, and 6, Tianwan NPP Units 3 and 4, Ningde

NPP Units 3 and 4, and Hongyanhe NPP Units 3 and 4, were issued. The environmental impact statements on construction stage of National Nuclear Demonstration Project Units 1 and 2, Fujian Zhangzhou NPP Units 1 and 2, Guangdong Taipingling NPP Units 1 and 2, and the environmental impact statement on siting of the Hainan Changjiang Multi-Purpose Small Modular Reactor Technology Demonstration Project and the environmental impact statement of the Marine Engineering Optimization Project of Hainan Changjiang NPP, were approved.

Refer to Table 3 for the operation data of China's NPPs in 2019.

Table 3. Operation data of NPPs in 2019

NPP Name	Generated Energy (TWh)	Unit No.	Uniform Unit No.	Rated Power (MWe)	Unit Generated Energy (TWh)	Load Factor (%)	Unit Capacity Factor (%)
Qinshan	2.627	1	CN01	330	2.627	90.88	88.09
		1	CN04	650	5.099	89.56	88.13
		2	CN05	650	5.053	88.74	86.75
Qinshan Phase II	20.972	3	CN14	660	5.698	98.55	98.80
		4	CN15	660	5.122	88.60	91.50

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continued

NPP Name	Generated Energy (TWh)	Unit No.	Uniform Unit No.	Rated Power (MWe)	Unit Generated Energy (TWh)	Load Factor (%)	Unit Capacity Factor (%)
Qinshan Phase III	11.635	1	CN08	728	5.457	85.57	87.62
		2	CN09	728	6.178	96.87	99.99
Fangjiashan	16.947	1	CN24	1089	8.495	89.05	91.18
		2	CN25	1089	8.452	88.60	91.49
Daya Bay	16.195	1	CN02	984	8.134	94.36	92.94
		2	CN03	984	8.061	93.52	92.35
Ling'ao	31.520	1	CN06	990	7.859	90.62	95.04
		2	CN07	990	7.172	82.70	87.12
		3	CN12	1086	8.869	93.22	99.98
		4	CN13	1086	7.621	80.11	89.29
Tianwan	32.890	1	CN10	1060	8.860	95.41	98.64
		2	CN11	1060	8.193	88.23	91.42
		3	CN45	1126	7.710	78.17	81.88
		4	CN46	1126	8.127	82.39	84.75
Hongyanhe	32.730	1	CN16	1119	8.603	87.78	90.30
		2	CN17	1119	8.591	87.66	91.57
		3	CN26	1119	7.973	81.35	84.75
		4	CN27	1119	7.563	77.17	92.02
Ningde	31.364	1	CN18	1089	8.576	89.90	97.54
		2	CN19	1089	7.080	74.22	91.13
		3	CN34	1089	7.919	83.01	91.62
		4	CN35	1089	7.789	81.65	90.92
Fuqing	30.753	1	CN20	1089	6.988	73.25	89.16
		2	CN21	1089	8.575	89.89	99.35
		3	CN42	1089	8.024	84.11	95.76
		4	CN43	1089	7.166	75.12	91.79

continued

NPP Name	Generated Energy (TWh)	Unit No.	Uniform Unit No.	Rated Power (MWe)	Unit Generated Energy (TWh)	Load Factor (%)	Unit Capacity Factor (%)
Yangjiang	43.953	1	CN22	1086	8.484	89.19	89.23
		2	CN23	1086	7.968	83.76	90.24
		3	CN40	1086	9.168	96.37	99.99
		4	CN41	1086	7.383	77.60	91.72
		5	CN47	1086	7.139	75.04	82.10
		6	CN48	1086	3.811	91.33	95.99
Taishan	17.280	1	CN32	1750	12.77	83.28	90.88
		2	CN33	1750	4.510	93.11	99.99
Changjiang	9.719	1	CN36	650	4.686	82.30	89.49
		2	CN37	650	5.033	88.41	95.87
Fangchenggang	17.150	1	CN38	1086	9.120	95.85	99.29
		2	CN39	1086	8.030	84.46	92.14
Sanmen	10.671	1	CN28	1251	9.687	88.40	92.26
		2	CN29	1251	0.984	8.98	8.96
Haiyang	20.494	1	CN30	1253	10.094	91.96	97.44
		2	CN31	1253	10.400	97.06	98.89

Qinshan NPP

In 2019, Qinshan NPP continued to operate stably and safely, and the integrity of the three physical barriers was maintained. The total failure of fuel elements, the leakage rate of primary circuit pressure boundary, and the leakage rate of containment were all within the prescribed limits. The 19th refueling overhaul of Unit 1 was completed on October 20th, 2019.

The nuclear safety regulatory approvals for

Qinshan NPP in 2019 are shown in Table 4, and the inspection activities for Qinshan NPP are shown in Table 5. Qinshan NPP reported 1 operational event, as shown in Table 6. The occupational radiation doses at Qinshan NPP are shown in Table 7.

In 2019, the Eastern Regional Office of the Nuclear and Radiation Safety Inspection, MEE (ERO) conducted daily inspections, routine inspections, and nonroutine inspections for the 9 operating units (including Qinshan NPP,

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Qinshan NPP Phase II, Qinshan NPP Phase III, and Fangjiashan NPP) in the Qinshan Nuclear Power base. In all, 2,593 man-days were spent on inspections, 7 routine inspections and 1 nonroutine inspection organized by the MEE(NNSA) were conducted. A total of 142 problems were found and 50 management requirements were proposed.

In 2019, the NSC conducted 24 reviews

for Qinshan NPP, including a review of the extension of Qinshan NPP operating license.



Figure 1. Complete view of the Qinshan Nuclear Power Base

Table 4. Nuclear safety regulatory approvals for Qinshan NPP in 2019

Date	Document No.	Document
2019-03-05	NNSA [2019] 36	Notification for approving the application for maintenance, decommissioning, and replacement of anchor bolts of the electric fire pump of Qinshan NPP Unit 1
2019-03-08	NNSA [2019] 40	Notification for approving the modification of technical specifications for Qinshan NPP Unit 1
2019-03-22	NNSA [2019] 57	Notification for approving the Operation Quality Assurance Programs of Qinshan NPP, Qinshan NPP Phase II, Qinshan NPP Phase III, and Fangjiashan NPP (Version B)
2019-05-21	NNSA [2019] 119	Notification for approving the modifications of the spray system of Qinshan NPP Unit 1 by additional installation of sodium hydroxide pipeline and sampling pipeline
2019-08-13	NNSA [2019] 170	Notification for approving the optimization and modification of control logic modules of electric control valves in the bypass pipeline of the spray system heat exchanger, and shutdown cooling system heat exchanger of Qinshan NPP Unit 1
2019-08-30	NNSA [2019] 187	Notification for approving the modification of isolation card for additional physical startup test of CB-503 panel of Qinshan NPP Unit 1
2019-09-06	NNSA [2019] 192	Notification for approving the modification of the sampling pipeline arrangement prior to valve sampling test in the hot section of the main ring of the sampling system in the reactor factories of Qinshan NPP Unit 1
2019-09-10	NNSA [2019] 195	Notification for approving the modification of loading distribution box of the diesel generator in the auxiliary water supply system of Qinshan NPP Unit 1

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Table 5. Regulatory inspection activities at Qinshan NPP in 2019

Start date	Item	Inspection contents
2019-05-14	Nonroutine nuclear and radiation safety inspection of the Qinshan nuclear power base	Handling of operational events and major non-conformance in the recent three years; management of radiation protection, effluents, radioactive sources, and radioactive wastes; physical protection; impact of hazardous chemicals on nuclear safety and fire and explosion safety; and nuclear and radiation emergency preparedness

Note: It includes the regulatory inspection activities at Qinshan NPP, Qinshan NPP Phase II, Qinshan NPP Phase III, and Fangjiashan NPP

Table 6. Operational events of Qinshan NPP Reported in 2019

Occurrence time	Event title	Cause	INES Level
2019-10-19	Automatically shut down of the reactor due to the sudden opening of the regulating valve during the impulse starting of Qinshan NPP Unit 1	Human error	0

Table 7. Occupational Radiation Doses at Qinshan NPP in 2019

Unit	Annual Average Effective Dose/ Person (mSv)	Annual Maximum Individual Effective Dose (mSv)	Annual Collective Effective Dose (man·Sv)	Normalized Collective Effective Dose (man·mSv/Gwh)
Unit 1	0.142	4.254	0.317	0.121

Qinshan NPP Phase II

In 2019, the 4 units of Qinshan NPP Phase II continued to operate stably and safely, and the integrity of the three physical barriers was maintained. The total failure of fuel elements, the leakage rate of primary circuit pressure boundary, and the leakage rate of containment were all within the prescribed limits. The 15th refueling overhaul of Unit 1 was completed on November 10th, 2019, the 13th refueling overhaul of Unit 2 was completed on March 12th, 2019, and the 7th refueling overhaul of Unit 4 was completed on September 29th, 2019.

The nuclear safety regulatory approvals for Qinshan NPP Phase II in 2019 are shown in Table 8. Qinshan NPP Phase II reported 2 operational events, as shown in Table 9. The occupational radiation doses at Qinshan NPP are shown in Table 10.

In 2019, the NSC conducted 18 reviews for Qinshan NPP Phase II, including irradiation test reviews of 12 CF3 improved fuel assembly of Units 1 and 4, and the modification review of one group of power supply that was additionally installed to the core cooling monitoring cabinet of Units 3 and 4 of Qinshan NPP Phase II.

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Table 8. Nuclear safety regulatory approvals for Qinshan NPP Phase II in 2019

Date	Document No.	Document
2019-01-29	NNSA [2019] 20	Notification for approving relevant modifications for slowing down water evaporation from safety injection system boric acid ripple tank of Qinshan NPP Phase II
2019-06-18	NNSA [2019] 143	Notification for approving modification of girth weld inspection methods for main steam and main water supply pipeline of Qinshan NPP M310 Unit
2019-09-01	NNSA [2019] 189	Notification for approving modification of preventive maintenance restrictions for valves of reactor refueling pool, spent fuel pool cooling and treatment system, and component cooling water system of Qinshan NPP Phase II Units 3 and 4
2019-08-13	NNSA Letter [2019] 57	Notification for approving irradiation tests of 12 CF3 improved fuel assembly of Qinshan NPP Phase II Units 1 and 4

Table 9. Operational events of Qinshan NPP Phase II reported in 2019

Occurrence time	Event title	Cause	INES Level
2019-01-30	Automatic shutdown of Qinshan NPP Phase II Unit 4 due to DCS network failure	Equipment	0
2019-08-09	Automatic shutdown of Qinshan NPP Phase II Unit 3 due to the failure of electrical penetration assemblies of No. 1 main pump	Equipment	0

Table 10. Occupational radiation doses at Qinshan NPP Phase II in 2019

Unit	Annual Average Effective Dose/ Person (mSv)	Annual Maximum Individual Effective Dose (mSv)	Annual Collective Effective Dose (man·Sv)	Normalized Collective Effective Dose (man·mSv/Gwh)
Units 1-4	0.302	7.000	1.099	0.052

Qinshan NPP Phase III

In 2019, the 2 units of Qinshan NPP Phase III continued to operate stably and safely, and the integrity of the three physical barriers was maintained. The total failure of fuel elements, the leakage rate of primary circuit pressure boundary, and the leakage rate of containment were all within the prescribed limits. The 10th refueling overhaul of Unit 1 was completed on May 7th, 2019.

The nuclear safety regulatory approvals for Qinshan NPP Phase III in 2019 are shown in Table 11. No operational event was reported at Qinshan NPP Phase III in 2019. The occupational radiation doses at Qinshan NPP are shown in Table 12.

In 2019, the NSC conducted 6 reviews for Qinshan NPP Phase III, including project reviews on prolonging the operation life of the pressure pipeline of Qinshan NPP Phase III Units 1 and 2.

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Table 11. Nuclear safety regulatory approvals for Qinshan NPP Phase III in 2019

Date	Document No.	Document
2019-03-18	NNSA [2019] 49	Notification for approving the addition of a control rod-based shutdown mode to Qinshan NPP Phase III
2019-03-27	NNSA [2019] 60	Notification for approving area control optimization of Qinshan NPP Phase III
2019-12-25	NNSA [2019] 260	Notification for approving the modification of the final safety analysis reports of Qinshan NPP Phase III Units 1 and 2

Table 12. Occupational radiation doses at Qinshan NPP Phase III in 2019

Unit	Annual Average Effective Dose/ Person (mSv)	Annual Maximum Individual Effective Dose (mSv)	Annual Collective Effective Dose (man·Sv)	Normalized Collective Effective Dose (man·mSv/Gwh)
Units 1 and 2	0.279	6.324	0.687	0.059

Fangjiashan NPP

In 2019, the 2 units of Fangjiashan NPP continued to operate stably and safely, and the integrity of the three physical barriers was maintained. The total failure of fuel elements, the leakage rate of primary circuit pressure boundary, and the leakage rate of containment were all within the prescribed limits. The 4th refueling overhaul of Unit 1 was completed on April 14th, 2019, and the 4th refueling overhaul of Unit 2 was completed on June 30th, 2019.

The nuclear safety regulatory approvals for Fangjiashan NPP in 2019 are shown in Table 13. Fangjiashan NPP reported 2 operational events in 2019, as shown in Table 14. The occupational radiation doses at Qinshan NPP are shown in Table 15.

In 2019, the NSC conducted 32 reviews for Fangjiashan NPP, including a review on the revision of the in-service inspection program of Fangjiashan NPP.

Table 13. Nuclear safety regulatory approvals for Fangjiashan NPP in 2019

Date	Document No.	Document
2019-03-18	NNSA [2019] 50	Notification for approving modification of safety injection and safety injection signals in the hard logic module of the emergency control panel of Fangjiashan NPP Units 1 and 2
2019-03-18	NNSA [2019] 51	Notification for approving open control function of the operation auxiliary system of the expansion project of Qinshan NPP Units 1 and 2 (Fangjiashan Nuclear Power Project)
2019-06-11	NNSA [2019] 124	Notification for approving irradiation tests of 8 CF3 improved fuel assemblies of Fangjiashan NPP Unit 2

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continued

Date	Document No.	Document
2019-09-09	NNSA [2019] 193	Notification for approving Fangjiashan NPP Units 1 and 2 to shut down auxiliary decommissioning under reactor power operation mode

Table 14. Operational events of Fangjiashan NPP Reported in 2019

Occurrence time	Event title	Cause	INES Level
2019-03-19	Fangjiashan NPP Unit 1 mistakenly sending 1ASG003PO start-up signals	Human error	0
2019-06-25	The pressure of the primary circuit of Fangjiashan NPP Unit 2 exceeding the permitted operation pressure and temperature ranges of the primary circuit under NS / RRA mode,	Human error	0

Table 15. Occupational radiation doses at Fangjiashan NPP in 2019

Unit	Annual Average Effective Dose/ Person (mSv)	Annual Maximum Individual Effective Dose (mSv)	Annual Collective Effective Dose (man·Sv)	Normalized Collective Effective Dose (man·mSv/Gwh)
Units 1 and 2	0.279	6.016	0.836	0.049

Daya Bay NPP

In 2019, the 2 units of Daya Bay NPP continued to operate stably and safely, and the integrity of the three physical barriers was maintained. The total failure of fuel elements, the leakage rate of primary circuit pressure boundary, and the leakage rate of containment were all within the prescribed limits. The 20th refueling overhaul of Unit 1 and the 20th refueling overhaul of Unit 2 were completed.

The nuclear safety regulatory approvals for Daya Bay NPP in 2019 are shown in Table 16, and regulatory inspection activities carried out by the MEE(NNSA) are shown in Table 17. No operational event was reported at Fangjiashan NPP in 2019. The occupational radiation doses at Qinshan NPP are shown in Table 18.

In 2019, the Southern Regional Office of the Nuclear and Radiation Safety Inspection, MEE (SRO) conducted daily inspections and routine inspections for the 6 operating units (including Daya Bay NPP and Ling'ao NPP) in Daya Bay Nuclear Power Base. In all, 1,141 man-days were spent on inspections, 12 routine inspections were conducted. A total of 82 problems were found, and 37 management requirements were proposed.

In 2019, the NSC conducted 28 reviews for Daya Bay NPP (including 20 joint reviews of Daya Bay NPP and Ling'ao NPP), including the demonstration analysis review of maintenance rules for equipment cooling water and other systems of Daya Bay NPP.



Figure 2. Liu Hua, Vice Minister of MEE and Administrator of NNSA, inspects the Daya Bay Nuclear Power Base



Figure 3. Tang Bo, Vice Administrator of NNSA and Director General of Department of Nuclear Power Safety Regulation of MEE, conducts nonroutine nuclear and radiation safety inspections in Daya Bay Nuclear Power Base

Table 16. Nuclear safety regulatory approvals for Daya Bay NPP in 2019

Date	Document No.	Document
2019-01-21	NNSA [2019] 11	Notification for approving Daya Bay NPP and Ling'ao NPP adopting one-point calibration method
2019-02-12	NNSA [2019] 26	Notification for approving the optimization and improvement of fuel management plan adopted by Daya Bay NPP
2019-03-06	NNSA [2019] 37	Notification for approving additional installation of metal particle detectors to lubricating oil circuits of emergency diesel engine system of Daya Bay NPP and Ling'ao NPP
2019-03-18	NNSA [2019] 48	Notification for approving waste resin clearance procedures for the steam generator slowdown system of Daya Bay Nuclear Power Base
2019-03-25	NNSA [2019] 54	Notification for approving the improvements to the main pump heat shield isolation of Daya Bay NPP and Ling'ao NPP Units 1 and 2
2019-07-20	NNSA [2019] 167	Notification for approving the special application for preventive maintenance of the fifth diesel generator unit of Daya Bay NPP and Ling'ao NPP
2019-08-27	NNSA [2019] 186	Notification for approving the modification of final safety analysis report of Daya Bay NPP and Ling'ao NPP
2019-09-11	NNSA [2019] 200	Notification for approving the upgrading of the special application for the single column operation of the essential service water system and the component cooling water system during refuelling of Daya Bay NPP and Ling'ao NPP
2019-10-11	NNSA [2019] 220	Notification for approving the replacement of 9020 series plates in the centralized control analog cabinet systems of Daya Bay NPP and Ling'ao NPP Unit 1s and 2
2019-10-25	NNSA [2019] 226	Notification for approving overall improvements of vehicle entrance and exit of Daya Bay NPP and Ling'ao NPP

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continued

Date	Document No.	Document
2019-11-01	NNSA [2019] 228	Notification for approving the modification of turbine flowmeters in the nuclear sampling systems of Daya Bay NPP and Ling'ao NPP
2019-11-26	NNSA [2019] 243	Notification for approving radiation zoning adjustment of nuclear island buildings of Daya Bay NPP and Ling'ao NPP
2019-12-11	NNSA [2019] 253	Notification for approving the update of regulation requirements for periodic tests of safety-related systems and equipment of Daya Bay NPP and Ling'ao NPP
2019-09-12	MEE App [2019] 125	Approval reply on the environmental impact statements of New Emergency Command Center Construction Project in Daya Bay Nuclear Power Base

Table 17. Regulatory inspection activities at Daya Bay NPP in 2019

Start date	Item	Inspection contents
2019-05-13	Nonroutine nuclear and radiation safety inspection of Daya Bay Nuclear Power Base	Quality assurance systems of Daya Bay NPP and Ling'ao NPP, nuclear island fire safety management, accident management and emergency preparedness, and impact of hazardous chemicals on nuclear safety, radioactive source management, etc.

Note: It includes the regulatory inspection activities at Daya Bay NPP and Ling'ao NPP.

Table 18. Occupational radiation doses at Daya Bay NPP in 2019

Unit	Annual Average Effective Dose/ Person (mSv)	Annual Maximum Individual Effective Dose (mSv)	Annual Collective Effective Dose (man-Sv)	Normalized Collective Effective Dose (man-mSv/Gwh)
Units 1 and 2	0.299	9.139	0.960	0.059

Ling'ao NPP

In 2019, the 4 units of Ling'ao NPP continued to operate stably and safely, and the integrity of the three physical barriers was maintained. The total failure of fuel elements, the leakage rate of primary circuit pressure boundary, and the leakage rate of containment were all within the prescribed limits. The 16th refueling overhaul of Unit 1, the 15th refueling overhaul of Unit 2 and the 7th refueling overhaul of Unit 4 were completed.

The nuclear safety regulatory approvals for Ling'ao NPP in 2019 are shown in Table 19. No operational event was reported in Ling'ao NPP in 2019. The occupational radiation doses at Ling'ao NPP are shown in Table 20.

In 2019, the NSC conducted 42 reviews for Ling'ao NPP (including 20 joint reviews of Daya Bay NPP and Ling'ao NPP), including review of the optimization and improvement of the speed control systems of the emergency diesel generators of Ling'ao NPP Units 3 and 4.

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Table 19. Nuclear safety regulatory approvals for Ling'ao NPP in 2019

Date	Document No.	Document
2019-01-21	NNSA [2019] 12	Notification for approving the modifications of regulation requirements for regular tests of safety-related system and equipment regarding model change of main steam system safety limit switch of Ling'ao NPP Units 3 and 4
2019-01-29	NNSA [2019] 18	Notification for approving the optimizations and improvements of speed-adjusting systems of the emergency diesel generators of Ling'ao NPP Units 3 and 4
2019-04-30	NNSA [2019] 111	Notification for approving the improvement of dead pipeline section of the safety injection system of Ling'ao NPP Unit 2
2019-09-10	NNSA [2019] 199	Notification for approving special application for the suspension of spent fuel pool cooling during the improvements being made in the reactors and spent fuel pool cooling and treatment system of Ling'ao NPP Unit 1
2019-12-03	NNSA [2019] 245	Notification for approving one set of CZ2 sampling tube assemblies and three sets of M5 AFA3G fuel assemblies of Ling'ao NPP Unit 3, to be added to the reactors for further burn-up tests
2019-09-12	MEE App [2019] 124	Approval reply on the environmental impact statement of new emergency diesel generator building construction project of Ling'ao NPP

Note: In all, there were 13 joint-approval projects of Ling'ao NPP and Daya Bay NPP. Refer to table 16 for details.

Table 20. Occupational radiation doses at Ling'ao NPP in 2019

Unit	Annual Average Effective Dose/ Person (mSv)	Annual Maximum Individual Effective Dose (mSv)	Annual Collective Effective Dose (man-Sv)	Normalized Collective Effective Dose (man-mSv/Gwh)
Units 1 and 2	0.425	6.936	1.312	0.087
Units 3 and 4	0.298	5.813	0.826	0.050

Tianwan NPP

In 2019, Units 1, 2, 3 and 4 of Tianwan NPP continued to operate stably and safely, and the integrity of the three physical barriers was maintained. The total failure of fuel elements, the leakage rate of primary circuit pressure boundary, and the leakage rate of containment were all within the prescribed limits. The 11th refueling overhaul of Unit 1, the 11th refueling overhaul of Unit 2, the 1st refueling overhaul of Unit 3, and the 1st refueling overhaul of Unit 4

were completed. The cold functional test of Unit 5 was completed on November 1st, 2019. The main pipeline welding of Unit 6 was completed on September 28th, 2019.

The nuclear safety regulatory approvals for Tianwan NPP in 2019 are shown in Table 21, and the regulatory inspection activities carried out by the MEE(NNSA) are shown in Table 22. Tianwan NPP reported 2 operational events, as shown in Table 23, and reported 3 construction events, as shown in Table 24.

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The occupational radiation doses at Tianwan NPP are shown in Table 25.

In 2019, the Northern Regional Office of the Nuclear and Radiation Safety Inspection, MEE (NRO) conducted daily inspections, routine inspections, and nonroutine inspections for the 4 operating units of Tianwan Nuclear Power Base. In all, 2,536 man-days were spent on the inspections, 14 routine inspections and 4 nonroutine inspections were conducted. A total of 120 problems were found, and 81 management requirements were proposed.

In 2019, the NSC conducted 82 reviews for

Tianwan NPP, including reviews of the periodic refueling projects of Tianwan NPP Unit 3 and 4, review of the reply to the licensing conditions of Tianwan NPP Unit 3 and 4, etc.



Figure 4. Li Ganjie, Minister of MEE, visits the inspectors of NRO in Tianwan NPP

Table 21. Nuclear safety regulatory approvals for Tianwan NPP in 2019

Date	Document No.	Document
2019-01-29	NNSA [2019] 19	Notification for approving the modification of the liquid radioactive waste solidification system process waste interface of Tianwan NPP Units 1 and 2
2019-02-27	NNSA [2019] 35	Notice for issue of the operating licenses for Tianwan NPP Units 3 and 4
2019-04-01	NNSA [2019] 76	Notification for approving the optimization and modification of steam generator liquid-level signal degradation logic module of Tianwan NPP Units 3 and 4
2019-04-26	NNSA [2019] 101	Notification for approving the cancellation of the modification of safety service water system manual valve of Tianwan NPP Units 1 and 2
2019-04-28	NNSA [2019] 106	Notification for approving the modification of auxiliary building special drainage system flange of Tianwan NPP Units 1 and 2
2019-04-29	NNSA [2019] 109	Notification for approving the In-Service Inspection Program of Tianwan NPP Units 3 and 4 (Version B0)
2019-09-10	NNSA [2019] 196	Notification for approving the In-Service Inspection Program of Tianwan NPP Unit 5 and 6 (Version A1)
2019-09-10	NNSA [2019] 197	Notification for approving the Quality Assurance Program (under Design and Construction Stage) of Tianwan NPP Unit 5 and 6 Project (Version F1)
2019-09-23	NNSA [2019] 206	Notification for approving the Commissioning Program of Tianwan NPP Units 5 and 6 (Version A)
2019-09-30	NNSA [2019] 213	Approval reply on the Inspection Results and Treatment Measures of Nuclear Grade Support to Tianwan Units 5 and 6 Provided by Zhejiang Hanyuan Power Equipment Co., Ltd. (Version C)

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continued

Date	Document No.	Document
2019-10-21	NNSA [2019] 224	Notification for approving the modification of the pressurizer high-water level measurement up-warping pipe of Tianwan NPP Unit 5
2019-10-24	NNSA [2019] 225	Notification for approving seismic analysis of sealed storage tank and transfer container and radiation zoning of spent fuel storage area of Tianwan NPP
2019-09-29	MEE App [2019] 129	Approval reply on environmental impact statement of periodic refueling project of Tianwan NPP Units 3 and 4

Table 22. Regulatory inspection activities at Tianwan NPP in 2019

Start date	Event title	Cause
2019-06-10	Nonroutine nuclear and radiation safety inspection of Tianwan NPP	Handling of operational events and major non-conformance in the recent three years; managements of radiation protection, effluents, radioactive sources and radioactive wastes; physical protection; impact of hazardous chemicals on nuclear safety and fire and explosion safety; and nuclear and radiation emergency preparedness

Table 23. Operational events of Tianwan NPP reported in 2019

Occurrence time	Event title	Cause	INES Level
2019-02-01	Safety system action caused by power loss of emergency power bus of Tianwan NPP Unit 3	Equipment	0
2019-02-26	Shutdown triggered by Low Liquid-level of steam generator due to failure of main condensate secondary control valve of Tianwan NPP Unit 1	Equipment	0

Table 24. Construction events of Tianwan NPP reported in 2019

Occurrence time	Unit	Event title
2019-01-22	Unit 5	Exceeding standard range in welding width between seal shell of control rod-driven mechanism and upper head pipe seat of the pressure vessel in Tianwan NPP Unit 5
2019-06-04	Unit 5	Up-warping of High water-level measurement connection pipe of the pressurizer of Tianwan NPP Unit 5
2019-11-14	Unit 5	Mechanical damage to small stainless-steel branch pipe in reactor coolant system of Tianwan NPP Unit 5

Table 25. Occupational radiation doses at Tianwan NPP in 2019

Unit	Annual Average Effective Dose/ Person (mSv)	Annual Maximum Individual Effective Dose (mSv)	Annual Collective Effective Dose (man·Sv)	Normalized Collective Effective Dose (man·mSv/Gwh)
Units 1 and 2	0.094	1.511	0.307	0.018
Units 3 and 4	0.246	5.022	0.953	0.060

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Hongyanhe NPP

In 2019, Units 1, 2, 3, and 4 of Hongyanhe NPP continued to operate stably and safely, and the integrity of the three physical barriers was maintained. The total failure of fuel elements, the leakage rate of primary circuit pressure boundary, and the leakage rate of containment were all within the prescribed limits. The 5th refueling overhaul of Unit 1, the 4th refueling overhaul of Unit 2, the 4th refueling overhaul of Unit 3, and the 2nd refueling overhaul of Unit 4 were completed. The refueling overhaul of Units 5 and 6 progressed smoothly. The first closure of reactor pressure vessel of Unit 5 was completed on March 14th, 2019, and the cold functional test of primary circuit was completed on October 19th. The installation of the first low-pressure cylinder of the steam turbine in Unit 6 started on August 15th, 2019, and the welding and nondestructive testing (NDT) of nuclear island main pipeline were completed on November 30th.

The nuclear safety regulatory approvals for

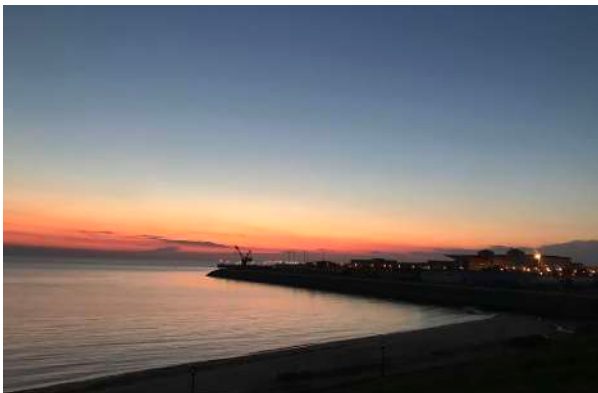


Figure 5. Night view of Hongyanhe NPP

Hongyanhe NPP in 2019 are shown in Table 26. Hongyanhe NPP reported 2 operational events, as shown in Table 27, and reported 2 construction events, as shown in Table 28. The occupational radiation doses at Hongyanhe NPP are shown in Table 29.

In 2019, the Northeast Regional Office of the Nuclear and Radiation Safety Inspection, MEE (NERO) conducted daily inspections, routine inspections, and nonroutine inspections for Hongyanhe Nuclear Power Base. In all, 2,153 man-days were spent on the inspections, 8 routine inspections and 8 nonroutine inspections were conducted. A total of 112 problems were found, and 42 management requirements were proposed.

In 2019, the NSC conducted 73 reviews for Hongyanhe NPP, including reviews of the in-service inspection program of Hongyanhe NPP, and the discussion meeting on the test and review projects for the installation of high burn-up components in the 6th cycle of Hongyanhe NPP Unit 1.



Figure 6. Inspectors conduct the penetration inspection after the hydrostatic test of control rod-driven mechanism seal welding of Hongyanhe NPP Unit 5

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Table 26. Nuclear safety regulatory approvals for Hongyanhe NPP in 2019

Date	Document No.	Document
2019-01-09	NNSA [2019] 3	Notification for approving the Liaoning Hongyanhe NPP (Phase I) Maintenance Program (Version 3)
2019-01-15	NNSA [2019] 8	Notification for approving annual refueling extension operations of Liaoning Hongyanhe NPP Units 3 and 4
2019-01-15	NNSA [2019] 9	Notification for approving the mechanical designs and flow adjustments of primary circuits of Liaoning Hongyanhe NPP Units 1 to 4
2019-01-30	NNSA [2019] 21	Notification for approving important safety modification of shellfish catcher filter screen in the essential service water system of Liaoning Hongyanhe NPP Unit 3
2019-03-22	NNSA [2019] 55	Notification for approving the third edition of chemical and radiochemical technical specifications for Liaoning Hongyanhe NPP Units 3 and 4
2019-04-01	NNSA [2019] 75	Notification for approving the test of installing high burn-up components in reactors in the 6th cycle of Hongyanhe NPP Unit 1
2019-06-10	NNSA [2019] 130	Notification on the approval of hybrid welding process by adding tungsten inert gas into fuel assemblies, fuel rod and end plug of the guide tube of Hongyanhe NPP
2019-08-14	NNSA [2019] 173	Notification for approving displacements and reinforcement improvements in monitoring the hosts of 500 kV and 220 kV network control systems in the intermediate control room of Liaoning Hongyanhe NPP Unit 1-4
2019-09-10	NNSA [2019] 194	Notification for approving the Commissioning Program of Hongyanhe NPP Units 5 and 6 (Version A)
2019-09-11	NNSA [2019] 201	Notification for approving the Technical Specifications for the Operation of Hongyanhe NPP Units 1 and 2 (Refueling Every 18 Months) (Version 4) and the Technical Specifications for the Operation of Hongyanhe NPP Units 3 and 4 (Version 5)
2019-09-12	NNSA [2019] 205	Notification for approving the demonstration projects of probabilistic safety analysis technology in Hongyanhe NPP
2019-09-30	NNSA [2019] 214	Notification for approving the Quality Assurance Program for Design and Construction of Liaoning Hongyanhe NPP Phase II (Version 3)
2019-10-15	NNSA [2019] 222	Notification for approving the Quality Assurance Program of the Operation Phase of Liaoning Hongyanhe NPP (Phase I) (Version 2)
2019-12-20	NNSA [2019] 257	Notice on issuing operating licenses to Liaoning Hongyanhe NPP Units 3 and 4

Table 27. Operational events of Hongyanhe NPP Reported in 2019

Occurrence time	Event title	Cause	INES Level
2019-05-16	Shut down of two RRA pumps simultaneously during the T1EIE001 test of Liaoning Hongyanhe NPP Unit 1 in RCS mode	Human error	0

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continued

Occurrence time	Event title	Cause	INES Level
2019-11-14	Automatic shutdown of control rod drop reactors caused by power system failure of the control rod drive mechanism of Liaoning Hongyanhe NPP Unit 3	Equipment	0

Table 28. Construction events of Hongyanhe NPP Reported in 2019

Occurrence time	Event title
2019-12-09	No PT on the first welding flayer of bypass pipe of H5RCV050VP valve of Liaoning Hongyanhe NPP
2019-12-23	Sampling directions for raw material tensile test of valves LOT190CA and 190CD of Liaoning Hongyanhe NPP Phase II project not meeting standards

Table 29. Occupational radiation doses at Hongyanhe NPP in 2019

Unit	Annual Average Effective Dose/ Person (mSv)	Annual Maximum Individual Effective Dose (mSv)	Annual Collective Effective Dose (man-Sv)	Normalized Collective Effective Dose (man-mSv/Gwh)
Units 1 and 2	0.413	6.361	1.171	0.068
Units 3 and 4	0.325	5.898	0.972	0.063

Ningde NPP

In 2019, Units 1, 2, 3, and 4 of Ningde NPP continued to operate stably and safely, and the integrity of the three physical barriers was maintained. The total failure of fuel elements, the leakage rate of primary circuit pressure boundary, and the leakage rate of containment were all within the prescribed limits. The 4th refueling overhaul of Unit 1 was completed on January 9th, 2019, the 4th refueling overhaul of Unit 2 was completed on October 16th, 2019, the 3rd refueling overhaul of Unit 3 was completed on May 22nd, 2019, and the 2nd refueling overhaul of Unit 4 was completed on March 6th, 2019. Construction-related preparations of Units 5 and 6 were underway.

The nuclear safety regulatory approvals for Ningde NPP in 2019 are shown in Table 30. Ningde NPP reported 6 operational events, as shown in Table 31. The occupational radiation doses at Ningde NPP are shown in Table 32.



Figure 7. Ningde NPP Units 1-4

In 2019, the ERO conducted daily inspections,

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routine inspections, and nonroutine inspections for the 4 units of Ningde NPP. In all, 1,735 man-days were spent on inspections, 3 routine inspections and 1 nonroutine inspection organized by MEE(NNSA) were conducted. A total of 161 problems were found, and 85

management requirements were proposed.

In 2019, the NSC conducted 38 reviews for Ningde NPP, including the review of adopting “TIG Hybrid Welding” process in the manufacture of fuel rods for Ningde NPP.

Table 30. Nuclear safety regulatory approvals for Ningde NPP in 2019

Date	Document No.	Document
2019-01-09	NNSA [2019] 2	Notification for approving the modification of chemical and volume control system discharge temperature set-up values of Ningde NPP Units 1 and 2
2019-01-28	NNSA [2019] 15	Notification for approving the modification of diesel engine building low-temperature protection of Ningde NPP Units 1 and 2
2019-06-10	NNSA [2019] 131	Notification for approving the modification of the Regulatory Requirements for Periodic Tests of Safety-Related Systems and Equipment of Ningde NPP Units 3 and 4
2019-06-10	NNSA [2019] 134	Notification for approving the incorporation of construction substation of Ningde NPP into the centralized management and protection zone (ZP) fence, and set-up of new emergency response exit at the switch station
2019-06-10	NNSA [2019] 135	Notification for approving the upgrade and reconstruction of video, storage, and control rooms, and plant blind detection project in the physical protection system of Ningde NPP
2019-06-10	NNSA [2019] 136	Notification for approving the modification of the Regulatory Requirements for Periodic Tests of Safety-Related Systems and Equipment of Ningde NPP Units 1 and 2
2019-06-10	NNSA [2019] 137	Notification for approving the modification of anti-intrusion detection device to be installed for the rainwater well of the physical security boundary of Ningde NPP
2019-06-10	NNSA [2019] 138	Notification for approving the heightening of the breast wall at the east revetment of Ningde NPP Phase I Project for the second time
2019-07-29	NNSA [2019] 169	Approval reply on the modification of the technical specifications and regulatory requirements for the periodic test of safety-related systems and equipment of Ningde NPP
2019-08-28	NNSA [2019] 179	Notification for approving the modification of adopting "TIG hybrid welding (M5 pipe + Zr-4 end plug)" process" in the manufacture of fuel rods for Ningde NPP
2019-10-08	NNSA [2019] 215	Notice on issuing operating licenses for Fujian Ningde NPP Units 3 and 4
2019-11-11	NNSA [2019] 230	Notification for approving the revised version of regulatory requirements for periodic test of safety-related systems and equipment of Ningde NPP

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continued

Date	Document No.	Document
2019-12-04	NNSA [2019] 249	Notification for approving the Maintenance Program of Fujian Ningde NPP Units 3 and 4 (Revised Version)
2019-12-04	NNSA [2019] 250	Notification for approving the Maintenance Program of Fujian Ningde NPP Units 1 and 2 (Revised Version)

Table 31. Operational events of Ningde NPP reported in 2019

Occurrence time	Event title	Cause	INES Level
2019-02-08	A control rod bundle partially removing from the fuel assembly when an upper internals of Ningde NPP Unit 4 was lifted in the shutdown mode for refueling	Human error	0
2019-02-27	The power buildup rate exceeding the range required in the technical specifications after long-term low-power operation of Ningde NPP Unit 3	Human error	0
2019-03-07	The unavailable time of two pumps at the same time exceeding the range required in the technical specifications due to reverse installation of ASG001/ 002PO outlet valve labels in Ningde NPP Unit 4	Human error	0
2019-04-23	The primary circuit pressure in a short time exceeding the range required in the technical specifications during the recalibration test of the power control rods of Ningde NPP Unit 4	Equipment	0
2019-06-19	The primary circuit pressure in a short time exceeding the range required in the technical specifications during the failure of 2RCP050MT—a temperature measurement bypass instrument of the primary circuit of Ningde NPP Unit 2	Equipment	0
2019-07-08	Manually shut down of Ningde NPP Unit 1 due to power failure of the emergency bus LHB	Equipment	1

Table 32. Occupational radiation doses at Ningde NPP in 2019

Unit	Annual Average Effective Dose/ Person (mSv)	Annual Maximum Individual Effective Dose (mSv)	Annual Collective Effective Dose (man·Sv)	Normalized Collective Effective Dose (man·mSv/ Gwh)
Units 1 and 2	0.175	3.739	0.473	0.030
Units 3 and 4	0.333	6.678	1.006	0.064

Fuqing NPP

In 2019, Units 1, 2, 3, and 4 of Fuqing NPP continued to operate stably and safely, and the integrity of the three physical barriers was

maintained. The total failure of fuel elements, the leakage rate of primary circuit pressure boundary, and the leakage rate of containment were all within the prescribed limits. The 4th refueling overhaul of Unit 1 was completed on

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November 2nd, 2019, the 2nd refueling overhaul of Unit 3 was completed on January 14th, 2019, and the 2nd refueling overhaul of Unit 4 was completed on September 7th, 2019. Units 5 and 6 were in the installation and commissioning stage, with overall safety and quality under control. Cold functional test of Unit 5 was completed, and hot functional test had commenced; and the main pipeline welding of Unit 6 was completed.

The nuclear safety regulatory approvals for Fuqing NPP in 2019 are shown in Table 33, and the regulatory inspection activities carried out by the MEE(NNSA) are shown in Table 34. No operational event but 4 construction events of Fuqing NPP were reported, as shown in Table 35. The occupational radiation doses at Fuqing NPP are shown in Table 36.



Figure 8. Fuqing NPP Units 1-4

In 2019, the ERO conducted daily inspections, routine inspections, and nonroutine inspections for the 4 operating units and 2 construction units of Fuqing NPP. In all, 2,887 man-days were spent on inspections, 6 routine inspections and 2 nonroutine inspections were conducted, including 1 nonroutine inspection organized by MEE(NNSA). A total of 197 problems were found in the operating units and 53 management requirements were proposed, and a total of 162 problems were found in the construction units.

In 2019, the NSC conducted 81 reviews for Fuqing NPP, including a discussion on the first batch of review issues of the 18-month refueling project of Fuqing NPP Units 3 and 4, and the discussion on the remaining issues for construction licenses of Fuqing NPP Units 5 and 6.



Figure 9. Construction site of Fuqing NPP Units 5 and 6

Table 33. Nuclear safety regulatory approvals for Fuqing NPP in 2019

Date	Document No.	Document
2019-01-29	NNSA [2019] 17	Notification for approving the second revision of the Regulatory Requirements for Periodic Tests of Safety-Related Systems and Equipment of Fujian Fuqing NPP Units 1 and 2 (Version D)

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continued

Date	Document No.	Document
2019-03-08	NNSA [2019] 39	Notification for approving the Regulatory Requirements for Physical Tests of Fujian Fuqing NPP Units 1 and 2 (Version 002)
2019-03-15	NNSA [2019] 46	Notification for approving the Chemical and Radiochemical Technical Specifications of Fujian Fuqing NPP Unit 3 and 4 (Version C)
2019-03-15	NNSA [2019] 47	Notification for approving the Chemical and Radiochemical Technical Specifications of Fujian Fuqing NPP Unit 1 and 2 (Version E)
2019-03-15	NNSA [2019] 52	Notification for approving the Regulatory Requirements for Physical Tests of Fujian Fuqing NPP Units 3 and 4 (Version 002)
2019-04-08	NNSA [2019] 85	Notification for approving the Commissioning Program of Fujian Fuqing NPP Unit 5 and 6 (Version A/2)
2019-04-19	NNSA [2019] 90	Notification for approving the design change of steel support for externally-installed water tank of Fujian Fuqing NPP Unit 6
2019-04-26	NNSA [2019] 95	Notification for approving the In-Service Inspection Program of Fujian Fuqing NPP Units 5 and 6 (Version 000)
2019-06-10	NNSA [2019] 132	Notification for approving the addition of a new alkalizer control mode to the chemical and radiochemical technical specifications of Fujian Fuqing NPP Units 1 to 4
2019-06-10	NNSA [2019] 133	Notification for approving the design change of steel formwork for the outer containment dome of Fujian Fuqing NPP Unit 6
2019-06-18	NNSA [2019] 144	Notification for approving the important safety modifications of fuel rod end plug materials of Fujian Fuqing NPP Units 1-4
2019-08-23	NNSA [2019] 178	Notification for approving the important safety modification of shellfish catcher screen in the essential service water system of Fujian Fuqing NPP Units 1 and 2
2019-12-05	NNSA [2019] 247	Notification for approving the Commissioning Program of Fujian Fuqing NPP Units 5 and 6 (Version B/2)

Table 34. Regulatory inspection activities at Fuqing NPP in 2019

Start date	Item	Inspection contents
2019-05-21	Nonroutine nuclear and radiation safety inspection of Fujian Fuqing NPP	Handling of operational events and construction events, and major non-conformance; implementation of design changes and important safety modifications, and important experience feedback; contractor management; commissioning management; impact of hazardous chemicals on nuclear safety; fire and explosion safety; emergency preparation, radiation protection and radioactive source management; physical protection; and management of radiation waste and effluents of Fuqing NPP Units 1-6
2019-09-16	Nonroutine nuclear and radiation safety inspection of Fujian Fuqing NPP Units 5 and 6	Implementation of quality assurance program of Fuqing NPP Units 5 and 6; handling of non-conformance and commissioning defects; management of design changes; management of temporary commissioning measures; and completion of welding and NDT

Table 35. Construction events of Fuqing NPP reported in 2019

Occurrence time	Event title
2019-05-15	Qualifications of welders responsible for welding stainless steel pool TIG pipe plate of Fujian Fuqing NPP Units 5 and 6 not meeting the requirements of HAF603 specification
2019-08-04	Cutting of 5RCS0044 pipeline after the hydrostatic test of Fujian Fuqing NPP Unit 5
2019-08-28	Leakage of fuel transfer tank of Fujian Fuqing NPP Unit 5
2019-09-27	Noncompliance subcontracting of some nuclear-grade pipe fitting of Fujian Fuqing NPP Units 5 and 6 by Wuxi Xinfeng

Table 36. Occupational radiation doses at Fuqing NPP in 2019

Unit	Annual Average Effective Dose/ Person (mSv)	Annual Maximum Individual Effective Dose (mSv)	Annual Collective Effective Dose (man·Sv)	Normalized Collective Effective Dose (man·mSv/Gwh)
Units 1 and 2	0.164	3.683	0.471	0.030
Units 3 and 4	0.120	2.926	0.300	0.020

Yangjiang NPP

In 2019, the 6 units of Yangjiang NPP continued to operate stably and safely, and the integrity of the three physical barriers was maintained. The total failure of fuel elements, the leakage rate of primary circuit pressure boundary, and the leakage rate of containment were all within the prescribed limits. The 4th refueling overhaul of Unit 1, the 3rd refueling overhaul of Unit 2, the 2nd refueling overhaul of Unit 4, and the 2nd refueling overhaul of Unit 5 were completed.

The nuclear safety regulatory approvals for Yangjiang NPP in 2019 are shown in Table 37, and the regulatory inspection activities carried out by the MEE(NNSA) are shown in Table 38. Yangjiang NPP reported 3 operational events, as shown in Table 39. The occupational

radiation doses at Yangjiang NPP are shown in Table 40.



Figure 10. Full view of Yangjiang NPP

In 2019, the SRO conducted daily inspections, routine inspections, and nonroutine inspections for the 6 operating units of Yangjiang NPP. In all, 1,301 man-days were spent on inspections, 16 routine inspections and 1 nonroutine

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inspection organized by MEE(NNSA) were conducted. A total of 84 problems were found, and 54 management requirements were proposed.

for Yangjiang NPP, including review of the internal fire probability safety assessment reports of Yangjiang NPP Unit 5 and 6, in the construction drawing design stage.

In 2019, the NSC conducted 53 reviews

Table 37. Nuclear safety regulatory approvals for Yangjiang NPP in 2019

Date	Document No.	Document
2019-01-30	NNSA [2019] 22	Notification for approving the in-Service Inspection Program of Yangjiang NPP (Version 13)
2019-03-08	NNSA [2019] 38	Notification for approving the overall replacements of check valves at the outlets of two medium-pressure safety injection tanks of Yangjiang NPP Unit 6
2019-03-27	NNSA [2019] 61	Notification for approving the Quality Assurance Program for the Design and Construction Stage of Yangjiang NPP (Version 15)
2019-03-27	NNSA [2019] 62	Notification for approving the Quality Assurance Program for Operation Stage of Yangjiang NPP (Version 11)
2019-04-28	NNSA [2019] 103	Notice on issuing operating licenses for Yangjiang NPP Units 3 and 4
2019-04-28	NNSA [2019] 104	Notice on issuing operating licenses for Yangjiang NPP Units 5 and 6
2019-05-27	NNSA [2019] 120	Notification for approving the transformation of safety-level process control cabinet systems of Yangjiang NPP Units 5 and 6
2019-06-10	NNSA [2019] 128	Notification for approving the Chemical and Radiochemical Technical Specifications for Yangjiang NPP Units 3 and 4 (Version 11)
2019-06-10	NNSA [2019] 129	Notification for approving the function adjustments of emergency personnel permitted to enter and exit from Yangjiang NPP
2019-09-10	NNSA [2019] 198	Notification for approving Yangjiang NPP to implement secondary neutron source-free loading and start-up
2019-11-22	NNSA [2019] 237	Notification for approving the reconstruction of physical protection video monitoring system for Yangjiang NPP Units 1 to 4

Table 38. Regulatory inspection activities at Yangjiang NPP in 2019

Start date	Item	Inspection contents
2019-04-01	Comprehensive inspection prior to the issuance of the operating licenses for Yangjiang NPP Unit 6	Quality assurance system operation, handling of structural and nuclear safety equipment defects, pre-service inspection, commissioning test and system handover, production preparation, environmental protection facilities "three simultaneities (design, construction, and operation simultaneously)", and fulfillment of license conditions and commitments in the final safety analysis report of Yangjiang NPP Unit 6.

Table 39. Operational events of Yangjiang NPP reported in 2019

Occurrence time	Event title	Cause	INES Level
2019-06-02	Switching to manual mode unexpectedly of GCTa control valves of three steam generators of Yangjiang NPP Unit 5	Human error	0
2019-06-26	Unusable of two steam-driven auxiliary feed pumps of Yangjiang NPP Unit 1	Human error	0
2019-09-22	The maintenance time of the additional diesel generator of Yangjiang NPP exceeding the period specified in the technical specifications	Equipment	0

Table 40. Occupational radiation doses at Yangjiang NPP in 2019

Unit	Annual Average Effective Dose/ Person (mSv)	Annual Maximum Individual Effective Dose (mSv)	Annual Collective Effective Dose (man·Sv)	Normalized Collective Effective Dose (man·mSv/Gwh)
Units 1 and 2	0.281	6.214	1.515	0.092
Units 3 and 4	0.117	2.653	0.393	0.024
Units 5 and 6	0.074	3.373	0.657	0.060

Changjiang NPP

In 2019, Units 1 and 2 of Changjiang NPP continued to operate stably and safely, and the integrity of the three physical barriers was maintained. The total failure of fuel elements, the leakage rate of primary circuit pressure boundary, and the leakage rate of containment were all within the prescribed limits. The 3rd refueling overhaul of Unit 1 and the 2nd refueling overhaul of Unit 2 were completed.

The nuclear safety regulatory approvals for Changjiang NPP in 2019 are shown in Table 41. Changjiang NPP reported 3 operational events, as shown in Table 42. The occupational radiation doses at Changjiang NPP are shown in Table 43.

In 2019, the SRO conducted daily inspections, routine inspections, and nonroutine inspections for the 2 operating units of Changjiang NPP. In

all, 584 man-days were spent on inspections, 6 routine inspections and 2 nonroutine inspections were conducted, including 1 nonroutine inspection organized by MEE(NNSA). A total of 72 problems were found, and 36 management requirements were proposed.

In 2019, the NSC conducted 28 reviews for Changjiang NPP, including reviews of the in-service inspection programs of Hainan Changjiang NPP Units 1 and 2 (Version 000).



Figure 11. Complete view of Changjiang NPP

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Table 41. Nuclear safety regulatory approvals for Yangjiang NPP in 2019

Date	Document No.	Document
2019-01-28	NNSA [2019] 16	Notification for approving the modification of driven mode for drum-shaped screen of Hainan Changjiang NPP Units 1 and 2
2019-02-27	NNSA [2019] 34	Notification for approving clearance of the metal frames of scrapped air filters of Hainan Changjiang NPP
2019-03-28	NNSA [2019] 64	Notice on issuing operating licenses for Changjiang NPP Units 1 and 2
2019-04-26	NNSA [2019] 96	Notification for approving important safety modifications of the marine engineering optimization project of Hainan Changjiang NPP
2019-04-26	NNSA [2019] 99	Notification for approving the modifications of the logic modules related to safety injection system and safety spray system in the hard logic modules of the emergency operation platform of Hainan Changjiang NPP Units 1 and 2
2019-04-26	NNSA [2019] 100	Notification for approving the Regulatory Requirements for Periodic Tests of Safety-Related Systems and Equipment of Hainan Changjiang NPP Units 1 and 2 (Version 003)
2019-09-03	NNSA [2019] 190	Notification for approving temporary optimization measures for rod bundle display failures of the rod control and rod position system of Hainan Changjiang NPP Unit 1
2019-10-12	NNSA [2019] 221	Notification for approving the modifications of fuel cycles of Hainan Changjiang NPP Units 1 and 2
2019-11-19	NNSA [2019] 234	Notification for approving the suspension of spent fuel pool cooling of Hainan Changjiang NPP Unit 1, for preventive maintenance of the component cooling water system valves
2019-12-11	NNSA [2019] 252	Notification for approving the In-Service Inspection Program of Hainan Changjiang NPP Units 1 and 2 (Version 001)
2019-12-25	NNSA [2019] 259	Notification for approving the upgrade of the final safety analysis reports of Hainan Changjiang NPP Units 1 and 2
2019-04-26	MEE App [2019] 63	Approval reply on the environmental impact statement for the marine engineering optimization project of Hainan Changjiang NPP
2019-09-12	MEE App [2019] 123	Approval reply on the environmental impact statements for the fuel cycle projects of Hainan Changjiang NPP Units 1 and 2

Table 42. Operational events of Changjiang NPP reported in 2019

Occurrence time	Event title	Cause	INES Level
2019-01-03	Automatic reactor shutdown triggered by high neutron flux in the intermediate range during zero power physical test of Hainan Changjiang NPP Unit 2	Human error	0
2019-01-28	Automatic reactor shutdown triggered by low water level and steam-water mismatch signal of No.2 steam generator of Hainan Changjiang NPP Unit 1	Equipment	0

continued

Occurrence time	Event title	Cause	INES Level
2019-09-11	Accumulated time of the offset of axial power deviation ΔI of Hainan Changjiang NPP Unit 2 exceeding the range required by the technical specifications	Management	0

Table 43. Occupational radiation doses at Changjiang NPP in 2019

Unit	Annual Average Effective Dose/ Person (mSv)	Annual Maximum Individual Effective Dose (mSv)	Annual Collective Effective Dose (man·Sv)	Normalized Collective Effective Dose (man·mSv/Gwh)
Units 1 and 2	0.167	5.918	0.382	0.039

Fangchenggang NPP

In 2019, Units 1 and 2 of Fangchenggang NPP continued to operate stably and safely, and the integrity of the three physical barriers was maintained. The total failure of fuel elements, the leakage rate of primary circuit pressure boundary, and the leakage rate of containment were all within the prescribed limits. The 2nd refueling overhaul of Unit 2 were completed. Thirty percent of 14-layer casting of the containment, cushion casting of the inner dome and F-layer reinforcement binding of Unit 3 were completed. Fifth layer casting of the emergency gate of the containment and concrete casting of the twelfth layer of the emergency gate of the inner shell of Unit 4 were completed.

The nuclear safety regulatory approvals for Fangchenggang NPP in 2019 are shown in Table 44, and supervision and inspection activities conducted by the MEE(NNSA) are shown in Table 45. Fangchenggang NPP

reported 3 operational events, as shown in Table 46, and reported 1 construction event, as show in Table 47. The occupational radiation doses at Fangchenggang NPP are shown in Table 48.

In 2019, the SRO conducted daily inspections, routine inspections, and nonroutine inspections for the 2 operating units and 2 construction units of Fangchenggang NPP. In all, 910 man-days were spent in the inspections, 5 routine inspections and 2 nonroutine inspections were conducted, including 1 nonroutine inspection organized by MEE(NNSA). A total of 57 problems were found in the operating units, and 22 management requirements were proposed. A total of 19 problems were found in the construction units, and 6 management requirements were proposed.

In 2019, the NSC conducted 25 reviews for Yangjiang NPP, including reviews of the upgrade of the maintenance programs of Fangchenggang NPP Units 1 and 2 (Version 1).

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Figure 12. Construction site of Fangchenggang NPP Unit 3 Project

Table 44. Nuclear safety regulatory approvals for Fangchenggang NPP in 2019

Date	Document No.	Document
2019-06-12	NNSA [2019] 141	Notification for approving the treatment plan for the appearance quality defects of the first-layer concrete casting of the containment of Fangchenggang NPP Unit 4
2019-06-20	NNSA [2019] 145	Notification for approving the changes and modifications of the ground drain sump pipeline in the drain and exhaust system of nuclear islands of Fangchenggang NPP Units 1 and 2
2019-09-23	NNSA [2019] 207	Notification for approving the maintenance programs of Fangchenggang NPP Units 1 and 2 (Version 2)
2019-12-04	NNSA Letter [2019] 101	Approval reply on the the Emergency Plan for Nuclear Accident of Fangchenggang NPP Units 1 and 2 (Version 2)

Table 45. Regulatory inspection activities of Fangchenggang NPP in 2019

Start date	Item	Inspection contents
2019-10-28	Nonroutine nuclear safety inspections for the dealing of steel lining quality problems of the nuclear island of Fangchenggang NPP Unit 3	NDT for the containment steel lining, repair of weld defects, mechanical evaluation, and operation effectiveness of quality assurance system for nuclear safety-related activities of Fangchenggang NPP Unit 3

Table 46. Operational events of Fangchenggang NPP reported in 2019

Occurrence time	Event title	Cause	INES Level
2019-05-06	The primary circuit pressure in a short time exceeding the range required in the technical specifications under NS/RRA mode of Fangchenggang NPP Unit 2	Human error	0
2019-06-26	Unexpected concurrence of two first group events during the T1RPA030 test caused by the failure of the F1SEC021SP of Fangchenggang NPP Unit 1	Human error	0
2019-11-07	Automatic reactor shutdown of Fangchenggang NPP Unit 1 due to turbine protection system failure	Equipment	0

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Table 47. Construction events of Fangchenggang NPP reported in 2019

Occurrence time	Event title
2019-06-03	Quality defects in floors of safety buildings and fuel buildings of Fangchenggang NPP Units 3 and 4

Table 48. Occupational radiation doses at Fangchenggang NPP in 2019

Unit	Annual Average Effective Dose/ Person (mSv)	Annual Maximum Individual Effective Dose (mSv)	Annual Collective Effective Dose (man·Sv)	Normalized Collective Effective Dose (man·mSv/Gwh)
Units 1 and 2	0.245	4.096	0.493	0.029

Sanmen NPP

In 2019, Units 1 and 2 of Sanmen NPP continued to operate stably and safely, and the integrity of the three physical barriers was maintained. The total failure of fuel elements, the leakage rate of primary circuit pressure boundary, and the leakage rate of containment were all within the prescribed limits. The 1st refueling overhaul of Unit 1 was started on December 3rd, 2019 and was completed on January 19th, 2020. Troubleshooting of the main pump and network re-connection of Unit 2 were completed on November 27th, 2019. Construction-related preparations of Units 3 and 4 are underway.

The nuclear safety regulatory approvals for Sanmen NPP in 2019 are shown in Table 49, and supervision and inspection activities conducted by the MEE(NNSA) are shown in Table 50. Sanmen NPP reported 1 operational event, as shown in Table 51. The occupational radiation doses at Sanmen NPP are shown in Table 52.

In 2019, the ERO conducted daily inspections,

routine inspections, and nonroutine inspections of the 2 operating units of Sanmen NPP. In all, 1,281 man-days were spent on inspections, 1 routine inspection and 1 nonroutine inspection organized by MEE(NNSA) were conducted. A total of 115 problems were found, and 21 management requirements were proposed.

In 2019, the NSC conducted 31 reviews for Sanmen NPP, including the revisions of partial chapters of FSAR of Sanmen NPP Units 1 and 2, the reviews of upgrading and modifications of PMS software of Sanmen NPP Units 1 and 2.



Figure 13. On-site unpacking supervision of newly imported main pumps by inspectors in the radiation control area of Sanmen NPP Unit 2

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Table 49. Nuclear safety regulatory approvals for Sanmen NPP in 2019

Date	Document No.	Document
2019-05-08	NNSA [2019] 114	Notification for approving the modification of protection and safety monitoring system software of Sanmen NPP Units 1 and 2
2019-08-20	NNSA [2019] 177	Notification for approving the Refueling Programs for Sanmen Nuclear Power Units 1 and 2 (Version 1)
2019-11-22	NNSA [2019] 239	Notice on releasing the first critical control point after the recovery of main pump of Sanmen NPP Unit 2
2019-10-23	NNSA Letter [2019] 78	Reply to the request for the Test Plans of Main Pump and Bulk Material Recovery of Sanmen NPP Unit 2

Table 50. Regulatory inspection activities at Sanmen NPP in 2019

Start date	Item	Inspection contents
2019-11-18	First pre-critical inspection after the replacement of main pump of Sanmen NPP Unit 2	Preparation for the first pre-critical inspection after the replacement of main pump of Sanmen NPP Unit 2

Table 51. Operational events of Sanmen NPP reported in 2019

Occurrence time	Event title	Cause	INES Level
2018-12-22	Shutdown caused by output grounding protection of 2B frequency converter of main pump of Sanmen NPP Unit 2	Equipment	0

Note: This event was reported in 2019.

Table 52. Occupational radiation doses at Sanmen NPP in 2019

Unit	Annual Average Effective Dose/ Person (mSv)	Annual Maximum Individual Effective Dose (mSv)	Annual Collective Effective Dose (man·Sv)	Normalized Collective Effective Dose (man·mSv/Gwh)
Units 1 and 2	0.160	4.105	0.398	0.037

Haiyang NPP

In 2019, the Units 1 and 2 of Haiyang NPP continued to operate stably and safely, and the integrity of the three physical barriers was maintained. The total failure of fuel elements, the leakage rate of primary circuit pressure boundary, and the leakage rate of containment were all within the prescribed

limits. Unit 2 was ready for commercial operation on January 9, 2019.

The nuclear safety regulatory approvals for Haiyang NPP in 2019 are shown in Table 53, and supervision and inspection activities conducted by the MEE(NNSA) are shown in Table 54. Haiyang NPP reported 1 operational event, as shown in Table 55. The occupational

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radiation doses at Haiyang NPP are shown in Table 56.

In 2019, the ERO conducted the daily inspections, routine inspections, and nonroutine inspections of the 2 operating units of Haiyang NPP. In all, 1,428 man-days were spent on inspections, and 1 nonroutine inspection organized by NNSA was conducted. A total of 176 problems were found, and 77 management requirements were proposed.

In 2019, the NSC conducted 21 reviews for

Haiyang NPP, including analysis and review of the possible impact of special facilities used for severe accident mitigation in Haiyang NPP Units 5 and 6.



Figure 14. Complete view of Haiyang NPP

Table 53. Nuclear safety regulatory approvals for Haiyang NPP in 2019

Date	Document No.	Document
2019-01-03	NNSA [2019] 1	Notification for approving the modifications of the technical specifications of Haiyang NPP Units 1 and 2
2019-01-09	NNSA [2019] 4	Notification for approving the modifications of the technical specifications of Haiyang NPP Units 1 and 2
2019-03-22	NNSA [2019] 56	Notification for approving the Quality Assurance Program (at Operation Stage) of Haiyang NPP Phase I Project (Version B)
2019-11-13	NNSA [2019] 233	Notification for approving the upgrade and modification of Protection and Safety Monitoring system (PMS) software of Haiyang NPP Units 1 and 2
2019-12-04	NNSA [2019] 246	Notification for approving the Refueling Programs of Haiyang NPP Units 1 and 2 (Version 1)

Table 54. Regulatory inspection activities at Haiyang NPP in 2019

Start date	Item	Inspection contents
2019-05-27	Nonroutine nuclear and radiation safety inspections of Haiyang NPP Units 1 and 2	Operation of the NPP's quality assurance system; management of the contractors by operators; evaluation and handling of operational events and abnormal occurrences in the past year; operation management of the NPP; radiation protection; environment and effluent monitoring; radioactive source management; radioactive wastes management; physical protection; impact of hazardous chemicals on nuclear safety; fire safety management; accident management and emergency preparedness

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Table 55. Operational events of Haiyang NPP reported in 2019

Occurrence time	Event title	Cause	INES Level
2019-12-03	Operation of the PCS system caused by unexpected opening of PCS-V001B valve of Haiyang NPP Unit 1	Equipment	0

Table 56. Occupational radiation doses at Haiyang NPP in 2019

Unit	Annual Average Effective Dose/ Person (mSv)	Annual Maximum Individual Effective Dose (mSv)	Annual Collective Effective Dose (man·Sv)	Normalized Collective Effective Dose (man·mSv/Gwh)
Units 1 and 2	0.008	0.612	0.010	0.0005

Taishan NPP

In 2019, Taishan NPP continued to operate stably and safely, and the integrity of the three physical barriers was maintained. The total failure of fuel elements, the leakage rate of primary circuit pressure boundary, and the leakage rate of containment were all within the prescribed limits. The preventive minor repair of Unit 1 was completed, and the first loading of Unit 2 was started on April 12th, 2019, and it was ready for commercial operations on September 7th.

The nuclear safety regulatory approvals for Taishan NPP in 2019 are shown in Table 57, and supervision and inspection activities conducted by the MEE(NNSA) are shown in Table 58. Taishan NPP reported 5 operational events, as shown in Table 59. The occupational radiation doses at Taishan NPP are shown in Table 60.

In 2019, the SRO conducted daily inspections, routine inspections, and nonroutine inspections of the 2 operating units of Taishan NPP. In all, 739 man-days were spent on inspections, 14 routine inspections and 1 nonroutine inspection organized by MEE(NNSA) were conducted. A total of 162 problems were found, and 60 management requirements were proposed.

In 2019, the NSC conducted 35 reviews for Taishan NPP, including the review of pre-service inspection report of Taishan NPP Unit 2.



Figure 15. Complete view of Taishan NPP

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Table 57. Nuclear safety regulatory approvals for Taishan NPP in 2019

Date	Document No.	Document
2019-03-22	NNSA [2019] 53	Notification for approving the Quality Assurance Program of Taishan NPP Units 1 and 2 at Operation Stage (Version B)
2019-04-04	NNSA [2019] 79	Notice on issuing the operating licenses for Taishan NPP Units 1 and 2
2019-04-10	NNSA [2019] 86	Notification for approving the Loading and Refueling Programs of Taishan NPP Units 1 and 2 (Version B)
2019-04-12	NNSA [2019] 87	Notification for approving the Commissioning Programs of Taishan NPP Units 1 and 2 (Version D2)
2019-04-26	NNSA [2019] 98	Notification for approving the upgrade of the technical specifications of Taishan NPP Units 1 and 2
2019-09-23	NNSA [2019] 208	Notification for approving the Commissioning Programs of Taishan NPP Units 1 and 2 (Version E0)

Table 58. Regulatory inspection activities of Taishan NPP in 2019

Start date	Item	Inspection contents
2019-03-19	Comprehensive nuclear safety inspection prior to the issuance of the operating licenses for Taishan NPP Unit 2	Quality assurance system operation, handling of structural and nuclear safety equipment defects, pre-service inspection, commissioning test and system handover, production preparation, environmental protection facilities "three simultaneities (design, construction and operation simultaneously)", and fulfillments of license conditions and commitments in the final safety analysis reports of Taishan NPP Unit 2.

Table 59. Operational events of Taishan NPP reported in 2019

Occurrence time	Event title	Cause	INES Level
2019-04-19	Two DELs unavailable due to the staff going into the wrong compartment of Taishan NPP Unit 2	Human error	0
2019-06-28	Nonconformity to the technical specifications due to long time no canceling of the temporary modifications of 4 KRT instruments' action logic mode of Taishan NPP Unit 2	Human error	0
2019-07-07	Automatic shutdown triggered by high water levels in the steam generator due to the loss of CEX pumps in 20% nuclear power platforms of Taishan NPP Unit 2	Equipment	0
2019-07-17	The unavailable time of the ventilation system in the control area of the fourth safety building of Taishan NPP Unit 1 exceeding the range required in the technical specifications due to the damper being set up in the local control mode	Human error	0
2019-09-17	Automatic shutdown triggered by the high pressure drop rate of steam generator due to the abnormal response of steam turbine caused by grid disturbance of Taishan NPP Unit 1	Equipment	0

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Table 60. Occupational radiation doses at Taishan NPP in 2019

Unit	Annual Average Effective Dose/ Person (mSv)	Annual Maximum Individual Effective Dose (mSv)	Annual Collective Effective Dose (man·Sv)	Normalized Collective Effective Dose (man·mSv/Gwh)
Unit 1	0.019	1.013	0.044	0.003
Unit 2	0.006	0.250	0.010	0.001

Huaneng Shandong Shidao Bay NPP (High Temperature Gas-Cooled Reactor Demonstration Project)

In 2019, the Huaneng Shandong Shidao Bay NPP (High Temperature Gas-Cooled Reactor Demonstration Project, referred to as HTGR Demonstration Project) was mainly engaged in equipment installation and the commissioning of some equipment. On July 2nd, the upper internals of No.1 reactor pressure vessel were installed; two steam generators were hoisted and installed on January 27th and July 27th, respectively; on August 3rd, the steel roof of the nuclear island reactor buildings was constructed, and all large equipment were hoisted and installed in place. As of the end of 2019, about 86% and 99% of nuclear island and conventional island systems had been installed, respectively. 68.1% of the system commissioning was completed, and 136 systems including closed circulating water system were put in the production phase.

The nuclear safety regulatory approvals for HTGR Demonstration Project in 2019 are shown in Table 61, and the supervision and inspection activities conducted by the MEE(NNSA) are shown in Table 62. HTGR Demonstration Project reported 8 construction

events, as shown in Table 63.

In 2019, the ERO conducted daily inspections, routine inspections, and nonroutine inspections of 1 construction unit of HTGR Demonstration Project. In all, 664 man-days were spent on inspections, 2 routine inspections and 1 nonroutine inspection organized by MEE(NNSA) were conducted. A total of 83 problems were found, and 39 management requirements were proposed.

In 2019, the NSC conducted 11 reviews for HTGR Demonstration Project, including reviews of the reports on high temperature endurance tests of steam generator materials and high temperature creep test of heat transfer tubes of HTGR Demonstration Project.



Figure 16. Onsite inspection of steam generator bolt holes of HTGR Demonstration Project by inspectors

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Table 61. Nuclear safety regulatory approvals for HTGR Demonstration Project in 2019

Date	Document No.	Document
2019-02-03	NNSA [2019] 30	Notification for approving the installation of steam generators for HTGR Demonstration Project
2019-04-02	NNSA [2019] 78	Letters on approval of the Quality Assurance Program (Design and Construction Stage) for Huaneng Shidao Bay (Shandong) NPP HTGR Demonstration Project (E2 Version) and the Quality Assurance Program (Commissioning Stage) for Huaneng Shidao Bay (Shandong) NPP HTGR Demonstration Project

Table 62. Regulatory inspection activities at HTGR Demonstration Project in 2019

Start date	Item	Inspection contents
2019-05-20	Nonroutine nuclear and radiation safety inspection report of Huaneng Shidao Bay (Shandong) NPP	Handling of construction events and major non-conformance; radiation protection, and management of effluents, radioactive sources, and radioactive waste; physical protection; impact of hazardous chemicals on nuclear safety, and fire and explosion safety; nuclear and radiation emergency preparedness, etc.

Table 63. Construction events of HTGR Demonstration Project in 2019

Occurrence time	Event title
2018-11-04	Welding impact test indicated unqualified P91 welding of the main steam pipeline
2019-03-21	Inconsistency between nameplate identifications on electrical penetration and those on the main body of the control rod-driven mechanism
2019-04-11	Insufficient spot welding of fixed bolts of the No.2 steam generator flow distribution plate
2019-04-11	Insufficient welding of the top chamber cover plate of the steam generator
2019-10-16	Mismatch between flange bolt holes in the right bellows and those in the right section of the hot-gas duct of No. 2 reactor
2019-11-20	Inconsistency between opening directions of two pressure pipe supports of the main steam pipeline of No 2 reactor and the requirements as per the drawings
2019-11-25	Scratch in the pressure vessel head manhole blind plate of No.1 reactor
2019-12-05	Collision between threads, screw teeth of bolts and screw rods of the air penetration assemblies of the main helium blower

Note: The event occurred on November 4th, 2018 but was reported in 2019.

National Nuclear Demonstration Project

In 2019, National Nuclear Demonstration Project was in the civil works construction and module installation stage. On April 10th, 2019,

the large-scale concrete casting of the nuclear island basemat of Unit 1 was completed; on June 14th, the CR10 reinforced composite modules of Unit 1 were installed; on July 25th, the CVBH (steel containment bottom head) module was installed; on August 5th, the CA20

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(large structure of Auxiliary Building Area 6) module of Unit 1 was installed; on November 5th, the large-scale concrete casting of the nuclear island basemat of Unit 2 was completed; on November 29th, the first-ring hoisting and installation of No.1 nuclear island CV (steel containment) were completed; and on December 16th, the hoisting and installation of No.1 nuclear island CA01 (large structure in containment building) module were completed.

The nuclear safety regulatory approvals for National Nuclear Demonstration Project in 2019 are shown in Table 64, and the supervision and inspection activities conducted by the MEE(NNSA) are shown in Table 65. No construction event was identified.

In 2019, the ERO conducted daily inspections, routine inspections, and nonroutine inspections of the 2 construction units of

National Nuclear Demonstration Project. In all, 613 man-days were spent on inspections, and 1 nonroutine inspection organized by MEE(NNSA) was conducted. A total of 87 problems were found, and 19 management requirements were proposed.

In 2019, the NSC conducted 5 reviews for National Nuclear Demonstration Project, including reviews of the CAP1400 demonstration project and unresolved problems.



Figure 17. Construction site of National Nuclear Demonstration Project

Table 64. Nuclear safety regulatory approvals for National Nuclear Demonstration Project in 2019

Date	Document No.	Document
2019-04-05	NNSA [2019] 84	Notification for approving the Quality Assurance Program (Design and Construction Stage) (Version D) of National Nuclear Demonstration Project
2019-03-21	MEE App [2019] 48	Approval reply on the environmental impact statement (in construction stage) of National Nuclear Demonstration Project

Table 65. Regulatory inspection activities at National Nuclear Demonstration Project in 2019

Start date	Item	Inspection contents
2019-03-18	Nuclear safety inspection for the preparation prior to the first concrete date (FCD) of nuclear island of National Nuclear Demonstration Project Unit 1	Handling of unresolved issues in the preliminary construction supervision and inspection such as the excavation of the nuclear island foundation pits; preparation for construction management conditions such as the nuclear island construction organization and construction plans; preparation of technical conditions such as design documents and construction plans; preparation of construction conditions prior to the casting of the first concrete in the nuclear island; and implementation of the quality assurance program in the design and construction stage

continued

Start date	Item	Inspection contents
2019-10-28	Nuclear safety inspection preparation for the casting of the first concrete in the nuclear island basemat of National Nuclear Demonstration Project Unit 2	Handling of unresolved issues in the preliminary construction supervision and inspection such as the excavation of the nuclear island foundation pits; preparation for construction management conditions such as the nuclear island construction organization and construction plans; preparation of technical conditions such as design documents and construction plans; preparation of construction conditions prior to the casting of the first concrete in the nuclear island; and implementation of quality assurance program in the design and construction stage

Zhangzhou NPP

On October 9th, 2019, the environmental impact statements (construction stage) and construction licenses of Zhangzhou NPP Units 1 and 2 were approved. The construction of Unit 1 commenced on October 16th, 2019 and is currently underway in an orderly manner as per plan. The safety and quality issues were under control, and no construction event was found. The inspection of nuclear island foundation pits of Unit 2 was completed.

The nuclear safety regulatory approvals for Zhangzhou NPP in 2019 are shown in Table 66, and the supervision and inspection activities conducted by the MEE(NNSA) are shown in Table 67.

In 2019, the ERO conducted daily inspections and routine inspections of Zhangzhou

NPP. In all, 196 man-days were spent on the inspections, 2 routine inspections and 1 nonroutine inspection organized by MEE(NNSA) were conducted. A total of 58 problems were found, and 22 management requirements were proposed.

In 2019, the NSC conducted 7 reviews for Zhangzhou NPP, including reviews of the preliminary safety analysis reports of Zhangzhou NPP Units 1 and 2.



Figure 18. Issuance of construction licenses for Zhangzhou NPP Units 1 and 2

Table 66. Nuclear safety regulatory approvals for Zhangzhou NPP in 2019

Date	Document No.	Document
2019-07-11	NNSA [2019] 156	Notification for approving the Quality Assurance Programs (Design and Construction Stage) for Fujian Zhangzhou NPP Units 1 and 2 (Version C)

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continued

Date	Document No.	Document
2019-10-09	NNSA [2019] 219	Notice on issuing the construction licenses for Fujian Province Zhangzhou NPP Units 1 and 2
2019-10-09	MEE App [2019] 132	Reply to approval of environmental impact statements (construction stage) of Fujian Zhangzhou NPP Units 1 and 2

Table 67. Regulatory inspection activities at Zhangzhou NPP in 2019

Start date	Item	Inspection contents
2019-09-16	Nuclear safety inspection prior to FCD of Fujian Province Zhangzhou NPP Unit 1	Handling of unresolved issues in the preliminary construction supervision and inspection such as the excavation of the nuclear island foundation pits; preparations for construction management conditions such as the nuclear island construction organization and construction plans; preparation of technical conditions such as design documents and construction plans; preparation of construction conditions prior to the casting of the first concrete in the nuclear island; and implementation of the quality assurance program in the design and construction stage; implementation of remedial measures for quality events related to the steel lining in the NPP

Taipingling NPP

The environmental impact statements (construction stage) and construction licenses of Taipingling NPP Units 1 and 2 were approved on December 24th and 25th, 2019, respectively.

The nuclear safety regulatory approvals for Taipingling NPP in 2019 are shown in Table 68, and the supervision and inspection activities conducted by the MEE(NNSA) are shown in Table 69. No construction event was identified.



Figure 19. Issuance of construction licenses for Guangdong Taipingling NPP Units 1 and 2



Figure 20. Concrete casting site of Taipingling NPP Unit 1

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In 2019, the SRO conducted daily inspections and routine inspections of Taipingling NPP. In all, 126 man-days were spent on the inspections, and 1 routine inspection was conducted. A total of 9 problems were found and 7 management requirements were proposed.

In 2019, the NSC conducted 9 reviews for Taipingling NPP, including reviews of the preliminary safety analysis reports of Taipingling NPP Units 1 and 2.

Table 68. Nuclear safety regulatory approvals for Taipingling NPP in 2019

Date	Document No.	Document
2019-12-11	NNSA [2019] 254	Notification for approving the Quality Assurance Program (Design and Construction Stage) of Guangdong Taipingling NPP Phase I Project (Version 2)
2019-12-25	NNSA [2019] 258	Notice on issuing the construction licenses for Guangdong Taipingling NPP Units 1 and 2
2019-12-24	MEE App [2019] 164	Reply to approval of the environmental impact statements (in construction stage) of Guangdong Taipingling NPP Units 1 and 2

Table 69. Regulatory inspection activities at Taipingling NPP in 2019

Start date	Item	Inspection contents
2019-12-17	Nuclear safety inspection for the preparation prior to the first concrete in the nuclear island basemat of Guangdong Taipingling NPP Unit 1	Implementation of quality assurance program for Taipingling NPP Unit 1, preparations such as nuclear island construction organization, construction plan, and construction schemes, etc., onsite preparation prior to the casting of the first concrete in the nuclear island base, implementation of experience feedback on quality events related to steel linings of Fangchenggang NPP Unit 3, and implementation of requirements proposed by the Southern Office of National Nuclear Safety Administration during the previous onsite nuclear safety inspections and remedial measures

Planned NPPs

San Ao NPP Units 1 and Unit 2

In 2019, the technical reviews of the application documents for site selection review opinion letters and environmental impact statements of CGN Zhejiang San Ao NPP Units 1 and 2 were arranged and conducted.

Hainan Changjiang Multi-Purpose Small Modular Reactor Technology Demonstration Project

In July 2019, the review opinions on siting and environmental impact statement (site selection stage) of Hainan Changjiang Multi-Purpose Small Modular Reactor Technology Demonstration Project were issued.

4 Safety Regulation of Research Reactors

In 2019, there were 19 civil in-service research reactors (critical assemblies), of which 11 were in operation (including those in the commissioning phase), 1 was safely closed, 3 were in long-term shutdown, and 4 were not in operation (as shown in Table 70). According to the *Reporting System for Research Reactor Operators*, 17 operational events were reported in 2019, none of which caused adverse consequences to the environment outside the reactor buildings (as shown in Table 71).

In 2019, the environmental impact statement and construction licenses for the 2MWt liquid fuel thorium-based molten salt reactors in the construction phase were reviewed.

The nuclear safety regulatory approvals for research reactors in 2019 are shown in Table 72, and supervision and inspection activities conducted by the MEE(NNSA) are shown in Table 73.

In 2019, the regional offices of nuclear and radiation safety inspection conducted

daily inspections, routine inspections, and nonroutine inspections for research reactor operators. In all, 1,246 man-days were spent on the inspections, 12 routine inspections and 6 nonroutine inspections were conducted. A total of 188 problems were found, and 126 management requirements were proposed.

In 2019, the NSC conducted 13 reviews for research reactor operators, including onsite technical review discussions on the Environmental Impact Statements issued by China Institute of Atomic Energy (CIAE).



Figure 21. Liu Hua, Vice Minister of MEE and Administrator of NNSA, conducts nonroutine inspection at the CIAE

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Table 70. Operation status of research reactors in 2019

Facility	Power	Licensee	Status
101 Heavy Water Reactor (101 HWR)	10MW	CIAE	Safely closed
China Experimental Fast Neutron Reactor (CEFR)	65MW	CIAE	Not in operation
China Advanced Research Reactor (CARR)	60MW	CIAE	In operation
49-2 Swimming Pool Reactor (49-2SPR)	3.5MW	CIAE	In operation
Miniature Neutron Source Reactor (MNSR)	27kW	CIAE	In operation
Miniature Reactor Zero Power Facility (CFMNSR)	-	CIAE	In operation
Zirconium Hydride Solid Critical Facility (SSZR)	-	CIAE	Long-term shutdown
DF-VI Fast Neutron Criticality Facility (DF-VI CFFR)	-	CIAE	Long-term shutdown
Criticality Safety Facility (CCF) for the Spent Fuel Reprocessing Pilot Plant	-	CIAE	Not in operation
Shielding Experiment Reactor (SER)	1MW	Tsinghua University	Long-term shutdown
5MW Experimental Nuclear Heating Reactor (5MW-NHR)	5MW	Tsinghua University	Not in operation
10MW High Temperature Gas-Cooled Test Reactor (10MW-HTGR)	10MW	Tsinghua University	In operation
High Flux Engineering Test Reactor (HFETR)	125MW	Nuclear Power Institute of China (NPIC)	In operation
High Flux Engineering Test Reactor Experimental Facility (HFETR)	-	NPIC	Long-term shutdown
China Burst Reactor (CRP)	1MW	NPIC	In operation
Minjiang Test Reactor (MJTR)	5MW	NPIC	In operation
18-5 Critical Facility	-	NPIC	Not in operation
Miniature Neutron Source Reactor of Shenzhen University (MNSR)	30kW	Shenzhen University	In operation
In-Hospital Neutron Irradiator (IHNI)	30kW	Beijing Capture Tech Co., Ltd.	Not in operation

Table 71. Operational events of research reactors in 2019

Occurrence time	Facility	Event title	Cause	INES Level
2019-01-26	10 MW High Temperature Gas-Cooled Test Reactor (HTR-10)	Unplanned shutdown initiated by the protection system action	Equipment	0
2019-03-10	HTR-10	Unplanned shutdown initiated by the protection system action	Equipment	0

Safety Regulation of Research Reactors

continued

Occurrence time	Facility	Event title	Cause	INES Level
2019-04-23	Light water swimming pool reactor	Automatic reactor shutdown due to power failure of eastern substation	Equipment	0
2019-06-22	High Flux Engineering Test Reactor	Shutdown caused by voltage fluctuation of external power supply	Equipment	0
2019-07-16	HTR-10	Reactor shutdown due to voltage loss of external power grid	Equipment	0
2019-07-20	HTR-10	Reactor shutdown due to voltage loss of external power grid	Equipment	0
2019-07-22	High Flux Engineering Test Reactor	Shutdown caused by voltage fluctuation of external power supply	Equipment	0
2019-07-23	China Experimental Fast Neutron Reactor	Leakage of low-level liquid waste collection tank	Equipment	0
2019-07-28	High Flux Engineering Test Reactor	Shutdown caused by voltage fluctuation of external power supply	Equipment	0
2019-08-02	High Flux Engineering Test Reactor	Shutdown caused by voltage fluctuation of external power supply	Equipment	0
2019-08-15	HTR-10	Reactor shutdown due to voltage loss of external power grid	Equipment	0
2019-09-09	Light water swimming pool reactor	Primary water pump failure	Equipment	0
2019-10-26	High Flux Engineering Test Reactor	Abnormal electric shock protection shutdown at the top of No. 1 safety rod	Equipment	0
2019-10-28	High Flux Engineering Test Reactor	Abnormal electric shock protection shutdown at the top of No. 1 safety rod	Equipment	0
2019-10-29	China Advanced Research Reactor	Control rod solenoid DC power failure	Equipment	0
2019-11-02	High Flux Engineering Test Reactor	Low flow protection shutdown of No. 2 loop	Equipment	0
2019-11-29	Light water swimming pool reactor	Automatic reactor shutdown due to power failure of Eastern substation	Equipment	0

Table 72. Nuclear safety regulatory approvals for research reactors in 2019

Date	Document No.	Document
2019-01-18	NNSA [2019] 14	Notification on approving low power operation of China Experimental Fast Reactor
2019-03-25	NNSA [2019] 59	Notification on approving the upgrade in the storage capacity of the new fuel repository of China Experimental Fast Reactor
2019-04-19	NNSA [2019] 88	Notification on approving high temperature test inside the reactor of the compound single crystal emitter reactor in 49-2 Light Water Swimming Pool Reactor

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continued

Date	Document No.	Document
2019-04-29	NNSA [2019] 107	Notification on approving 125I irradiation production in Minjiang Test Reactor
2019-04-29	NNSA [2019] 108	Notification on approving the modification of the single crystal silicon irradiation channel in the Minjiang Test Reactor
2019-05-24	NNSA Letter [2019] 37	Approval reply on the application for modification of operating limit conditions of absorption spheres of the 10 MW high temperature reactor by Tsinghua University
2019-02-11	MEE NP Letter [2019] 3	Letters on the approval of cancellation of four nuclear safety licensing applications, including the Submission of the Safety Analysis Report of Nuclear Material Repositories by CIAE
2019-12-02	MEE App [2019] 149	Reply on the approval of environmental impact statement (construction stage) of 2MWt liquid fuel thorium-based molten salt reactor

Table 73. Regulatory inspection activities of the research reactor in 2019

Start date	Item	Inspection contents
2019-03-25	Comprehensive nuclear safety inspection for CIAE	Quality assurance management of the research reactor; implementation of technical specifications of the research reactor; operational events and experience feedback of the research reactor; management of radioactive waste and operation of relevant facilities; and implementation of rectifications required by previous inspection
2019-05-21	Nonroutine nuclear and radiation safety inspections of In-Hospital Neutron Irradiator for Beijing Capture Tech Co., Ltd.	Handling of operational events and major non-conformance; radiation protection and management of effluents and radioactive waste; physical protection; impact of hazardous chemicals on nuclear safety and fire and explosion safety; nuclear and radiation emergency preparedness
2019-05-27	Nonroutine nuclear and radiation safety inspections for NPIC	Handling of operational events and major non-conformance; radiation protection, and management of effluents and radioactive waste; physical protection; impact of hazardous chemicals on nuclear safety and fire and explosion safety; nuclear and radiation emergency preparedness
2019-06-03	Nonroutine nuclear and radiation safety inspections for Institute of Nuclear and New Energy Technology, Tsinghua University (INNET, Tsinghua University)	Handling of operational events and major non-conformance; radiation protection, and management of effluents and radioactive waste; physical protection; impact of hazardous chemicals on nuclear safety and fire and explosion safety; nuclear and radiation emergency preparedness
2019-09-24	Inspection on construction preparation of 2MWt liquid fuel thorium-based molten salt experimental reactor	Operation of quality assurance system; preparation of construction management conditions such as construction organization and construction plan; preparation of technical conditions such as design documents and construction plans; management of contractors; and implementation of management requirements proposed by the National Nuclear Safety Administration

5 Safety Regulation on Nuclear Fuel Cycle Facilities

In 2019, the facilities in-service for producing, fabricating, storing, and reprocessing nuclear fuels continued to be operated safely and maintained a good safety record, and the quality of facilities under-construction was effectively controlled. The nuclear and radiation safety of nuclear fuel cycle facilities was under control, and no unacceptable nuclear and radiation harmful events to worker, public or environment occurred. The details of the main facilities are shown in Table 74.

In 2019, there were 6 environmental impact statements approved, 1 operating license issued, and 5 nuclear safety technical modifications approved. Regulatory standards were continuously improved, and the preparation and revision of regulatory standards (including formats and contents of nuclear safety analysis reports for nuclear fuel cycle facilities) were promoted. In accordance with the requirements of the *Notice on the Investigation of Nuclear and Radiation Safety Hazards (NNSA [2019] 77)*, regional offices of nuclear and radiation safety inspection were organized to conduct regulatory inspections

of national civil nuclear fuel cycle facilities. Other major regulatory inspection activities are shown in Table 75.

In 2019, regional offices of nuclear and radiation safety inspection conducted daily inspections, routine inspections, and nonroutine inspections of nuclear fuel cycle facility operators. In all, 2,040 man-days were spent on inspections, with 15 routine inspections and 2 nonroutine inspections. A total of 149 problems were found, and 98 management requirements were proposed.

In 2019, the NSC conducted 54 reviews for nuclear fuel cycle facility operators, including review of the modified gasification process of high temperature reactor element production line.



Figure 22. Inspection by inspectors in the assembly workshop of the nuclear fuel production line

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Table 74. Major civilian facilities in China for producing, fabricating, and storing nuclear fuel

Facility / Project	Licensee	Major Product Form	Status
Dry Fabrication Line for Chemical Conversion	CNNC* Jianzhong Nuclear Fuel Co., Ltd.	UO2 Powder	In operation
Powder Metallurgical Fabrication Line	CNNC Jianzhong Nuclear Fuel Co., Ltd.	UO2 Powder	In operation
Nuclear Fuel Assembly Fabrication Line	CNNC Jianzhong Nuclear Fuel Co., Ltd.	PWR nuclear fuel elements	In operation
IDR Process Research and Equipment Production Line	CNNC Jianzhong Nuclear Fuel Co., Ltd.	UO2 Powder	In operation
Nuclear Fuel Element Fabrication Line Extension and Technical Reformation Project	CNNC Jianzhong Nuclear Fuel Co., Ltd.	PWR nuclear fuel elements	In operation
HWR Nuclear Fuel Element Fabrication Line	China North Nuclear Fuel Co., Ltd.	HWR Nuclear Fuel Elements	In operation
PWR Nuclear Fuel Element Fabrication Line	China North Nuclear Fuel Co., Ltd.	HWR Nuclear Fuel Elements	In operation
Reactor Fuel Element Fabrication Line for HTGR Demonstration Project	China North Nuclear Fuel Co., Ltd.	High temperature gas cooled reactor sphere fuel	In operation
PWR Nuclear Fuel Element Fabrication Line Extension	China North Nuclear Fuel Co., Ltd.	UO2 Pellets	In operation
AP1000 Nuclear Fuel Element Fabrication Line	China North Nuclear Fuel Co., Ltd.	AP1000 nuclear fuel elements	In operation
405-1A Project	CNNC Shaanxi Uranium Enrichment Co., Ltd.	Low enrichment UF6	In operation
Phase IV Centrifugation Project	CNNC Shaanxi Uranium Enrichment Co., Ltd.	Low enrichment UF6	In operation
North Region Centrifuge Extension Project, Phase I	CNNC Shaanxi Uranium Enrichment Co., Ltd.	Low enrichment UF6	In operation
North Region Centrifuge Extension Project, Phase II	CNNC Shaanxi Uranium Enrichment Co., Ltd.	Low enrichment UF6	In operation
Centrifuge Project	CNNC Lanzhou Uranium Enrichment Co., Ltd.	Low enrichment UF6	In operation
Domestic Centrifuge Commercial Paradigm Project	CNNC Lanzhou Uranium Enrichment Co., Ltd.	Low enrichment UF6	In operation
Uranium Enrichment Project, Phase III	CNNC Lanzhou Uranium Enrichment Co., Ltd.	Low enrichment UF6	In operation

Safety Regulation on Nuclear Fuel Cycle Facilities

continued

Facility / Project	Licensee	Major Product Form	Status
Uranium Enrichment Project, Phase IV	CNNC Lanzhou Uranium Enrichment Co., Ltd.	Low enrichment UF6	In operation
Temporary Dry Storage Facility for Spent Fuel of Qinshan NPP, Phase III	CNNC Nuclear Power Operation Management Co., Ltd.	–	In operation

*CNNC: China National Nuclear Corporation

Table 75. Regulatory inspection activities for the civil nuclear fuel cycle facilities in 2019

Start date	Item	Inspection contents
2019-04-23	Nuclear and Radiation Safety Inspection for CNNC Shaanxi Uranium Enrichment Co., Ltd.	Nuclear and Radiation Safety
2019-05-14	Nuclear and Radiation Safety Inspection of CNNC 272 Uranium Co., Ltd.	Nuclear and Radiation Safety
2019-05-14	Nuclear and Radiation Safety Inspection of Sichuan Honghua Industry Co., Ltd.	Nuclear and Radiation Safety
2019-05-20	Nuclear and Radiation Safety Inspection of CNNC Lanzhou Uranium Enrichment Co., Ltd.	Nuclear and Radiation Safety
2019-06-10	Nuclear and Radiation Safety Inspection of CNNC Jianzhong Nuclear Fuel Co., Ltd.	Nuclear and Radiation Safety
2019-06-10	Nuclear and Radiation Safety Inspection of China North Nuclear Fuel Co., Ltd.	Nuclear and Radiation Safety
2019-07-22	Nuclear and Radiation Safety Inspection of CNNC Jianzhong Nuclear Fuel Co., Ltd.	Nuclear and Radiation Safety

V

6 Radiation Environment Regulation on Exploitation and Utilization of Uranium and Associated Radioactive Minerals

VI

Regulatory Approval

In 2019, the environmental impact assessment (EIA) approvals of 6 uranium mining and metallurgical construction projects, including the modification project of complex

molybdenum ore oxygen pressure leaching technology for CNNC Guyuan Uranium Co., Ltd. (as shown in Table 76) were conducted, and six corresponding review activities were conducted by the NSC.

Table 76. Regulatory approvals for environmental inspections of exploitation and utilization of uranium and associated radioactive minerals in 2019

Date	Document No.	Document
2019-01-11	MEE App [2019] 5	Approval reply on the environmental impact statement for the complex molybdenum ore oxygen pressure leaching technology modification project of CNNC Guyuan Uranium Co., Ltd.
2019-01-22	MEE App [2019] 12	Approval reply on the environmental impact statement for the 741 Mine Decommissioning Phase II Project of CNNC Shaoguan Jinhong Uranium Co., Ltd.
2019-02-03	MEE App [2019] 17	Approval reply on the environmental impact statement for the Drilling and Exploration Project of Sawafuqi Uranium Mine
2019-06-26	MEE App [2019] 81	Approval reply on the environmental impact statement for the emergency treatment of hidden dangers to safety and environmental protection facilities in 706 tailings repositories of CNNC Xi'an Lantian Uranium Industry Co., Ltd.
2019-08-16	MEE App [2019] 106	Approval reply on the environmental impact statement for the wastewater treatment system transformation of Lantian Mining Area 101 of CNNC Xi'an Lantian Uranium Industry Co., Ltd.,
2019-10-21	MEE App [2019] 139	Approval reply on the environmental impact statement for the uranium mining and metallurgy verification and scientific research construction project of The Fourth Research and Design Engineering Co., Ltd. of CNNC

Radiation Environment Regulation on Exploitation and Utilization of Uranium and Associated Radioactive Minerals



Figure 23. Anti-seepage facilities of the mill tailing repository

Regulatory Inspections

According to the requirements of the *Notice on the Investigation and Elimination of Nuclear and Radiation Safety Hazards (NNSA [2019]77)*, regional offices of nuclear and radiation safety inspection conducted radiation safety inspections of uranium tailings repositories around the country. Nonroutine regulatory inspections were conducted of uranium mining enterprises such as CNNC 272 Uranium Co., Ltd., Fengzhou Mining Area of the CNNC Ganzhou Jinrui Uranium Industry Co., Ltd., and CNNC Xi'an Lantian Uranium Industry Co., Ltd.. The inspection results of regional offices in various regions were summarized and sorted out, and the *nonroutine Inspection Report on Nuclear and Radiation Safety of Uranium Mining and Metallurgical Enterprises* was prepared and issued.

In 2019, regional offices of nuclear and radiation safety inspection conducted daily inspections, routine inspections, and

nonroutine inspections of uranium and naturally occurring radioactive material exploitation and utilization enterprises. In all, 378 man-days were spent on inspections, with 40 routine inspections and 9 nonroutine inspections. A total of 190 problems were found, and 188 management requirements were proposed.



Figure 24. Inspection team inspects the mill tailing repository of a uranium mine

Survey of Associated Radioactive Minerals

The survey of associated radioactive minerals was completed, the preparation and training of survey report were organized, and the preparations for survey bulletins of associated radioactive minerals, statistical analysis reports of general survey data and explanatory materials of bulletin were organized.

A total of 29,688 enterprises in 31 provinces (autonomous regions and municipalities) of China were surveyed, and 464 enterprises

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were identified for the exploitation and utilization of associated radioactive minerals, which mainly included zircon, zirconia, rare earth, and other minerals that are mainly distributed in Hunan Province, Guangdong Province, Guangxi Province, Jiangxi Province, Yunnan Province, Inner Mongolia Autonomous Region, and other provinces and regions. The

total storage capacity of naturally occurring radioactive waste in China is 2.03 billion tons, of which the solid waste with radioactivity concentration exceeding 10Bq/g mainly included rare earth, niobium/tantalum, zircon and zirconia, lead/zinc, germanium/ titanium, steel and other minerals, with a total output of 2.2495 million tons

7 Safety Regulation on Radioactive Waste

MEE(NNSA) actively promoted the development of relevant regulations and standards for radioactive waste safety management, and performed safety supervision of radioactive waste disposal sites, radioactive waste storage and operation of disposal facilities. MEE(NNSA) actively promoted site selection and treatment and disposal of the historical legacy radioactive waste and carried out specific research and policy development for radioactive waste disposal and nuclear facility decommissioning.

Regulatory Approval

In 2019, a radioactive waste storage license was issued to the Gansu Dongfang Ruilong Environmental Treatment Co., Ltd.

In 2019, the NSC conducted 9 review activities of radioactive waste management, including a review of the preliminary safety analysis report on capacity reduction and treatment facilities submitted by the Gansu Dongfang Ruilong Environmental Treatment Co., Ltd.

Safety Supervision on Operation of Radioactive Waste Disposal Sites

In 2019, the Northwest Disposal Site accepted a total of 20,023 packages of low-and-intermediate level radioactive waste, with a total volume of 4,924.85 m³, and gross radioactivity of 1.30E+12Bq. As of the end of 2019, the Northwest Disposal Site had accepted a total of 56,966 packages of low-and-intermediate level radioactive waste, with the total volume of 22,422.47 m³, and gross radioactivity of 6.22E+14Bq.

In 2019, the Beilong Disposal Site accepted a total of 336 packages of low-and-intermediate level radioactive waste generated by Daya Bay NPP, with a total volume of 134.4 m³, and gross radioactivity of 1.27E+10Bq. As of the end of 2019, the Beilong Disposal Site had accepted a total of 2,240 packages of radioactive waste, with a total volume of 2,526.44 m³, and gross radioactivity of 7.95E+13Bq.

In 2019, regional offices of nuclear and radiation safety inspection conducted

daily inspections, routine inspections, and nonroutine inspections of radioactive waste disposal sites. In all, 176 man-days were spent on inspections and 7 routine inspections were conducted. A total of 32 problems were found, and 24 management requirements were proposed.



Figure 25. Jiang Guang, Vice Administrator of NNSA and Director General of Department of Radiation Source Safety Regulation of MEE, investigates the historical legacy radioactive waste decommissioning site

Treatment of Historical Legacy Radioactive Waste

MEE(NNSA) advanced the treatment and disposal of leftover radioactive waste and strengthened the safety regulation of radioactive waste. In 2019, the MEE(NNSA) approved 3 environmental impact assessment documents and carried out 2 special inspections.

8 Safety Regulation of Radioisotopes and Irradiation Devices

By the end of December 31st, 2019, there were 78,802 organizations that were producing, selling, or using radioisotopes and irradiation devices in China. Among them, there were 10,707 organizations that only produced, sold, or used radioisotopes, and 68,095 organizations that only produced, sold, or used irradiation devices. The number of radioactive sources in use was 146,291 (including 14,793 category I, 16,942 category II, 1,927 category III, and 112,629 other sources), and the number of various irradiation devices was 198,321. The number of disused radioactive sources accepted by provincial, regional, and municipal radioactive waste repositories was 61,574, and the number of disused radioactive sources transferred to or accepted by the national radioactive sources centralized temporary repositories or recycled by the manufacturers was 148,026.

In 2019, there were 257 organizations that produced radioisotopes (except the preparation of Positron Emission Tomography radiopharmaceuticals for self-use), sold or

used category I radioactive sources (excluding category I medical radioactive sources), sold (including installation) or used category I irradiation devices, and owned unsealed class A radioactive material workplaces under the regulation of the MEE(NNSA). All these organizations kept a good radiation safety record.

Comprehensive Administration Streamlining and Power Delegation on Nuclear Technology Utilization

Simplifying the administration and delegating power in the field of nuclear technology utilization was further promoted. In November 2019, the State Council issued the *Notice of the State Council on the Full Coverage Demonstration Reform of “Separating License and Operators” in the Demonstration Free Trade Zone (GF [2019] 25)*. It temporarily adjusted and applied provisions regarding the approval authority in the *Regulations on the Safety and Protection of Radioisotopes*

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and Irradiation Devices in the free trade zone, and delegated the examination and approval authority of MEE for the enterprises using category B and category C radioisotopes to the provincial ecology and environment authorities, and the examination and approval authority of the provincial ecology and environment authorities for the enterprises using categories IV and V radioactive sources and class III irradiation devices to the municipal ecology and environment authorities.

In July 2019, the Ministry of Ecology and Environment issued the *Decision of the Ministry of Ecology and Environment on Repealing and Amending Some Regulations (MEE Decree No. 7)*. When nuclear technology utilization organizations apply for radiation safety licenses, they will no longer be required to submit photocopies of their licenses, as well as the originals and photocopies of legal person's business licenses of the enterprises, and legal person's certificates and legal representative's ID cards of government-affiliated institutions, etc.

In order to implement the requirements of the CPC Central Committee and the State Council to deepen the reforms by "Simplifying Administration, Delegating Power, and Optimizing Service", and to effectively reduce the burden on enterprises, the MEE(NNSA) reformed the training and assessment of radiation safety and protection for nuclear

technology utilization. The *Notice on Training and Assessment of Radiation Safety and Protection for Nuclear Technology Utilization in 2020 (MEE RL [2019] 853)* and the *Announcement on Radiation Safety and Protection Training and Assessment for Nuclear Technology Utilization (STHJBGG [2019] 57)* were issued, and the mode of radiation safety training changed from "paid offline training" to "online independent training and free-of-charge onsite online examination".



Figure 26. Radiation safety and protection training reform demonstration site

The archiving exemption supporting documents for radioisotopes and Irradiation Devices approved by each province were summarized, and the *Announcement on the Archiving Exemption Supporting Documents of Radioisotopes and Irradiation Devices (Sixth Batch)* was issued. The archiving exemption supporting documents for Irradiation Devices, and the activities announced and the radioactive sources or unsealed radioactive materials used in such

Safety Regulation of Radioisotopes and Irradiation Devices

activities are valid in the whole country, and archiving exemption will no longer be applied individually.

Regulatory Approval and Inspection

In 2019, radiation safety licenses were issued to 11 nuclear technology utilization organizations. Licenses of 22 organizations were renewed, new items were added to the licenses of 32 organizations, and licenses of 48 organizations were modified. The licenses of 5 organizations were partially cancelled and the licenses of 3 organizations were cancelled (see Table 77). The NSC completed 63 corresponding reviews.

The MEE(NNSA) approved 2 organizations' environmental impact statements of decommissioning nuclear technology utilization projects and 5 archiving exemption documents from regulation, and made a decision of administrative penalty of RMB100,000 to 1 organization and issued decisions on ordering the corrections of illegal acts to 2 organizations (see Table 78).

In 2019, regional offices of nuclear and radiation safety inspection conducted routine inspections, nonroutine inspections, and special inspections of nuclear technology utilization organizations. In all, 1,188 man-days were spent on inspections, with 253 routine inspections, 139 nonroutine

inspections, and 25 special inspections. A total of 937 problems were found, and 918 management requirements were proposed.



Figure 27. Inspection by the inspectors in the dust-free preparation workshop

Review and Approval of Radioisotope Imports and Exports

There were totally 2,038 import and export applications for radioactive sources and unsealed radioactive materials (containing radio-pharmaceuticals and their raw materials) approved in 2019, including 1,103 applications for imported and exported radioactive sources and 529 applications for exported radioactive sources. The total number of imported radioactive sources was 6,731, and the total number of exported radioactive sources was 2,409. The gross radioactivity of imported unsealed radioactive materials was $9.71\text{E}+16\text{Bq}$, and the gross radioactivity of exported unsealed radioactive materials was $4.09\text{E}+12\text{Bq}$.

Training on Radiation Safety and Radiation Protection

In 2019, the National Nuclear Technology Utilization Radiation Safety and Protection Training Platform was established and developed. Radiation safety and protection training materials, video courses, training courseware, and other training materials were prepared by 8 technical support organizations including CIAE, Tsinghua University, Soochow University, Sichuan University, University of South China, China Institute for Radiation Protection, Radiation Environment Monitoring Technology Center of MEE, and Nuclear and Radiation Safety Center of MEE. From January 1st, 2020, the above training resources of the National Nuclear Technology Utilization Radiation Safety and Protection Training Platform were made open to the public free of charge.

The MEE(NNSA) continued to promote scientific, institutionalized, and refined nuclear technology utilization radiation safety regulations, and standardized the radiation safety regulations and improved regulation levels. According to the *2019 Training Program of MEE*, 2 training courses on enforcement and approval of radiation safety in nuclear technology radiation utilization were conducted, and more than 110 radiation safety regulation trainees from provincial ecology and environment authorities participated in the training classes. One

training course on national nuclear technology utilization radiation safety management system administrator was conducted, and more than 60 administrators at all levels were trained.

Radiation Accidents

In 2019, there were 5 radiation accidents nationwide, and all of them were ordinary accidents. Among them, 2 accidents involved the loss of radioactive sources, 2 involved radioactive sources falling into a well, and 1 involved an over-dose exposure accident of staff.

Developing Real-time Monitoring Capacity for High-Risk Mobile Radioactive Sources

The development of real-time monitoring capacity for high-risk mobile radioactive sources was vigorously promoted. The *Data Collection Rules for Online Monitoring Platform for High Risk Mobile Radioactive Sources* was issued to all provinces to clarify the data transmission rules from provincial monitoring platforms to the national platform. As of the end of 2019, the data of 13 provincial monitoring platforms had been transmitted to the national high-risk mobile radioactive source real-time monitoring platform.

Safety Regulation of Radioisotopes and Irradiation Devices

Urban Radioactive Waste Repository

All urban radioactive waste repositories were operated safely in 2019, with steady improvement in security and safety risk prevention capacity. In addition to the security system upgrade projects independently organized by each province, the security system upgrade projects of three provincial-

level urban radioactive waste repositories in Hunan Province, Guizhou Province, and Qinghai Province supported by central government funds had completed the final acceptance. The security system upgrade projects of two provincial-level urban radioactive waste repositories in Yunnan Province and Guangxi Province have got the preliminary acceptance.

Table 77. List of approved radiation safety licenses in 2019

No.	Organization	Type
1	Shanghai APACTRON Particle Equipment Co., Ltd.	New application
2	Shantou HTA Pharmaceutical Co., Ltd.	New application
3	Taiyuan HTA Pharmaceutical Co., Ltd.	New application
4	Anhui Polymeric Chemistry Co., Ltd.	New application
5	Shijiazhuang HTA Pharmaceutical Co., Ltd.	New application and Addition
6	Shanghai Advanced Research Institute, Chinese Academy of Sciences	New application (change of subject)
7	Huazhong University of Science and Technology	Re-application (change of certificate issued by the original province)
8	Zhengzhou Branch of Nanjing Jiangyuan AMS Positron Research and Development Co., Ltd.	Re-application (renewal and change of certificate issued by the original province)
9	Tsinghua University	Re-application (renewal of certificate issued by the original province)
10	Zhengzhou Niukelai Biotechnology Co., Ltd.	Re-application (renewal of certificate issued by the original province)
11	Hebei Yizhou Tumor Hospital Co., Ltd.	Re-application (renewal of certificate issued by the original province)
12	Baoji Jinqiao Irradiation Technology Co., Ltd.	Renewal
13	Sichuan Jinhe Irradiation Technology Co., Ltd.	Renewal

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No.	Organization	Type
14	Shenzhen Aowo Medical New Technology Development Co., Ltd.	Renewal
15	Shenzhen Haibo Technology Co., Ltd.	Renewal
16	Hainan Zheda Irradiation Technology Co., Ltd.	Renewal
17	Zhejiang Yin Du Radiation Technology Co., Ltd.	Renewal
18	Radiation Environmental Safety Technology Center of Henan Province	Renewal
19	University of Science and Technology of China	Renewal
20	The 404 Co., Ltd., CNNC	Renewal
21	Guangzhou Huada Biotechnology Co., Ltd.	Renewal
22	Beijing Zhibo Bio-Medical Technology Co., Ltd.	Renewal
23	Jilin Zhonghe Irradiation Technology Co., Ltd.	Renewal
24	Radiation Environment Supervision Station of Heilongjiang Province	Renewal
25	The 719th Research Institute of China State Shipbuilding Co., Ltd.	Renewal
26	Huashan Hospital Affiliated to Fudan University	Renewal
27	Nuclear and Radiation Safety Center of Gansu Province	Renewal
28	Zhengzhou Tianhong Lvyuan Irradiation Co., Ltd.	Renewal
29	Shanghai Academy of Agricultural Sciences	Renewal and modification
30	Beijing Shanweizhengzi Pharmaceutical Technology Co., Ltd.	Renewal and modification
31	National Institute for Radiological Protection, Chinese Center for Disease Control And Prevention	Addition
32	Nanjing Jiangyuan AMS Positron Research and Development Co., Ltd.	Addition
33	Guangxi Nanxiang Environmental Protection Co., Ltd	Addition
34	Hefei Institutes of Physical Science, Chinese Academy of Sciences	Addition
35	Guangzhou Atomic High Tech Radiopharmaceutical Co., Ltd.	Addition
36	China Isotope & Radiation Corporation (CIRC)	Addition
37	National Institute of Metrology, China	Addition
38	CIAE	Addition
39	Zhengzhou Hongyuan Bioengineering Co., Ltd.	Addition
40	Guangdong Junqi Pharmaceutical Technology Co., Ltd.	Addition

Safety Regulation of Radioisotopes and Irradiation Devices

continued

No.	Organization	Type
41	CGN* Uranium Resources Co., Ltd.	Addition
42	Shanghai Proton and Heavy Ion Center Co., Ltd.	Addition
43	Changsha HTA Pharmaceutical Co., Ltd.	Addition
44	Nanning Atom Gaotong Pharmaceutical Co., Ltd.	Addition
45	Yantai Dongfang Irradiation Application Co., Ltd.	Addition
46	Zhengzhou HTA Pharmaceutical Co., Ltd.	Addition
47	Chongqing HTA Pharmaceutical Co., Ltd.	Addition
48	Nanjing University of Aeronautics and Astronautics	Addition
49	Beijing Beike Radioisotope Science & Trade Co., Ltd.	Addition
50	Xuzhou HTA Pharmaceutical Co., Ltd.	Addition
51	CNNC 272 Uranium Co., Ltd.,	Addition and partial cancellation
52	Chengdu New Radiomedicine Technology Co., Ltd.	Addition and modification
53	Chengdu Gaotong Isotope Co., Ltd., CNNC	Addition and modification
54	Suzhou Branch, Shanghai Xinke Pharmaceutical Co., Ltd.	Addition and modification
55	Radiation Environment Supervision Station of Jilin Province	Addition and modification
56	China Isotope & Radiation Corporation (CIRC)	Addition and modification
57	HTA. Co., Ltd.	Addition and partial cancellation
58	CIAE	Addition and partial cancellation
59	Suzhou CNNC Huadong Radiation Co., Ltd.	Addition and partial cancellation
60	Wuhan Yiyang Technology Co., Ltd.	Modification
61	Guangzhou Furui High Energy Technology Co., Ltd.	Modification
62	Union Medical & Pharmaceutical Technology (Tianjin) Group Co., Ltd.	Modification
63	Radiation Environment Supervision and Management Station of Guangxi Zhuang Autonomous Region	Modification
64	Guangdong Chuangyi Biotechnology Co., Ltd.	Modification
65	Changchun Institute of Applied Chemistry, Chinese Academy of Sciences	Modification

continued

No.	Organization	Type
66	Jilin Ceyuan Biotechnology Co., Ltd.	Modification
67	Dalian Fu'an Radiation New Technology Co., Ltd.	Modification
68	Shanghai Gamma Star Technology Development Co., Ltd.	Modification
69	CIRC Radiation Technology (Sichuan) Co., Ltd.	Modification
70	Beijing Senke Pharmaceutical Co., Ltd.	Modification
71	HTA Co., Ltd.	Modification
72	Guangdong Junqi Pharmaceutical Technology Co., Ltd.	Modification
73	Siemens Medical Systems Limited	Modification
74	Shanghai Institute of Applied Physics, Chinese Academy of Sciences	Modification
75	Hefei (National) Forestry Irradiation Center	Modification
76	Changshu Irradiation Technology Application Factory	Modification
77	Harbin Radiance Radiation Technology Co., Ltd.	Modification
78	Radiation Environment Workstation of Qinghai Province	Modification
79	Senke (Nanjing) Pharmaceutical Technology Co., Ltd.	Modification
80	Guangzhou Chuangyi Biotechnology Co., Ltd.	Modification
81	Zhejiang Hengdian HTA Pharmaceutical Co., Ltd.	Modification
82	Hangzhou HTA Pharmaceutical Co., Ltd.	Modification
83	Guangzhou Atomic High Tech Radiopharmaceutical Co., Ltd.	Modification
84	Foshan Laibaoli High Energy Technology Co., Ltd.	Modification
85	Shanghai Xinke Pharmaceutical Co., Ltd.	Modification
86	Nuclear and Radiation Safety Center of Ningxia Hui Autonomous Region	Modification
87	Lanzhou Weite Irradiation Co., Ltd.	Modification
88	Shanghai Jiangyuan ADM Pharmaceutical Co., Ltd.	Modification
89	Guangdong ADM Positron Technology Co., Ltd.	Modification
90	CNNC Bine (Beijing) High-Tech Co., Ltd.	Modification
91	Ningbo Junan Pharmaceutical Technology Co., Ltd.	Modification
92	Zhangjiagang Municipal CNNC Huakang Radiation Co., Ltd.	Modification

Safety Regulation of Radioisotopes and Irradiation Devices

continued

No.	Organization	Type
93	Linyi Xingda Engineering Co., Ltd.	Modification
94	Xi'an Integrated Medical Technology Co., Ltd.	Modification
95	Xiamen Wanheyuan Development Co., Ltd.	Modification
96	Radiation Environment Supervision Station of Anhui Province	Modification
97	Lanzhou Kejin Taiji Co., Ltd.	Modification
98	Gansu Heavy Ion Hospital Co., Ltd.	Modification
99	CNNC (Xinghua) Irradiation Technology Co., Ltd.	Modification change of subject
100	Shenzhen Laerwen Bioengineering Technology Co., Ltd.	Partial cancellation
101	Anhui Time Radiochemical Co., Ltd.	Cancellation
102	Changchun Institute of Applied Chemistry, Chinese Academy of Sciences	Cancellation
103	Air China Cargo Co., Ltd.	Cancellation

*CGN: China General Nuclear Power Corporation

Table 78. Other environmental protection approval and punishment documents in the field of safety regulation of radioisotopes and irradiation devices in 2019

Date	Document No.	Document
2019-09-23	NNSA Letter [2019] 72	Letter on printing and distributing nonroutine radiation safety regulatory inspection reports of nuclear technology utilization organizations
2019-04-28	MEE App [2019] 65	Reply to approval of environmental impact statements of the decommissioning project of Cobalt source irradiation device submitted by the Anhui Time Radiochemical Co., Ltd.
2019-08-23	MEE App [2019] 109	Reply to approval of environmental impact statements of the decommissioning project of irradiation device submitted by the Tonghua Dongfang Irradiation Disinfecting Co., Ltd.
2019-01-11	MEE DL [2019] 5	Letter of decision on administrative penalty (excessive emission of iodine-131 by Chengdu Gaotong Isotopes Co., Ltd.)
2019-08-13	MEE DL [2019] 74	Letter of decision on ordering correction of illegal act (Xianyang Huake Irradiation Technology Co., Ltd.)
2019-08-27	MEE DL [2019] 76	Letter of decision on ordering a correction of illegal acts (Chengdu Gaotong Isotopes Co., Ltd.)

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Date	Document No.	Document
2019-01-04	MEE RL [2019] 19	Notification on improving the information of disused radioactive sources in the national nuclear technology utilization radiation safety management system
2019-01-03	MEE RL [2019] 20	Reply to approval of classified management consultation of cabinet type X-ray safety inspection equipment
2019-01-11	MEE RL [2019] 38	Letter on notification of the issuance of radiation safety license in 2018
2019-01-18	MEE RL [2019] 69	Reply to approval of extended operation of the irradiation device of Shanghai Academy of Agricultural Sciences
2019-04-11	MEE RL [2019] 374	Letter on approval of cancellation of radiation safety license of Air China Cargo Co., Ltd.
2019-04-19	MEE RL [2019] 404	Reply on cancellation of radiation safety licenses of nuclear technology organizations
2019-07-18	MEE RL [2019] 634	Reply on approval of cancellation of class I radioactive source radiation safety license of Changchun Institute of Applied Chemistry, Chinese Academy of Sciences
2019-08-27	MEE RL [2019] 711	Reply on the delivery and storage of disused radioactive sources
2019-10-11	MEE RL [2019] 787	Reply on exemption from management of nickel-63 radioactive source in HD800A portable explosive drug detector and HD900A explosive drug detector
2019-11-11	MEE RL [2019] 835	Reply on exemption from management of nickel-63 radioactive source in SIM-MAX FCA2018 fixed toxic gas monitor of Shanghai SIM-MAX Technology Co., Ltd.
2019-11-19	MEE RL [2019] 851	Reply on exemption from management of nickel-63 radioactive source in MI1000 odor detector and MI2000 trace organic analyzer of Nuctech Company Limited
2019-12-03	MEE RL [2019] 884	Reply on the approval of the cancellation of radiation safety license of Anhui Time Radiochemical Co., Ltd.
2019-04-26	MEE R [2019] 37	Notice on issuing the Data Collection Rules for Online Monitoring Platform of High Risk Mobile Radioactive Sources

9 Nuclear Material Control and Physical Protection of Nuclear Facilities

In 2019, according to the *Nuclear Safety Law of the People's Republic of China*, the *Law of the People's Republic of China on Prevention and Control of Radioactive Pollution*, the *Safety Regulation on Civilian Nuclear Facilities*, the *Regulation on Nuclear Material Control*, and other relevant laws and regulations, MEE(NNSA) executed its responsibilities for regulatory inspections and technical reviews on nuclear material control and physical protection of nuclear facilities, and responsibilities for nuclear material license verification.

Nuclear Material License Verification and Approval

Technical reviews and onsite inspections were conducted on the nuclear material license application documents of the 719th Research Institute of China State Shipbuilding Co., Ltd. and the review comments of the Nuclear Material Control Office of the China Atomic Energy Authority. The approval procedures were appropriately fulfilled.

10 Safety Regulation on Transportation of Radioactive Materials

In 2019, the transportation activities of radioactive materials were safely implemented without the occurrence of any nuclear and radiation accidents or incidents in China. To improve the regulatory regulation system, the preparation and revision of classification list of radioactive materials, and regulations and standards on the load design and criteria of radioactive material transport containers were advanced. The development of domestic spent fuel transport containers was promoted, and the transportation for categories II and III radioactive materials were standardized.

In 2019, 6 certificates of approval for the design of transport container for category I radioactive materials (including 2 renewals and 4 modifications) were issued. One license for the manufacture of transport containers for category I radioactive materials was issued. Five transport containers designed and manufactured abroad for category I radioactive materials (including 1 renewal) were approved for use in China. Fifteen

nuclear and radiation safety analysis reports for the transportation of radioactive materials (including 4 renewals and 5 modifications) were approved.

The 2019 regulatory approvals in the field of safety regulation on radioactive material transportation are shown in Table 79, and regulatory inspection activities are shown in Table 80.

In 2019, regional offices of nuclear and radiation safety inspection conducted 16 regulatory inspections for transportation of radioactive materials such as of the outward transportation of radioactive waste from Qinshan NNP. Two problems were found, and 2 management requirements were proposed.

In 2019, the NSC conducted 11 review activities on the transportation of radioactive materials, including a review of the *nuclear and radiation safety analysis reports on Road Transportation of High Temperature Gas Cooled Reactor Fuel Elements*.

Safety Regulation on Transportation of Radioactive Materials

Table 79. Major regulatory approvals for radioactive material transportation in 2019

Date	Document No.	Document
2019-06-11	NNSA [2019] 122	Notice on issuing nuclear and radiation safety approval letter for the use of TK-C57 new fuel transportation container by CIAE
2019-06-11	NNSA [2019] 125	Notification for approving nuclear and radiation safety analysis reports (renewal report) on domestic road transportation of fast reactor fuel assembly in China
2019-06-11	NNSA [2019] 126	Notification for approving the use of NPC transport containers in the People's Republic of China
2019-06-11	NNSA [2019] 127	Notification for approving the changes of limits of CNFC-3G new fuel transportation container in the design approval letter
2019-06-12	NNSA [2019] 140	Notification for approving nuclear and radiation safety analysis reports on domestic highway-railway transportation of PC fuel
2019-08-14	NNSA [2019] 172	Notification for approving the modification to the nuclear and radiation safety analysis reports on Cobalt Source (R7021 Type Container) Transportation
2019-08-19	NNSA [2019] 174	Notification for approving the extension of validity period of the design approval letter of SY-I (A) transportation container
2019-08-19	NNSA [2019] 175	Notification for approving the extension of validity period of design approval letter of FCTC10 transport container
2019-09-04	NNSA [2019] 191	Notification for approving the extension of nuclear and radiation safety analysis reports on iridium-192 and selenium-75 radioactive source transportation submitted by Beijing CIAE-RIAR Radioisotope Technology Co., Ltd.
2019-11-13	NNSA [2019] 232	Notification for approving the extension of nuclear and radiation safety analysis reports of medical cobalt-60 radioactive source transportation
2019-11-28	NNSA [2019] 242	Notification for approving the extension of the validity period of the approval letter on the use of uranium hexafluoride transport containers submitted by China Nuclear Energy Industry Co., Ltd.
2019-12-12	NNSA [2019] 251	Notice on the issuance of manufacturing license for category I radioactive material transportation container to CNNC Lanzhou Uranium Enrichment Co., Ltd.
2019-08-16	NNSA Letter [2019] 59	Approval reply on the change of designated representative in the design and approval letter of three transport containers including SY-I transport container submitted by the China Institute of Radiation Protection
2019-09-11	NNSA Letter [2019] 69	Approval reply on the change of two authorized representatives in the approval letter for the use of FCC4-V1 new fuel transportation container submitted by the Taishan Nuclear Power Joint Venture Co., Ltd.

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Table 80. Inspection activities on radioactive material transportation in 2019

Start date	Item	Inspection contents
2019-01-18	Onsite witness to the mechanical test for neutron source transport container of Renqiu Jinke Petroleum Equipment Co., Ltd.	Container test witness
2019-01-21	Onsite witness to the shielding test for neutron source transport container of Renqiu Jinke Petroleum Equipment Co., Ltd.	Container test witness
2019-03-28	Onsite witness to the mechanical test and shielding test for neutron source transport container of Renqiu Jinke Petroleum Equipment Co., Ltd.	Container test witness
2019-04-09	Onsite witness to the heat treatment and physical and chemical inspections of XN3000 UF6 transport container of CNNC Lanzhou Uranium Enrichment Co., Ltd.	Container manufacture supervision
2019-04-24	Onsite witness to the water immersion test for UF4 transport container of CNNC Xinneng Nuclear Engineering Co., Ltd. (I)	Container test witness
2019-04-28	Onsite regulatory inspection on the radioactive material transportation safety of Dandong Sunshine Instrument Co., Ltd.	Transportation safety inspection
2019-05-16	Onsite witness to the mechanics test for ISC-YSRQ transport container of CIAE	Container test witness
2019-05-24	Onsite witness to the water immersion test for UF4 transport container of CNNC Xinneng Nuclear Engineering Co., Ltd. (2)	Container test witness
2019-06-13	Onsite witness to the mechanical test and heat resistance test for OP48 Type UF6 transport packaging of China Radiation Protection Research Institute	Container test witness
2019-06-20	Onsite inspection on the remedy for the findings of the model part during manufacturing license certification application for XN3000 UF6 transport container of CNNC Lanzhou Uranium Enrichment Co., Ltd.	Container manufacture supervision
2019-06-24	Onsite witness to the mechanical test for UF4 transport container of CNNC Xinneng Nuclear Engineering Co., Ltd.	Container test witness
2019-07-01	Onsite witness to the heat resistance test and water leakage test for UF4 transport container of CNNC Xinneng Nuclear Engineering Co., Ltd.	Container test witness
2019-07-02	Onsite witness to the mechanical test and heat resistance test for ANT-12A new fuel transportation container of China Nuclear Power Technology Research Institute Co., Ltd.	Container test witness
2019-07-17	Onsite recheck inspection on the remedy for the findings of the model part during manufacturing license certification application for XN3000 UF6 transport container of CNNC Lanzhou Uranium Enrichment Co., Ltd.	Container manufacture supervision
2019-08-26	Onsite witness to the air tightness test, vacuum sealing test, and load test for lifting lug of XN3000 UF6 transport container of CNNC Lanzhou Uranium Enrichment Co., Ltd.	Container manufacture supervision

Safety Regulation on Transportation of Radioactive Materials

continued

Start date	Item	Inspection contents
2019-10-18	Onsite witness to the mechanical test and shielding test for LC-C-100 neutron source transport container of Renqiu Jinke Petroleum Equipment Co., Ltd.	Container test witness
2019-10-20	Onsite witness to the mechanical test and shielding test for HNSTC-DP-A neutron source transport container of Bazhou Dapu Petroleum Technology Service Co., Ltd.	Container test witness
2019-11-04	Safety regulatory inspection on the radioactive material transportation of Haimen Gamma Star Flaw Detection Equipment Co., Ltd.	Transportation safety inspection
2019-11-19	Inspection on the preparations for application for the manufacture of UF6 transport container of CNNC Shaanxi Uranium Enrichment Co., Ltd., and CNNC Shanyou Hanzhong Mechanical and Electrical Equipment Manufacturing Co., Ltd.	Container manufacture supervision
2019-12-31	Regulatory inspection on the category I radioactive material transport container design of China Nuclear Power Engineering Co., Ltd.	Container test witness

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11 Regulation on Civilian Safety Nuclear Equipment

Regulatory Approvals

In 2019, MEE(NNSA) received and reviewed a total of 54 organizations' new applications for civilian nuclear safety equipment licenses, and approved 110 organizations' applications, including 9 organizations' new applications for licenses (see Table 81), 36 organizations' applications for renewal (see Table 82), and 65 organizations' applications for change (see Table 83). As of the end of 2019, a total of 212 organizations were licensed for the design, manufacture, installation, and NDT of nuclear safety equipment.

In 2019, 41 organizations' applications for registration of civilian nuclear safety equipment import were received and reviewed, of which 74 applications were approved (see Table 84). As of the end of 2019, the total number of foreign organizations holding registration confirmations for design, manufacture, or NDT of nuclear safety equipment was 179.

In 2019, the NSC conducted 508 review activities related to the license and registration application for civil nuclear safety equipment.

Table 81. Issuances of new licenses for civilian nuclear safety equipment in 2019

Date	Document No.	Document
2019-01-18	NNSA [2019] 10	Notice on the issuance of manufacturing license for civil nuclear safety equipment of Dongfang Electric Co., Ltd.
2019-01-21	NNSA [2019] 13	Notice on the issuance of manufacturing license for civil nuclear safety equipment of CNNC Jiahua Nuclear Equipment Manufacturing Co., Ltd.
2019-04-19	NNSA [2019] 89	Notice on the issuance of manufacturing license for civil nuclear safety equipment of Jiangsu Yanxin Science and Technology Co., Ltd.
2019-04-19	NNSA [2019] 91	Notice on the issuance of design and manufacturing license for civil nuclear safety equipment of Jiangsu Saide Electric Co., Ltd.

Regulation on Civilian Safety Nuclear Equipment

continued

Date	Document No.	Document
2019-04-19	NNSA [2019] 94	Notice on the issuance of design and manufacturing licenses for civil nuclear safety equipment of Shandong Taikai Apparatus Complete Co., Ltd.
2019-05-16	NNSA [2019] 116	Notice on the issuance of design and manufacturing license for civil nuclear safety equipment of Siping VieX Heat Exchange Equipment Co., Ltd.
2019-06-28	NNSA [2019] 149	Notice on the issuance of design and manufacturing license for civil nuclear safety equipment of Schneider Electric Equipment Engineering (Xi'an) Co., Ltd.
2019-09-23	NNSA [2019] 209	Notice on the issuance of design license for civil nuclear safety equipment of Jiangsu Xinghe Valve Co., Ltd.
2019-11-19	NNSA [2019] 235	Notice on the issuance of design and manufacturing license for civil nuclear safety equipment of Hebei Qianhai Blower Co., Ltd.

Table 82. Approvals of license renewal for civilian nuclear safety equipment in 2019

Date	Document No.	Document
2019-01-14	NNSA [2019] 7	Notification for approving the renewal of design and manufacturing license for civil nuclear safety equipment of Shanghai Ruiniu Machinery Co., Ltd.
2019-02-03	NNSA [2019] 24	Notification for approving the renewal of manufacturing license for civil nuclear safety equipment of Hebei Hongrun Nuclear Equipment Technology Co., Ltd.
2019-02-03	NNSA [2019] 25	Notification for approving the renewal of manufacturing license for civil nuclear safety equipment of Shanghai Electric Power Generation Equipment Co., Ltd.
2019-03-28	NNSA [2019] 63	Notification for approving the renewal of manufacturing license for civil nuclear safety equipment of Shanghai Xinmin Heavy Forging Co., Ltd.
2019-03-29	NNSA [2019] 65	Notification for approving the renewal of design and manufacturing license for civil nuclear safety equipment of Jiangsu Shangshang Cable Group Co., Ltd.
2019-03-29	NNSA [2019] 66	Notification for approving the renewal of design and manufacturing license for civil nuclear safety equipment of Shaanxi Diesel Heavy Industry Co., Ltd.
2019-03-29	NNSA [2019] 67	Notification for approving the renewal of design and manufacturing license for civil nuclear safety equipment of Changzhou Bayi Cable Co., Ltd.
2019-03-29	NNSA [2019] 68	Notification for approving the renewal of manufacturing license for civil nuclear safety equipment of Wuxi Flange Casting Co., Ltd.

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continued

Date	Document No.	Document
2019-03-29	NNSA [2019] 69	Notification for approving the renewal of design and manufacturing license for civil nuclear safety equipment of Shanghai Apollo Machinery Co., Ltd.
2019-03-29	NNSA [2019] 70	Notification for approving the renewal of manufacturing license for civil nuclear safety equipment of Dongfang Framatome Nuclear Pump Co., Ltd.
2019-03-29	NNSA [2019] 71	Notification for approving the renewal of manufacturing license for civil nuclear safety equipment of Yantai Taihai Manuer Nuclear Power Equipment Co., Ltd.
2019-03-29	NNSA [2019] 72	Notification for approving the renewal of manufacturing license for civil nuclear safety equipment of Anhui Yingliu Group Huoshan Foundry Co., Ltd.
2019-03-29	NNSA [2019] 73	Notification for approving the renewal of design and manufacturing license for civil nuclear safety equipment of Jiangsu Huaguang Cable Electrical Appliance Co., Ltd.
2019-03-29	NNSA [2019] 74	Notification for approving the renewal of design and manufacturing license for civil nuclear safety equipment of Shanghai Power Equipment Research Institute Co., Ltd.
2019-04-19	NNSA [2019] 92	Notification for approving the renewal of civil nuclear safety equipment manufacturing license of Baosteel Special Steel Co., Ltd.
2019-06-28	NNSA [2019] 147	Notification for approving the renewal of nuclear safety equipment manufacturing license of Harbin Boiler Co., Ltd.
2019-06-28	NNSA [2019] 148	Notification for approving the renewal of NDT license for civil nuclear safety equipment of State NPP Service Company
2019-06-28	NNSA [2019] 150	Notification for approving the renewal of nuclear safety equipment design and manufacturing license of Jiangsu Shentong Valve Co., Ltd.
2019-06-28	NNSA [2019] 151	Notification for approving the renewal of design and manufacturing license for civil nuclear safety equipment of Anhui Cable Co., Ltd.
2019-06-28	NNSA [2019] 152	Notification for approving the renewal of design and manufacturing license, and the change of scope of licensed activities of civil nuclear safety equipment of Shanghai Automation Instrument Co., Ltd.
2019-06-28	NNSA [2019] 153	Notification for approving the renewal of design and manufacturing license for civil nuclear safety equipment of CNNC Xi'an Nuclear Instrument Co., Ltd.
2019-06-28	NNSA [2019] 154	Notification for approving the renewal of the design and manufacturing license for civil nuclear safety equipment of China Nuclear Power Technology Research Institute Co., Ltd.

Regulation on Civilian Safety Nuclear Equipment

continued

Date	Document No.	Document
2019-06-28	NNSA [2019] 155	Notification for approving the renewal of manufacturing license for civil nuclear safety equipment of China Nuclear Industry Fifth Construction Co., Ltd.
2019-07-12	NNSA [2019] 158	Notification for approving the renewal of design and manufacturing license for civil nuclear safety equipment of Nanjing Aerosun-TOLA Expansion Joint Co., Ltd.
2019-07-12	NNSA [2019] 159	Notification for approving the renewal of NDT license for civil nuclear safety equipment, and the change of scope of licensed activities of China Nuclear Power Operation Technology Co., Ltd.
2019-07-20	NNSA [2019] 162	Notification for approving the renewal of design and manufacturing license for civil nuclear safety equipment of Special Equipment Co., Ltd., CSIC
2019-07-20	NNSA [2019] 164	Notification for approving the renewal of manufacturing license for civil nuclear safety equipment of Alfa Lafa (Jiangyin) Equipment Manufacturing Co., Ltd.
2019-07-25	NNSA [2019] 168	Notification for approving the renewal of NDT license for civil nuclear safety equipment of NPIC
2019-09-29	NNSA [2019] 211	Notification for approving renewal of design and manufacturing license for civil nuclear safety equipment of Jiamusi Electric Machine Co., Ltd.
2019-09-30	NNSA [2019] 212	Notification for approving the renewal of NDT license for civil nuclear safety equipment of CGN Inspection Technology Co., Ltd.
2019-09-30	NNSA [2019] 216	Notification for approving the renewal of design and manufacturing license for civil nuclear safety equipment of Changzhou Power Station Auxiliary Equipment Co., Ltd.
2019-09-30	NNSA [2019] 217	Notification for approving the renewal of the design and manufacturing license, and the change of scope of licensed activities for civil nuclear safety equipment of China Nuclear Control System Engineering Co., Ltd.
2019-09-30	NNSA [2019] 218	Notification for approving the renewal of the design and manufacturing license for civil nuclear safety equipment of Yangzhou Electric Power Equipment Manufacture Factory Co., Ltd.
2019-12-04	NNSA [2019] 248	Notification for approving the renewal of manufacturing license for civil nuclear safety equipment of Shanghai Morimatsu Pressure Vessel Co., Ltd.
2019-12-30	NNSA [2019] 263	Notification for approving the renewal of manufacturing license for civil nuclear safety equipment of Hebei Canghai Nuclear Equipment Technology Co., Ltd.
2019-12-30	NNSA [2019] 264	Notification for approving the renewal of manufacturing license for civil nuclear safety equipment of Yangzhou Chengde Steel Pipe Co., Ltd.

Table 83. Change of license renewal for civilian nuclear safety equipment in 2019

Date	Document No.	Document
2019-02-03	NNSA [2019] 28	Notification for approving the change of scope of manufacturing license for civil nuclear safety equipment activities of Pangang Group Chengdu Steel & Vanadium Co., Ltd.
2019-04-08	NNSA [2019] 82	Approval on the change of design and manufacturing license for nuclear safety equipment of Shanghai Automation Instrument Co., Ltd.
2019-04-19	NNSA [2019] 93	Notification for approving the change of scope of activities in the design and manufacturing license for civil nuclear safety equipment of State Nuclear Power Automation System Engineering Co., Ltd.
2019-04-26	NNSA [2019] 97	Notification for approving the change of scope of activities in the design license for civil nuclear safety equipment of SUFA Technology Industry Co., Ltd., CNNC
2019-04-29	NNSA [2019] 110	Notification for approving the change of scope of activities in the design and manufacturing license for civil nuclear safety equipment of Shanghai Automation Instrument Co., Ltd.
2019-05-17	NNSA [2019] 118	Notification for approving the change of scope of activities in the design and manufacturing license for civil nuclear safety equipment of Yuancheng Cable Co., Ltd.
2019-06-10	NNSA [2019] 139	Notification for approving the change of scope of activities in the design and manufacturing license for civil nuclear safety equipment of China Nuclear Control System Engineering Co., Ltd.
2019-08-23	NNSA [2019] 180	Notification for approving the change of scope of activities in the design and manufacturing license for civil nuclear safety equipment of Baosheng Science and Technology Innovation Co., Ltd.
2019-08-23	NNSA [2019] 181	Notification for approving the change of scope of activities in the design and manufacturing license for civil nuclear safety equipment of China Tianshui Changcheng Switchgear Group Co., Ltd.
2019-08-23	NNSA [2019] 183	Notification for approving the change of scope of activities in the license of Neway Valve (Suzhou) Co.,Ltd.
2019-08-23	NNSA [2019] 184	Notification for approving the change of scope of activities in the design and manufacturing license for civil nuclear safety equipment of Yantai Taihai Manuer Nuclear Power Equipment Co., Ltd.
2019-08-23	NNSA [2019] 185	Notification for approving the change of scope of activities in the design and manufacturing license for civil nuclear safety equipment of The 719th Research Institute of China State Shipbuilding Co., Ltd.
2019-01-25	NNSA Letter [2019] 8	Notification for approving the changes in characteristic design parameters and manufacturing capacity of SUFA Technology Industry Co., Ltd., CNNC

Regulation on Civilian Safety Nuclear Equipment

continued

Date	Document No.	Document
2019-02-03	NNSA Letter [2019] 12	Notification for approving the change of license for civil nuclear safety equipment licenses of 8 organizations including China Nuclear Power Operation Technology Co., Ltd., and the change of registration confirmation of France Dresser Produces Industries
2019-03-13	NNSA Letter [2019] 13	Notification for approving the change of license parameters of Shanghai Kaiquan Pump (Group) Co., Ltd.
2019-03-22	NNSA Letter [2019] 14	Notification for approving the change of licenses for civil nuclear safety equipment of 7 organizations including Changshu Huaxin Special Steel Co., Ltd., and the change of registration confirmation of Pentair Valves & Controls US LP
2019-04-28	NNSA Letter [2019] 27	Notification for approving the change of licenses for civil nuclear safety equipment of 9 organizations including Baoyin Special Steel Tube Co., Ltd., and the change of registration confirmation of Japan Gear Industry Co., Ltd.
2019-05-17	NNSA Letter [2019] 36	Notification for approving the change of parameters of Neway Valve (Suzhou) Co.,Ltd.
2019-05-30	NNSA Letter [2019] 40	Notification for approving the changes in main subcontract projects in the manufacturing license for civil nuclear safety equipment of Vallourec Nuclear Tubes (Guangzhou) Co., Ltd.
2019-05-30	NNSA Letter [2019] 42	Notification for approving the change of license information of civil nuclear safety equipment of 7 organizations including POWERCHINA Nuclear Engineering Co., Ltd.
2019-06-18	NNSA Letter [2019] 46	Notification for approving the change of scope of activities in the manufacturing license for civil nuclear safety equipment of Shanghai No. Five Valve Factory Co., Ltd.
2019-07-20	NNSA Letter [2019] 51	Notification for approving the change of licenses for civil nuclear safety equipment of 4 organizations including Qingdao Lanshi Heavy Machinery Equipment Co., Ltd., and the change of registration confirmation of 2 foreign enterprises including UK Delta Controls Ltd.
2019-07-25	NNSA Letter [2019] 53	Notification for approving the change of license information of civil nuclear safety equipment of Zhejiang Hanyuan Power Equipment Manufacturing Co., Ltd.
2019-08-23	NNSA Letter [2019] 64	Notification for approving the change in characteristic parameters of civil nuclear safety equipment design and manufacturing license capacity of ABB Xiamen Low Voltage Equipment Co., Ltd.
2019-08-26	NNSA Letter [2019] 65	Notification for approving the change of scope of activities in the license for civil nuclear safety equipment of Dalian DV Valve Co., Ltd.
2019-09-23	NNSA Letter [2019] 71	Notification for approving the change of license for civil nuclear safety equipment of Lanzhou Lanshi Heat Exchange Equipment Co., Ltd., and the change of registration confirmation information of two foreign enterprises, including German KSB SE & CO. KGaA

continued

Date	Document No.	Document
2019-11-01	NNSA Letter [2019] 80	Notification for approving the change in characteristic parameters of Shijiazhuang No.1 Valve Factory Co., Ltd.
2019-11-11	NNSA Letter [2019] 83	Notification for approving the change of licenses for civil nuclear safety equipment of 6 organizations including Special Equipment Co., Ltd., CSIC and the changes of registration confirmations of 3 foreign enterprises including Weir Power & Industrial France

Table 84. Issuance of registration confirmation for civil nuclear safety equipment activities to foreign enterprises in 2019

Date	Document No.	Document
2019-02-03	NNSA [2019] 27	Notice on issuing the registration confirmations for civil nuclear safety equipment activities of foreign enterprises to 6 Russian organizations including Omz Special Steel LLC
2019-03-08	NNSA [2019] 41	Notice on issuing registration confirmations to three organizations including France's Velan S.A.S
2019-03-13	NNSA [2019] 42	Notice on issuing the registration confirmation for civil nuclear safety equipment activities of foreign enterprises to 16 organizations including United States' Westinghouse Electric Company
2019-04-26	NNSA [2019] 102	Notice on issuing the registration confirmation for civil nuclear safety equipment activities of foreign enterprises to 9 organizations including France's Nexans
2019-05-30	NNSA [2019] 121	Notice on issuing the registration confirmation for civil nuclear safety equipment activities of foreign enterprises to 4 organizations including Ukraine's PJSC "Energomashspetstal"
2019-06-17	NNSA [2019] 142	Notice on issuing the registration confirmation for civil nuclear safety equipment activities of foreign enterprises to two organizations including France's Mirion Technologies (MGPI) S.A.
2019-06-26	NNSA [2019] 146	Notice on issuing the registration confirmation for civil nuclear safety equipment activities of foreign enterprises to two organizations including Russia's JSC AEM Technology
2019-08-13	NNSA [2019] 171	Notice on issuing the registration confirmation for civil nuclear safety equipment activities of foreign enterprises to 13 organizations including Austria's Andritz AG
2019-08-23	NNSA [2019] 182	Notice on issuing the registration confirmation for civil nuclear safety equipment activities of foreign enterprises to 5 organizations including Germany Weidmuller Interface GmbH & Co. KG
2019-09-12	NNSA [2019] 204	Notice on issuing the registration confirmation for civil nuclear safety equipment activities of foreign enterprises to 9 organizations including Canada's Laker Energy Products Ltd.

Regulation on Civilian Safety Nuclear Equipment

continued

Date	Document No.	Document
2019-11-01	NNSA [2019] 229	Notice on issuing the registration confirmation for civil nuclear safety equipment activities of foreign enterprises to 5 organizations including France's CLYDE UNION SAS

Safety Inspections on Imported Equipment

MEE(NNSA) conducted regulatory inspections of imported nuclear safety equipment in accordance with law, and further standardized and optimized the safety inspection work process. There were 511 batches of regulatory inspection application documents (including customs and opening package inspection) submitted by safety applicants, including 266 for mechanical equipment and 245 for electrical equipment. Among which, 445 were signed for release, 66 were rejected, and 50 were witnessed.

Regulatory Inspection

MEE(NNSA) conducted 39 comprehensive

inspections (see Table 85) and 3 special inspections (see Table 86) on domestic enterprises according to the regulatory inspection program and plan and found 710 problems and proposed 341 regulatory requirements. MEE(NNSA) conducted 1 special inspection of foreign enterprises (see Table 87) and 2 recorded inspections and found 6 problems and proposed 6 rectification requirements. MEE(NNSA) promptly raised correction requirements for problems discovered in these inspections, and organized experts to review and perform special inspections on major non-conformance that affect nuclear safety. In 2019, the quality of design, manufacture, installation, and nondestructive testing of civilian nuclear safety equipment was under control.

Table 85. Comprehensive inspection on civilian nuclear safety equipment of domestic enterprises in 2019

Start Date	Inspected Enterprise
2019-02-26	FITOK (Shenzhen) Incorporated
2019-03-05	Kehua Tech - Power Solution Expert
2019-03-12	Nanjing Aerosun-TOLA Expansion Joint Co., Ltd.
2019-03-18	Baosheng Science and Technology Innovation Co., Ltd.
2019-03-19	Zhejiang Jiuli Hi-Tech Metals Co., Ltd.

Start Date	Inspected Enterprise
2019-03-25	Dongfang Electric (Guangzhou) Heavy Machinery Co., Ltd.
2019-03-26	Jiangsu Power Equipment Co., Ltd.
2019-04-08	China Nuclear Power Technology Research Institute Co., Ltd.
2019-04-09	Shanghai Electric Nuclear Power Equipment Co., Ltd.
2019-04-15	Chongqing Pump Industry Co., Ltd.
2019-04-16	Hebei Canghai Nuclear Equipment Technology Co., Ltd.
2019-04-16	Chongqing Chuanyi Automation Co., Ltd.
2019-04-22	Sunway Co., Ltd.
2019-04-22	China Nuclear Power Engineering Co., Ltd.
2019-05-15	Shanxi North Anteyou Engine Co., Ltd.
2019-05-21	ZhongXing Energy Equipment Co., Ltd.
2019-05-27	Angang Heavy Machinery Co., Ltd.
2019-05-27	ABB Xiamen Switchgear Co., Ltd.
2019-06-19	Harbin Electric Co., Ltd.
2019-06-24	Wolong Electric Nanyang Explosion Protection Group Co., Ltd.
2019-06-25	Wuhan Heavy Industry Casting and Forging Co., Ltd.
2019-07-08	State NPP Service Company
2019-07-09	Qinshan Branch of China Nuclear Industry 23 Construction Co., Ltd.
2019-07-22	Shanghai Morimatsu Pressure Vessel Co., Ltd.
2019-08-20	Qingdao Lanshi Heavy Machinery Equipment Co., Ltd.
2019-08-20	Shenyang Kejin Special Materials Co., Ltd.
2019-08-26	Xi'an XD Transformer Co., Ltd.
2019-09-02	China First Heavy Industries (Group) Co. Ltd.
2019-09-03	Erzhong (Deyang) Heavy Equipment Co., Ltd.
2019-09-03	Shanghai Guanghua Instrument Co., Ltd.
2019-09-17	Chuan Kai Electric Co., Ltd.
2019-09-24	Dongfang Boiler Group Co., Ltd.
2019-10-15	Bohai Shipyard Group Co., Ltd.

Regulation on Civilian Safety Nuclear Equipment

continued

Start Date	Inspected Enterprise
2019-10-21	Dongfang Electric Co., Ltd.
2019-10-22	Sichuan Huadu Nuclear Equipment Manufacturer Co., Ltd.
2019-10-28	China Techenergy Co., Ltd.
2019-11-18	Pearl Electric Co., Ltd.
2019-11-18	Harbin Electric Group (Qinhuangdao) Heavy Equipment Co., Ltd.
2019-11-19	Jiangsu Shentong Valve Co., Ltd.

Table 86. Special inspection on civilian nuclear safety equipment of domestic enterprises in 2019

Start Date	Inspected Enterprise
2019-04-16	China Nuclear Power Design Co., Ltd. (Shenzhen)
2019-09-16	China Nuclear Power Engineering Co., Ltd.
2019-11-19	China Nuclear Power Design Co., Ltd. (Shenzhen)

Table 87. Regulatory inspection on civilian nuclear safety equipment of foreign enterprises in 2019

Start Date	Inspected Enterprise	Inspection Type
2019-09-16	German KSB SE & Co. KGaA	Nuclear safety inspection

12 Regulation of Electromagnetic Radiation Environment

License Approval

In 2019, EIA approval procedures for 6 construction projects with electromagnetic radiation, such as the upgrade and reconstruction projects for the satellite monitoring network, were conducted (see

Table 88).

In 2019, the NSC conducted a total of 39 review activities of electromagnetic radiation projects, including technical review of the satellite monitoring network upgrade project of the National Radio Monitoring Center.

Table 88. Regulatory approvals in the field of electromagnetic radiation environment in 2019

Start Date	Document No.	Document
2019-04-26	MEE App [2019] 64	Approval reply on the environmental impact statement of the upgrade and reconstruction project of the satellite monitoring network
2019-05-27	MEE App [2019] 73	Approval reply on the environmental impact statement of Yunan-Guizhou Internet Channel Project
2019-07-08	MEE App [2019] 82	Approval reply on the environmental impact statement of Yazhong-Jiangxi \pm 800 kV UHVDC Transmission Project
2019-09-05	MEE App [2019] 116	Approval reply on the environmental impact statement of Guangdong-Guangxi Power Transmission of the Wudongde Power Station Power (UHV Multi-Terminal DC Demonstration Project) AC Supporting Project
2019-09-30	MEE App [2019] 130	Approval reply on the environmental impact statement of Taiyangshan-Liupanshan-Pingliang 750 kV Power Transmission and Transformation Project
2019-09-30	MEE App [2019] 131	Approval reply on the environmental impact statement of the variation of Guangdong \pm 500 kV Double Circuit HVDC Transmission Project of Xiluodu Right Bank Power Station

Review of Environmental Assessment Documents

According to the *Regulatory Management Measures for the Preparation of Environmental Impact Statements (Forms) of Construction Projects*, the preparation of the *Third-Level Technical Procedure for the Preparation of Environmental Impact Statements (Form) of Nuclear and Radiation Construction Projects* was organized, and technical reviews of 10 EIA documents for construction projects with electromagnetic radiation that had been approved in 2019 in Hunan Province, were conducted.

Implementation Verification of the Communication Base Station Environmental Protection Memorandum

To fully understand the implementation of the *Communication Base Station Environmental Protection Memorandum* and to strengthen entity responsibility for environmental

protection of communication enterprises, MEE(NNSA) cooperated with the Ministry of Industry and Information Technology (MIIT) to verify four communication enterprises' implementation of the *Communication Base Station Environmental Protection Memorandum*, such as China Telecom, China Mobile, China Unicom, and China Tower, in 2018. In April, MEE(NNSA) issued the *Notice on Verifying the Implementation of the Communication Base Station Environmental Protection Memorandum (MEE RL [2019] 436)* jointly with the MIIT, and organized provincial-level (regional and municipal-level) ecology and environment authorities (bureaus) and the communication administrations to conduct verifications, and to spot check the implementation work in some provinces. MEE(NNSA) organized the compiling of the *Implementation Verification Report of the Communication Base Station Environmental Protection Memorandum in 2018*, and sent the report to the four communication enterprises and officially issued it in cooperation with the MIIT on December 25th.

13 Radiation Environmental Monitoring

MEE(NNSA) successfully held the Second National Competition for Ecology and Environment Monitoring Professional Technicians – Special Competition for Radiation Monitoring, to create a professional technical atmosphere and discover and cultivate excellent talents, to further improve the national radiation monitoring level. MEE(NNSA) vigorously promoted the construction of radiation environment automatic monitoring stations—96 of the stations were in operation, 107 finished installation and commissioning, and 128 completed equipment supply. The MEE(NNSA) maintained high-quality operating of the national radiation environment monitoring network, with stable real-time data acquisition rate at more than 98%. The MEE(NNSA) strengthened regulatory monitoring of nuclear facilities, completed the technical reviews of regulatory monitoring plans for all important nuclear facilities, promoted the building of regulatory monitoring systems of Xudapu NPP, Zhangzhou NPP, and other NPPs, prepared technical specifications and further strengthened radiation monitoring of effluents from NPPs.

The MEE(NNSA) organized special research and vigorously promoted marine radiation monitoring. It also accelerated the revision of radiation environmental monitoring standards, completed the technical reviews of six radiation monitoring standards, such as the *Technical Specifications for Environmental Emergency Monitoring of NPPs*, and issued the national environmental protection standard *Analytical Method of ¹⁴C in Liquid Effluent of NPP—Wet Oxidation*.

Ionizing Radiation Environmental Monitoring

In 2019, the nationwide environmental ionizing radiation level was in the range of background fluctuations. The real-time continuous air absorbed dose rate and the cumulative dose were in the range of background fluctuation. The activity concentrations of natural radionuclides in the air were at the background level, and no abnormality in the activity concentrations of artificial radionuclides was observed. The activity concentrations of natural occurring radionuclides in the seven major river basins including the Yangtze River,

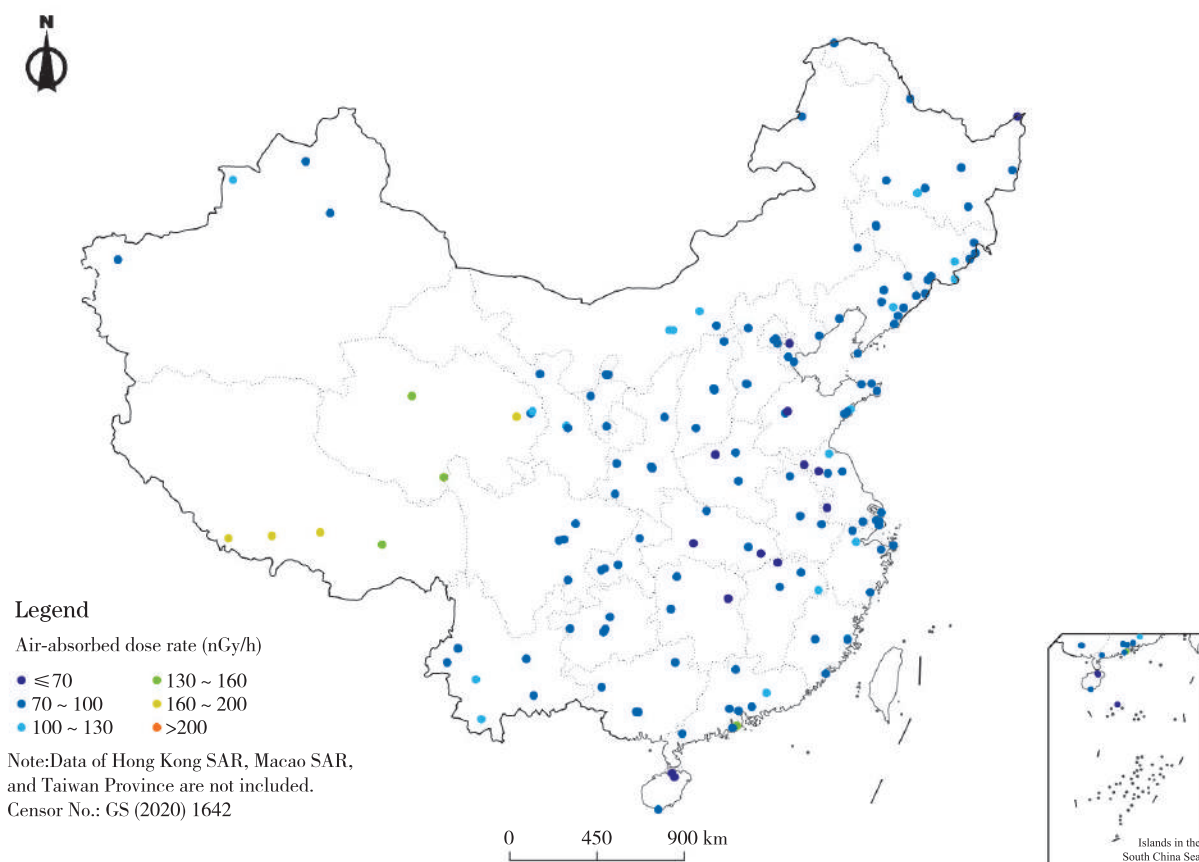


Figure 28. Distribution of real-time continuous air-absorbed dose rate by national automatic radiation environment monitoring stations in 2019

the Yellow River, the Pearl River, the Songhua River, the Huaihe River, the Haihe River, and the Liohe River, the rivers in the Zhejiang-Fujian basin, the northwestern rivers, the southwestern rivers, and the key lakes (reservoirs) were at the background level, and no abnormality in activity concentrations of artificial radionuclides was observed. The activity concentrations of gross α and gross β in urban centralized drinking water source and underground drinking water were lower than the guidance values specified in the *Standards for Drinking Water Quality (GB5749-2006)*. The

activity concentrations of natural occurring radionuclides in seawater and marine life in coastal waters were at the background level, and no abnormality in the activity concentrations of artificial radionuclides was observed; the activity concentrations of artificial radionuclides in seawater were significantly lower than the limits specified in the *Sea Water Quality Standard (GB3097-1997)*. The activity concentrations of natural occurring radionuclides in the soil were at the background level, and no abnormality in the activity concentrations of artificial radionuclides was observed.

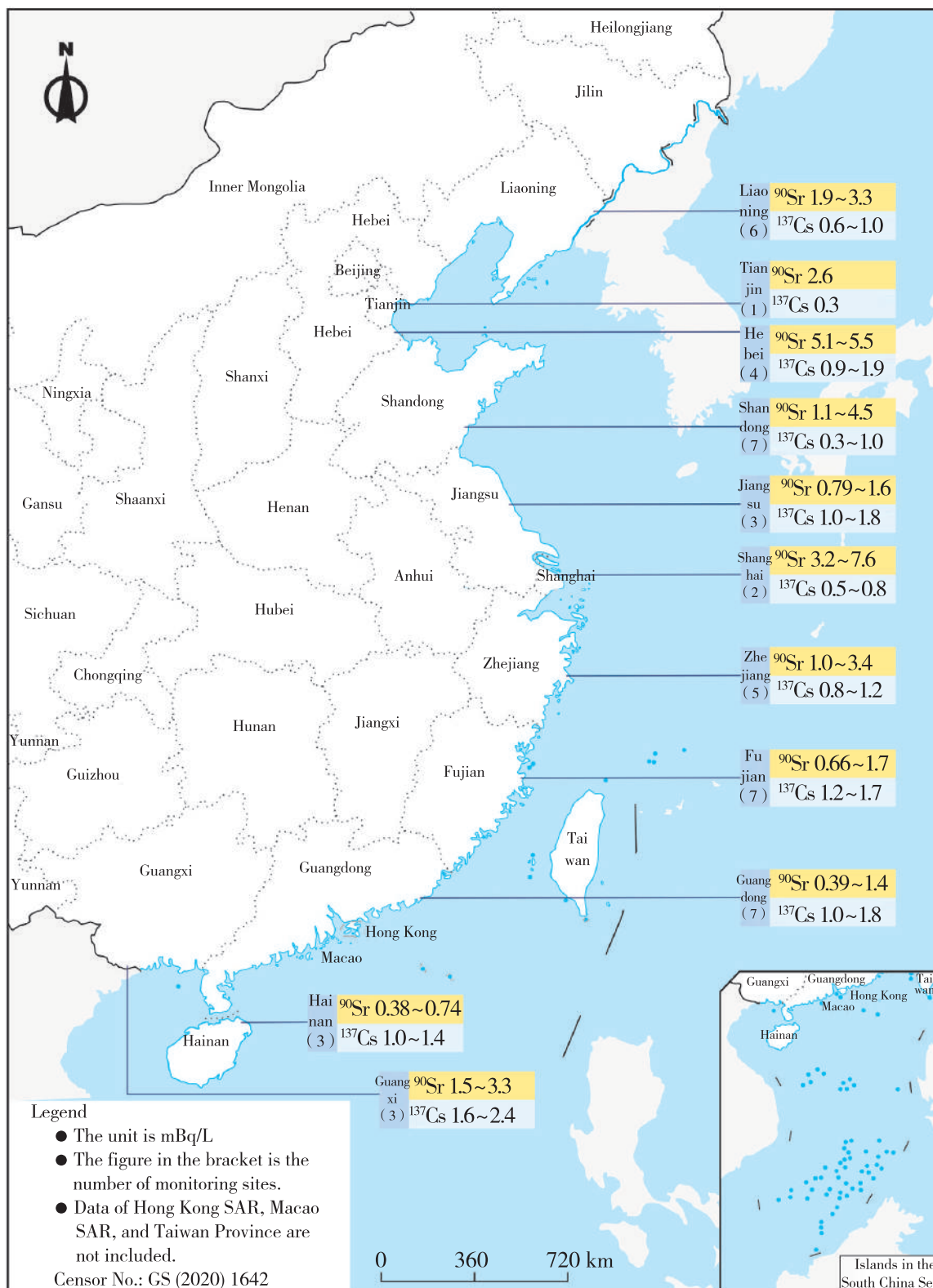


Figure 29. Distributions of ^{90}Sr and ^{137}Cs activity concentrations in offshore marine areas of China in 2019

Ionizing Radiation Environmental Monitoring around Operational Nuclear Power Bases

The real-time continuous air absorbed dose rate around operational nuclear power bases did not indicate anomalies caused by the operation of NPPs. There were no abnormal occurrences in the activity concentrations of artificial radionuclides in the air, water, soil, biological, and other environmental media around the Hongyanhe Nuclear Power Base, Sanmen Nuclear Power Base, Fuqing Nuclear Power Base, Haiyang Nuclear Power Base, Yangjiang Nuclear Power Base, and Changjiang Nuclear Power Base. The activity concentration of tritium increased slightly compared with the background level prior to the operation of NPPs in some environmental media around Tianwan Nuclear Power Base, Qinshan Nuclear Power Base, Ningde Nuclear Power Base, Daya Bay Nuclear Power Base, Taishan Nuclear Power Base, and Fangchenggang Nuclear Power Base. The assessment results indicated that the radiation doses to the public caused by the operation of the abovementioned NPPs were all far lower than the national limits.

Ionizing Radiation Environmental Monitoring around Civil Research Reactors

The ambient γ -radiation air absorbed dose rate around civil research reactors of

INNET, Tsinghua University and Shenzhen University and other civil research reactor facilities, and the activity concentration of artificial radionuclides in air, water, soil, biological, and other environmental media were not abnormal. Trace amounts of artificial radionuclides Strontium-90 and Cobalt-60 were detected in some environmental media around the production research area of the CIAE and the NPIC. The assessment results showed that the radiation doses to the public caused by the above-mentioned civil research reactors were far below the national limits.

Ionizing Radiation Environmental Monitoring around Nuclear Fuel Cycle Facilities and Waste Disposal Facilities

The ambient γ -radiation air absorbed dose rates of nuclear fuel cycle facilities operated by CNNC Lanzhou Uranium Enrichment Co., Ltd., CNNC Shaanxi Uranium Enrichment Co., Ltd., China North Nuclear Fuel Co., Ltd., China Nuclear Fuel Element Co., Ltd., CNNC 272 Uranium Co., Ltd. and The 404 Co., Ltd., CNNC, as well as the Northwest Low and Intermediate-Level Solid Waste Disposal Site and Beilong Low and Intermediate-Level Solid Waste Disposal Site were within the range of local natural background fluctuation, and the activity concentrations of radionuclides related to the activities of the above-mentioned enterprises in the environmental media were normal.

Ionizing Radiation Environmental Monitoring around Uranium Mining and Milling Facilities

The quality of the radiation environments around uranium mining and milling facilities was generally stable. The ambient environmental γ -radiation air-absorbed dose rates, air radon activity concentration, total uranium, and gross α concentration in aerosols, and total uranium and radium-226 concentrations in surface water and soil were within the range of historical fluctuations. The concentrations of total uranium, lead-210, polonium-210, and radium-226 in the surrounding drinking water were lower than the corresponding limits stipulated in the *Regulations for Radiation and Environmental Protection in Uranium Mining and Milling (GB 23727-2009)*.

Electromagnetic Radiation Environmental Monitoring

In 2019, the environmental electromagnetic radiation levels in 31 provinces, autonomous regions, and municipalities were below the public exposure control limits specified in the *Controlling Limits for Electromagnetic Environmental (GB 8702-2014)*. The electromagnetic radiation levels at the electromagnetic environment sensitive targets around the monitored broadcast and television transmitting facilities, power transmission and transformation facilities, and mobile communication bases were all lower than the public exposure control limits specified in the *Controlling Limits for Electromagnetic Environmental (GB 8702-2014)*.

14 Emergency Management of Nuclear and Radiation Accidents

In 2019, MEE(NNSA) reviewed and rechecked the emergency plans of civil nuclear facilities in accordance with the law, and supervised, inspected and evaluated daily emergency preparedness of nuclear facilities and comprehensive onsite emergency exercises, effectively strengthened the supervision and management of emergency preparedness of nuclear facilities. The MEE(NNSA) continually strengthened its emergency preparation and emergency response capability, and satisfactorily accomplished several nuclear and radiation emergency response tasks.

Regulation of Nuclear Facility Emergency Preparation

The MEE(NNSA) completed supervision and evaluation on the joint on-site& off-site comprehensive emergency exercises prior to the initial fuel loading of Fuqing NPP Unit 5 and Tianwan NPP Unit 5. The MEE(NNSA) completed supervision and evaluation of the comprehensive emergency exercises of 8 nuclear power bases, i.e., Ningde, Daya Bay,

Changjiang, Fanggangcheng, Yangjiang, Hongyanhe, Qinshan, and Tianwan, and other nuclear facility operators such as CIAE, CNNC Lanzhou Uranium Enrichment Co., Ltd., China North Nuclear Fuel Element Co., Ltd., CNNC Shaanxi Uranium Enrichment Co., Ltd., NPIC, and the INNET, Tsinghua University. The MEE(NNSA) systematically summarized the problems found during the special inspections, supervision and evaluation, and proposed nuclear safety management requirements.

Approval of Emergency Plans

The MEE(NNSA) reviewed and approved onsite emergency plans of civilian nuclear facilities such as Hongyanhe NPP, Ningde NPP, Qinshan NPP, Fangchenggang NPP, and CNNC Shaanxi Uranium Enrichment Co., Ltd..

Nuclear and Radiation Emergency Preparedness, Counterterrorism and Security

The MEE(NNSA) successfully convened

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the “One Belt and One Road” International Cooperation Summit Forum, the 70th Anniversary Nuclear Power Conference of the People’s Republic of China, the Second China International Import Expo, and other major nuclear and radiation emergency and security activities.

Coordinating and Guiding Provincial Ecology and Environment Authorities on Radiation Accident Emergency Exercises

The MEE(NNSA) coordinated and guided 3 Provincial Ecology and Environment Authorities of Jiangxi, Guangxi, and Yunnan Provinces (Autonomous Region) to carry out comprehensive radiation accident emergency exercises. Through the exercises, the local governments’ emphasis on radiation accident emergency work was enhanced, and the main responsibilities of the local governments in radiation emergency work were implemented. The emergency teams were comprehensively trained, the emergency plans and facilities were examined, the emergency response and handling capabilities were improved, and the radiation safety regulation was further promoted. At the same time, through onsite and video evaluations, the emergency

experience exchanges between provinces were strengthened, and ensured the effect of “replacing training with exercises, from one point to the whole area, exemplary demonstration and mutual learning”.



Figure 30. Guo Chengzhan, Vice Administrator of NNSA and Director General of Department of Nuclear Facility Safety Regulation of MEE, participates in and guides the special emergency exercises on radiation accidents in Guangxi Province

Effectively Maintaining the Emergency Response Capability

The MEE(NNSA) continued to make sound preparations on nuclear and radiation accident emergency response. A 24-hour on-duty emergency system was implemented, to ensure the effective operation of the nuclear and radiation emergency response system. The First Nuclear and Radiation Emergency Training for leaders of division-level in ecology and environment systems and nuclear operation organizations was conducted.

15 Personnel Qualification

In 2019, the MEE(NNSA) made a breakthrough in the qualification management of special process personnel, revised and issued two departmental rules and relevant supporting documents such as the *Regulations on the Qualification Management of Civil Nuclear Safety Equipment Nondestructive Testing Personnel* and the *Regulations on the Qualification Management of Civil Nuclear Safety Equipment Welding Personnel*, optimized the qualification assessment management mechanism, and conducted demonstration qualification assessments based on the new regulations. The MEE(NNSA) proposed qualification management measures for treatment facility organizations after investigation and made important progress in formulating the *Regulations on the Qualification Management of Civil Nuclear Facilities Operators*. The MEE(NNSA) organized systematic research on the practical application of the occupational qualification system and proposed a management reform plan for registered nuclear safety engineers. The MEE(NNSA) standardized business training and prepared the *Nuclear and Radiation Safety Inspector*

Business Training Program, formulated the list of graded training courses, and raised the requirements for planning implementation principles. The MEE(NNSA) published the training plan for 2019, strengthened organization planning, and improved the integration of resources. It also promoted the comprehensive integration of comprehensive administrative law enforcement documents on ecological and environmental protection and nuclear and radiation safety and optimized the qualification management of inspectors.

Qualification Management of Civilian Nuclear Facility Reactor Operators

In 2019, 4 Civilian Nuclear Facility Reactor Operator Qualification Approval Committee Meetings were held and civilian nuclear facility operator licenses were issued in 8 batches (see Table 89) by MEE(NNSA) to 1,711 operators in total, including 1,563 NPP operators and 148 civilian research reactor operators.

As of December 2019, there were 2,586

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people holding NPP operator licenses (see Table 90), including 1,401 people holding senior operator licenses, and 1,185 holding operator licenses. There were also 284 people

holding research reactor operator licenses (see Table 91), including 142 people holding senior operator licenses and 142 holding operator licenses.

Table 89. Regulatory approvals for civilian nuclear facility reactor operator license in 2019

Date	Document No.	Document
2019-02-03	NNSA [2019] 31	Notification on issuing the first batch of civilian nuclear facility reactor operator licenses (NPP) in 2019
2019-05-28	None	Notification on issuing the second batch of civilian nuclear facility reactor operator licenses (NPP) in 2019
2019-08-19	None	Notification on issuing the third batch of civilian nuclear facility reactor operator licenses (NPP) in 2019
2019-12-04	None	Notification on issuing the fourth batch of civilian nuclear facility reactor operator licenses (NPP) in 2019
2019-01-03	NNSA [2019] 29	Notification on issuing the first batch of civilian nuclear facility reactor operator licenses (nuclear research reactor) in 2019
2019-04-28	NNSA [2019] 105	Notification on issuing the second batch of civilian nuclear facility reactor operator licenses (nuclear research reactor) in 2019
2019-08-19	None	Notification on issuing the third batch of civilian nuclear facility reactor operator licenses (nuclear research reactor) in 2019
2019-12-04	None	Notification on issuing the fourth batch of civilian nuclear facility reactor operator licenses (nuclear research reactor) in 2019

Note: Document numbers have not been assigned for such documents since May 28th, 2019.

Table 90. Statistics on NPP operator license

Licensee	Nuclear Facility	Senior Operators	Operators	Subtotal
CNNC Nuclear Power Operation Management Co., Ltd.	Qinshan NPP	31	18	49
	Qinshan NPP Phase II Unit 1 and Unit 2	56	40	96
	Qinshan NPP Phase II Unit 3 and Unit 4	61	35	96
	Qinshan NPP Phase III Unit 1 and Unit 2	69	36	105
	Fangjiashan NPP Unit 1 and Unit 2	55	30	85

Personnel Qualification

continued

Licensee	Nuclear Facility	Senior Operators	Operators	Subtotal
Daya Bay Nuclear Power Operation and Management Co., Ltd.	Daya Bay NPP Unit 1 and Unit 2	72	27	99
	Ling'ao NPP Unit 1 and Unit 2	68	42	110
	Ling'ao NPP Unit 3 and Unit 4	68	33	101
Jiangsu Nuclear Power Co., Ltd.	Tianwan NPP Unit 1 and Unit 2	58	47	105
	Tianwan NPP Unit 3 and Unit 4	36	50	86
	Tianwan NPP Unit 5 and Unit 6	0	39	39
Fujian Ningde Nuclear Power Co., Ltd.	Ningde NPP Unit 1 and Unit 2	67	44	111
	Ningde NPP Unit 3 and Unit 4	53	45	98
Liaoning Hongyanhe Nuclear Power Co., Ltd.	Hongyanhe NPP Unit 1 and Unit 2	70	31	101
	Hongyanhe NPP Unit 3 and Unit 4	78	42	120
Yangjiang Nuclear Power Co., Ltd.	Yangjiang NPP Unit 1 and Unit 2	61	30	91
	Yangjiang NPP Unit 3 and Unit 4	88	22	110
	Yangjiang NPP Unit 5 and Unit 6	42	30	72
Fujian Fuqing Nuclear Power Co., Ltd.	Fuqing NPP Unit 1 and Unit 2	60	58	118
	Fuqing NPP Unit 3 and Unit 4	64	64	128
	Fuqing NPP Unit 5 and Unit 6	0	61	61
Guangxi Fangchenggang Nuclear Power Co., Ltd.	Fangchenggang NPP Unit 1 and Unit 2	97	52	149
Hainan Nuclear Power Co., Ltd.	Changjiang NPP Unit 1 and Unit 2	58	59	117
Sanmen Nuclear Power Co., Ltd.	Sanmen NPP Unit 1 and Unit 2	42	79	121
Shandong Nuclear Power Co., Ltd.	Haiyang NPP Unit 1 and Unit 2	47	102	149
Taishan Nuclear Power Joint Venture Co. Ltd.	Taishan NPP Unit 1 and Unit 2	0	69	69
Total		1401	1185	2586

Table 91. Statistics on civilian research reactor operator licenses

Licensee	Nuclear Facility	Senior Operators	Operators	Subtotal
CIAE	49-2 Swimming Pool Reactor	7	7	14
	DF-VI Fast Neutron Criticality Facility	0	0	0
	Reprocessing Pilot Plant Uranium Solution Criticality Facility	7	22	29
	Miniature Reactor Zero Power Facility	3	4	7
	China Experimental Fast Neutron Reactor	18	40	58
	China Advanced Research Reactor	18	6	24
	Miniature Reactor Zero Power Facility	3	4	7
NPIC	High Flux Engineering Test Reactor	24	16	40
	Minjiang Test Reactor	10	9	19
	China Burst Reactor	7	3	10
	High Flux Engineering Test Reactor	5	2	7
	18-5 Critical Facility	8	3	11
INNET, Tsinghua University	5 MW Experimental Low Temperature Nuclear Heating Reactor	14	13	27
	10 MW High Temperature Gas-Coded Test Reactor	17	7	24
	Shielding Experimental Reactor	1	2	3
Shenzhen University	Shenzhen Miniature Reactor	0	3	3
Beijing Capture Tech Co., Ltd.	In-Hospital Neutron Irradiator	0	1	1
Total		142	142	284

Qualification Management of Civilian Nuclear Safety Equipment Nondestructive Testing Personnel

In 2019, 4 civilian nuclear safety equipment nondestructive testing (NDT) personnel

examination plans were published. The MEE(NNSA) organized 5 NDT personnel examination centers to hold 100 batches of examinations, organized 6 level-III NDT personnel demonstration examinations, and issued 9 batches of civilian nuclear safety

equipment NDT personnel qualification certificates (see Table 92), approving a total of 2,469 people and 2,659 certificates. As of December 2019, a total of 6,223 people held 13,574 civilian nuclear safety equipment NDT qualification certificates, including 425 advanced (level III) certificates, 11,542 intermediate (level II) certificates, and 1,607 primary (level I) certificates.

According to the regulatory inspection program and work plan, MEE(NNSA) carried out 1 comprehensive inspection and 6 onsite witness inspections of 5 civilian nuclear safety equipment NDT personnel examination centers, and promptly proposed rectification requirements for problems found during the regulatory inspections.

Table 92. Regulatory approvals for civilian nuclear safety equipment NDT personnel qualification in 2019

Date	Document No.	Document
2019-04-29	NNSA [2019] 113	Notification on Issuing the First Batch of Certificates for Civilian Nuclear Safety Equipment Nondestructive Testing Personnel in 2019
2019-05-28	None	Notification on Issuing the Second Batch of Certificates for Civilian Nuclear Safety Equipment Nondestructive Testing Personnel in 2019
2019-07-04	None	Notification on Issuing the Third Batch of Certificates for Civilian Nuclear Safety Equipment Nondestructive Testing Personnel in 2019
2019-07-17	None	Notification on Issuing the Fourth Batch of Certificates for Civilian Nuclear Safety Equipment Nondestructive Testing Personnel in 2019
2019-09-09	None	Notification on Issuing the Fifth Batch of Certificates for Civilian Nuclear Safety Equipment Nondestructive Testing Personnel in 2019
2019-10-15	None	Notification on Issuing the Sixth Batch of Certificates for Civilian Nuclear Safety Equipment Nondestructive Testing Personnel in 2019
2019-10-28	None	Notification on Issuing the Seventh Batch of Certificates for Civilian Nuclear Safety Equipment Nondestructive Testing Personnel in 2019
2019-11-25	None	Notification on Issuing the Eighth Batch of Certificates for Civilian Nuclear Safety Equipment Nondestructive Testing Personnel in 2019
2019-12-31	None	Notification on Issuing the Ninth Batch of Certificates for Civilian Nuclear Safety Equipment Nondestructive Testing Personnel in 2019

Note: Document numbers are not assigned for such documents since May 28th, 2019.

Qualification Management of Civilian Nuclear Safety Equipment Welders and Welding Operators

In 2019, the MEE(NNSA) issued 4 examination plans for civilian nuclear safety equipment welders and welding operators and organized 15 civilian nuclear safety equipment welder and welding operator examination centers to hold 10 basic theoretical knowledge examinations and 102 item-based examinations. Three welding personnel demonstration examinations were organized, and 12 batches of civilian nuclear safety equipment welder and welding operator

qualification certificates (see Table 93) were issued throughout the year, and 3,182 persons and 6,062 certificates were approved. As of December 2019, a total of 9,758 people held 21,689 civilian nuclear safety equipment welder and welding operator qualification certificates.

According to the regulatory inspection program and work plan, the MEE(NNSA) carried out 7 onsite witness inspections of 15 civilian nuclear safety equipment welder and welding operator examination centers and promptly proposed rectification requirements for the problems found during the regulatory inspections.

Table 93. Regulatory approvals for civilian nuclear safety equipment welder and welding operator qualification in 2019

Date	Document No.	Document
2019-01-31	NNSA [2019] 23	Notification on Issuing the First Batch of Certificates for Civilian Nuclear Safety Equipment Welders and Welding Operators in 2019
2019-02-15	NNSA [2019] 33	Notification on Issuing the Second Batch of Certificates for Civilian Nuclear Safety Equipment Welders and Welding Operators in 2019
2019-03-13	NNSA [2019] 45	Notification on Issuing the Third Batch of Certificates for Civilian Nuclear Safety Equipment Welders and Welding Operators in 2019
2019-04-29	NNSA [2019] 112	Notification on Issuing the Fourth Batch of Certificates for Civilian Nuclear Safety Equipment Welders and Welding Operators in 2019
2019-05-28	None	Notification on Issuing the Fifth Batch of Certificates for Civilian Nuclear Safety Equipment Welders and Welding Operators in 2019
2019-07-04	None	Notification on Issuing the Sixth Batch of Certificates for Civilian Nuclear Safety Equipment Welders and Welding Operators in 2019
2019-07-17	None	Notification on Issuing the Seventh Batch of Certificates for Civilian Nuclear Safety Equipment Welders and Welding Operators in 2019
2019-09-09	None	Notification on Issuing the Eighth Batch of Certificates for Civilian Nuclear Safety Equipment Welders and Welding Operators in 2019

continued

Date	Document No.	Document
2019-09-26	None	Notification on Issuing the Ninth Batch of Certificates for Civilian Nuclear Safety Equipment Welders and Welding Operators in 2019
2019-10-28	None	Notification on Issuing the Tenth Batch of Certificates for Civilian Nuclear Safety Equipment Welders and Welding Operators in 2019
2019-11-25	None	Notification on Issuing the Eleventh Batch of Certificates for Civilian Nuclear Safety Equipment Welders and Welding Operators in 2019
2019-12-31	None	Notification on Issuing the Twelfth Batch of Certificates for Civilian Nuclear Safety Equipment Welders and Welding Operators in 2019

Note: document numbers are not assigned for such documents since May 28th, 2019.

Qualification Management of Registered Nuclear Safety Engineer

In 2019, a total of 1,609 applicants applied for the National Unified Examination for Registered Nuclear Safety Engineer Qualification, 1,065 applicants took the examination, and 174 applicants obtained the Registered Nuclear Safety Engineer Qualification. In the whole year, the MEE(NNSA) conducted 4 batches of registration of nuclear safety engineers (see Table 94), and approved 1,162 applications, including 341 new registrations and 821 renewals of registrations.

As of the end of December 2019, a total of 4,467 applicants nationwide had obtained the certificates of the Registered Nuclear Safety Engineer Qualification, and 1,707 registered nuclear safety engineers were working in 235 organizations. A total of 845 trainees were trained in 11 training courses on nuclear safety, including 170 trainees who attended 2 trainings on nuclear quality assurance and nuclear safety culture, 201 trainees who attended 3 radiation protection trainings, 273 trainees who attended 3 trainings on nuclear emergency and nuclear security, and 201 trainees who attended 3 trainings on nuclear safety law.

Table 94. Regulatory approvals for registered nuclear safety engineer qualification in 2019

Date	Document No.	Document
2019-02-11	NNSA [2019] 32	Notification on Publishing the List of Persons Approved for Registration and Renewal of Registration in the First Batch of Registered Nuclear Safety Engineers in 2019
2019-05-17	NNSA [2019] 117	Notification on Publishing the List of Persons Approved for Registration and Renewal of Registration in the Second Batch of Registered Nuclear Safety Engineers in 2019

Date	Document No.	Document
2019-08-19	None	Notification on Publishing the List of Persons Approved for Registration and Renewal of Registration in the Third Batch of Registered Nuclear Safety Engineers in 2019
2019-11-25	None	Notification on Publishing the List of Persons Approved for Registration and Renewal of Registration in the Fourth Batch of Registered Nuclear Safety Engineers in 2019

Note: Document numbers are not assigned for such documents since May 28th, 2019.

Nuclear and Radiation Safety Regulatory Inspection Personnel Training

The MEE(NNSA) strengthened top-level design, organized the preparation of the *Nuclear and Radiation Safety Regulation Business Training Program*, formulated the list of hierarchical training courses, and proposed the requirements for planning and implementation principles, so as to promote standardized and systematic business training. The MEE(NNSA) published the *2019 Annual Training Plan*, strengthened the organizational planning and resource integration, and clarified the requirements for teacher training and locations, in order to improve the training efficiency.

In 2019, 1 NNSA Nuclear Safety Advanced Training Class was held, with 51 participants. As of December 2019, the MEE(NNSA) had

held a total of 9 NNSA Nuclear Safety Primary Training Classes, with 461 participants obtaining certificates of completion; 10 Nuclear Power Training Classes (Nuclear and Radiation Safety Intermediate Training Classes), with 313 participants obtaining the certificates of completion; 9 Provincial Radiation Safety Regulatory Personnel Training Classes, with 306 participants obtaining the certificates of completion; and 3 NNSA Nuclear Safety Advanced Training Classes, with 140 people participants obtaining the certificates of completion. The MEE(NNSA) jointly held 6 postgraduate classes for a master's degree in engineering on radiation protection and environmental protection in the field of nuclear energy and nuclear technology engineering with Tsinghua University, and the classes were attended by 162 students in total.

16 International Cooperation

Took the Initiative to Expand Channels

In November, Li Ganjie, Minister of the MEE, witnessed the signing of a memorandum of understanding between the NSC and the French Institute for Radiation Protection and Nuclear Safety (IRSN). In September, Liu Hua, Vice Minister of the MEE and Administrator of the NNSA, signed the *Practical Arrangements between IAEA and NNSA on Cooperation in the Area of Nuclear and Radiation Safety*, with the Deputy Director General of the IAEA.

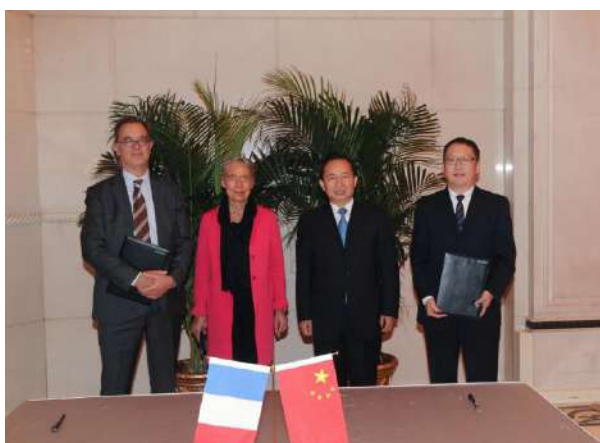


Figure 32. Li Ganjie, Minister of the MEE, witnesses the signing of a memorandum of understanding between NSC and the French IRSN

Consolidating Multilateral Cooperation and Safeguarding Important Mechanisms

Cooperation with IAEA

Liu Hua, Vice Minister of the MEE and Administrator of the NNSA, met with Najat Mokhtar, the Deputy Director General of the IAEA in Beijing in April. He led a delegation to Austria to attend the 63rd regular session of IAEA General Conference and the Senior Safety and Security Regulators' Meeting in September, to publicize the progress made by China in nuclear safety regulation and to present the *Nuclear Safety in China* white paper. He led a delegation to the Netherlands to attend the 5th International Conference on Effective Nuclear and Radiation Regulatory Systems in November, and gave a keynote speech calling on all countries to deepen bilateral and multilateral cooperation and to jointly build a global nuclear security community of common destiny. Liu Hua participated in the Commission on Safety Standards (CSS), Nuclear Safety Standards Committee (NUSSC), Transport Safety

Standards Committee (TRANSSC), Technical and Scientific Support Organization Forum (TSOF), Global Nuclear Safety and Security Network (GNSSN), Regulatory Cooperation Forum (RCF), and other important mechanisms, proactively attended regulatory meetings related to safety standards and small reactors, gave lectures, and held the CANDU Reactor Senior Regulatory Officials Meeting, playing an active role in the development of IAEA's safety standards, capacity-building, and the technology field. One person was deputed to work at the IAEA for one year.

Cooperation with the OECD-NEA

In September, Liu Hua, Vice Minister of the MEE and Administrator of the NNSA, led a delegation to attend the 13th meeting of the MDEP Policy Group, where reports by various working groups were presented, and the next year's work arrangement of MDEP and China's hosting of the 5th Mechanism Conference in 2020 were discussed. One person was deputed to work in the OECD-NEA for one year. Liu Hua was deeply involved in related activities of the MDEP, effectively organized and promoted the works of "Hualong No.1" Working Group, successfully held the third and fourth meetings of "Hualong No.1" Working Group and Technical Sub-Group Meetings, prepared relevant reports on common positions and technology, conducted specific technical discussions, and assigned

personnel to participate in the working group meetings of AP1000, EPR, VVER, etc. Liu Hua also proactively prepared for the 5th MDEP Conference, to be held in Hangzhou in October 2020.

Obligation for Fulfilling International Conventions

In February, Liu Hua, Vice Minister of the MEE and Administrator of the NNSA, attended the 6th Summary Meeting and the 7th Kick-Off Meeting of the *Joint Convention on the Safety of Spent Fuel Management and Radioactive Waste Management*. He took the initiative in establishing the 7th National Report Preparation and Review Committee of the Joint Convention of China, and proactively participated in the Working Group Meeting of the 4th Special Session of the Joint Convention.

The 8th round of implementation work of the *Convention on Nuclear Safety* was conducted in an orderly manner. Five Meetings of the National Report Preparation and Review Committee were organized, and the national report was submitted to the IAEA after it was approved by the State Council. Personnel were assigned to attend the 8th Review Officials Meeting of the Convention on Nuclear Safety, to organize the collection of reports from other parties, and to conduct the review and raise questions.

Deepening Bilateral Cooperation and Striving for Practical Results

Liu Hua, Vice Minister of the MEE and Administrator of the NNSA, attended the Joint Coordination Meeting and Workshop on the Cooperation in the Field of Nuclear and Radiation Safety Regulation between NNSA and Russian Rostekhnadzor in April, attended the 3rd Meeting of the NNSA/ONR Bilateral Steering Group in UK in November, and renewed the Nuclear Safety Regulatory Cooperation Agreement with the UK ONR. He also participated in the 12th Top Regulators' Meeting on Nuclear Safety among China, Japan, and Korea in November and met with delegations from Japan and South Korea. He also attended the Summary Meeting of the Sino-EU Nuclear Security Cooperation Project Phase II and met with the delegation from the French Institute for Radiation Protection and Nuclear Safety in December.



Figure 33. Liu Hua, Vice Minister of MEE and Administrator of NNSA, renews the Sino-UK Nuclear Safety Regulatory Cooperation Agreement with Mark Foy, Chief Supervisor of the UK Nuclear Regulatory Office

Cooperation with Developed Countries Producing Nuclear Power was Steadily Promoted

Personnel were assigned to participate in the Meeting of the Sino-US Nuclear Safety Cooperation Steering Committee and the 31st Nuclear Regulatory Cooperation Conference in the United States, to attend the Meetings of the Nuclear Subcommittee of the Chinese and Russian Prime Minister Regular Meeting Committee in Russia, to participate in the Regulatory Seminar on the Disposal of Decommissioning Wastes from Nuclear Facilities in Spain, and to attend the 4th Sino-Germany Nuclear Safety Regulatory Working Conference in Germany. The Sino-US Risk-Guided Nuclear Safety Regulatory Exchange Meeting was successfully convened, and the Sino-UK Seminar on Radioactive Waste Management and Environmental Impact Assessment was organized. Thirty-seven people attended the two-week training in the United States and Italy, and one person was assigned to attend the five-month Nuclear Research Scholar Exchange Program in Japan.

Nuclear Safety Cooperation with Countries along the “One Belt and One Road” was Strengthened

In November, Vice Minister Liu Hua and Director of the Moroccan Nuclear and Radiation Safety and Security Agency

(AMSSNuR) signed a memorandum of understanding on cooperation in nuclear and radiation safety regulation in the Hague. Personnel were sent to participate in the Sino-South Africa Nuclear Security Cooperation Working Conference in South Africa, to attend the Sino-Czech Nuclear Emergency Regulation Seminar in the Czech Republic, and to participate in the Second Sino-Vietnam Nuclear Security Cooperation Working Conference in Vietnam. Liu Hua met with the delegation from the IAEA to China composed of representatives of developing countries,

and the delegation of the Jordanian Atomic Energy Agency.

Exchanges on Supervision Experience was Strengthened

Personnel were deputed to the Pakistan Chashma NPP for the supervision of the NPP jointly established by China and Pakistan, and inspectors from South Africa, Czech Republic, and other countries were received to hold more in-depth exchanges.

17 Milestones

January 24th, 2019—the MEE(NNSA) held the 2018 Annual Nuclear and Radiation Safety Regulation Meeting in Beijing, where it summarized and reviewed the nuclear and radiation safety regulation work in 2018, and set up the working objectives and tasks for 2019.

February 21st, 2019—Liu Hua, Vice Minister of the MEE and Administrator of the NNSA, attended the 6th Summary Meeting and the 7th Kick-Off Meeting of the *Joint Convention on the Safety of Spent Fuel Management and Radioactive Waste Management* in Beijing.

February 27th, 2019—the operating licenses for Tianwan NPP Units 3 and 4 were issued.

March 10th to 17th, 2019—Zhou Shirong, Inspector of the Department of Nuclear Power Safety Regulation of MEE, participated in the Meeting of the Sino-US Nuclear Safety Cooperation Steering Committee and the 31st Nuclear Regulatory Cooperation Conference in the United States.

March 25th to 29th, 2019—Hao Xiaofeng, Deputy Director General of the Department of Nuclear Power Safety Regulation of MEE,

participated in the 3rd Meeting of MDEP HPR1000 Working Group, the Internal and External Event HPR1000 Sub-Group Meeting, and the Sino-UK Accident Analysis Seminar in the UK.

March 28th, 2019—the operating licenses for Changjiang NPP Units 1 and 2 were issued.

April 4th, 2019—the operating licenses for Taishan NPP Units 1 and 2 were issued.

April 7th to 13th, 2019—Guo Chengzhan, Vice Administrator of the NNSA and Director General of the Department of Nuclear Facility Safety Regulation of MEE, led a delegation to South Africa to participate in the 23rd Meeting of the MDEP Supplier Joint Supervision Working Group and Sino-South Africa Nuclear Safety Cooperation Working Conference.

April 15th, 2019—publicity and education activity in the field of nuclear safety was organized on the national security education day, and NNSA cooperated with “Topics in Focus” to shoot and broadcast the program “National Security: Cornerstone of the Country”, to launch the “2019 Media Nuclear

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Power Activity”.

April 23rd to 24th, 2019—Liu Hua, Vice Minister of the MEE and Administrator of the NNSA, attended the Joint Coordination Meeting on the Cooperation in the Field of Nuclear and Radiation Safety Regulation between NNSA and Russian Rostechnadzor in Beijing.

April 25th, 2019—Liu Hua, Vice Minister of the MEE and Administrator of the NNSA, met with Juan Carlos Rentiho, Deputy Director General of IAEA.

April 28th, 2019—the operating licenses for Yangjiang NPP Units 3 and 4 were issued.

April 28th, 2019—the operating licenses for Yangjiang NPP Units 5 and 6 were issued.

June 28th, 2019—Liu Hua, Vice Minister of the MEE and Administrator of the NNSA, met with Anwar Habib, former Chairman of Pakistan’s Nuclear Regulatory Authority, in Beijing.

July 8th, 2019—Li Ganjie, Minister of the MEE, and Liu Hua, Vice Minister of the MEE and Administrator of the NNSA, visited the National Nuclear and Radiation Safety Regulatory Technology Research and Development Base to organize the “Adhering to the Original Intention and Undertaking the Mission” research activity.

July 9th to 11th, 2019—Liu Hua, Vice Minister of the MEE and Administrator of the NNSA, attended the Seminar on Regulatory Inspection of Nuclear and Radiation Safety,

and the Advanced Seminar on Supervision of Nuclear and Radiation Safety in Yantai.

July 9th to 11th, 2019—Liu Hua, Vice Minister of the MEE and Administrator of the NNSA, attended the Training Course for Nuclear Safety Coordination Mechanism Liaison Officers in Yantai.

July 11th, 2019—the Review Opinions on Siting of Hainan Changjiang Multipurpose Modular Small Reactor Technology Demonstration Project was issued.

July 17th to 21st, 2019—Tang Bo, Vice Administrator of the NNSA and Director General of the Department of Nuclear Power Safety Regulation of MEE, led a delegation to Russia to attend the 23rd Meeting of the Nuclear Subcommittee of the Sino-Russia Prime Minister Regular Meeting Committee.

July 25th, 2019—the First Plenary Meeting of the National Nuclear Safety Expert Committee was held in Beijing. Li Ganjie, Minister of the MEE attended the meeting and gave a speech.

September 3rd, 2019—the State Council Information Office issued the *Nuclear Safety in China* white paper, with Liu Hua, Vice Minister of the MEE and Administrator of the NNSA, Guo Chengzhan, Vice Administrator of the NNSA and Director General of the Department of Nuclear Facility Safety Regulation of MEE, and Xi Yanchun, spokesman of the State Council Information Office, attending the Press Conference.

September 15th to 20th, 2019—Liu Hua, Vice Minister of the MEE and Administrator of the NNSA, attended the 63rd IAEA General Conference, Senior Safety and Security Regulators' Meeting, and the 13th meeting of MDEP Policy Group in Austria.

September 18th, 2019—Liu Hua, Vice Minister of the MEE and Administrator of the NNSA, met with Juan Carlos Rentiho, Deputy Director General of IAEA in Vienna, and signed a practical arrangement on cooperation in the area of nuclear and radiation safety.

September 22nd, 2019—the opening ceremony of the new office of the Ministry of Ecology and Environment of the People's Republic of China (National Nuclear Safety Administration) was held.

September 30 to October 6, 2019—Jiang Guang, Vice Administrator of the NNSA and Director General of the Department of Radiation Source Safety Regulation of MEE, led a delegation to Morocco to participate in the 3rd International Regulators Conference on Nuclear Security of IAEA.

October 8th, 2019—the operating licenses for Fujian Ningde NPP Units 3 and 4 were issued.

October 9th, 2019—the construction licenses for Fujian Zhangzhou NPP Units 1 and 2 were issued.

October 11th, 2019—Liu Hua, Vice Minister of the MEE and the Administrator of NNSA, met with Patrick Friedman, current president of US

Westinghouse Electric Corporation in Beijing.

October 14th, 2019—Tang Bo, Vice Administrator of the NNSA and Director General of the Department of Nuclear Power Safety Regulation of MEE, met with the IAEA delegation to China in Beijing.

October 21st, 2019—Liu Hua, Vice Minister of the MEE and Administrator of the NNSA, met with Miroslav Pinak, Department of Nuclear Safety and Security of IAEA, in Beijing.

October 21st to 22nd, 2019—Tang Bo, Vice Administrator of the NNSA and Director General of the Department of Nuclear Power Safety Regulation of MEE, participated in the 13th meeting of the MDEP VVER Working Group and Sino-Russia VVER-1000 Operation Safety Supervision Seminar in Suzhou.

October 23rd, 2019—Tang Bo, Vice Administrator of the NNSA and Director General of the Department of Nuclear Power Safety Regulation of MEE, attended the 11th meeting of the Sino-Pakistan Nuclear Safety Cooperation Steering Committee in Suzhou.

October 25th, 2019—Hao Xiaofeng, Deputy Director General of the Department of Nuclear Power Safety Regulation of MEE, met with Kamal Araki, Vice Chairman of the Jordanian Atomic Energy Commission, in Beijing.

November 3rd to 10th, 2019—Liu Hua, Vice Minister of the MEE and Administrator of the NNSA, visited Netherlands to attend the 5th I

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International Conference on Effective Nuclear and Radiation Regulatory Systems, and visited the UK to attend the 3rd Meeting of the NNSA/ONR Bilateral Steering Group.

November 4th, 2019—Liu Hua, Vice Minister of the MEE and Administrator of the NNSA, met with Kama Murabit, Director of Moroccan AMSSNuR, in Hague, and signed a memorandum of understanding between China and Morocco in nuclear and radiation safety supervision cooperation.

November 6th, 2019—Li Ganjie, Minister of the MEE, attended the signing ceremony of the memorandum of cooperation between NSC and the French Institute of nuclear Safety and Radiation Protection (IRSN) in Beijing.

November 7th, 2019, Kang Yufeng, Deputy Director General of Department of Radiation Source Safety Regulation of the MEE, and Ren Hongyan, Director of the NSC, attended the Sino-France Nuclear Safety Seminar in Beijing.

November 18th, 2019—Pan Su, Deputy Director General of Department of Radiation Source Safety Regulation of the MEE, attended the Sino-UK Bilateral Seminar on Radioactive Waste Management and Environmental Impact Assessment in Beijing.

November 28th, 2019—Liu Hua, Vice Minister of the MEE and Administrator of the NNSA, attended the 12th Top Regulators' Meeting on Nuclear Safety among China, Japan and Korea in Beijing.

November 28th, 2019—Liu Hua, Vice Minister of the MEE and Administrator of the NNSA, met with Mr. Yoshihiko, Vice Chairman of the Japan Atomic Force Regulatory Commission, in Beijing.

November 28th, 2019—Liu Hua, Vice Minister of the MEE and Administrator of the NNSA, met with Zhang Puxuan, Secretary General of the South Korean Nuclear Safety and Security Commission in Beijing.

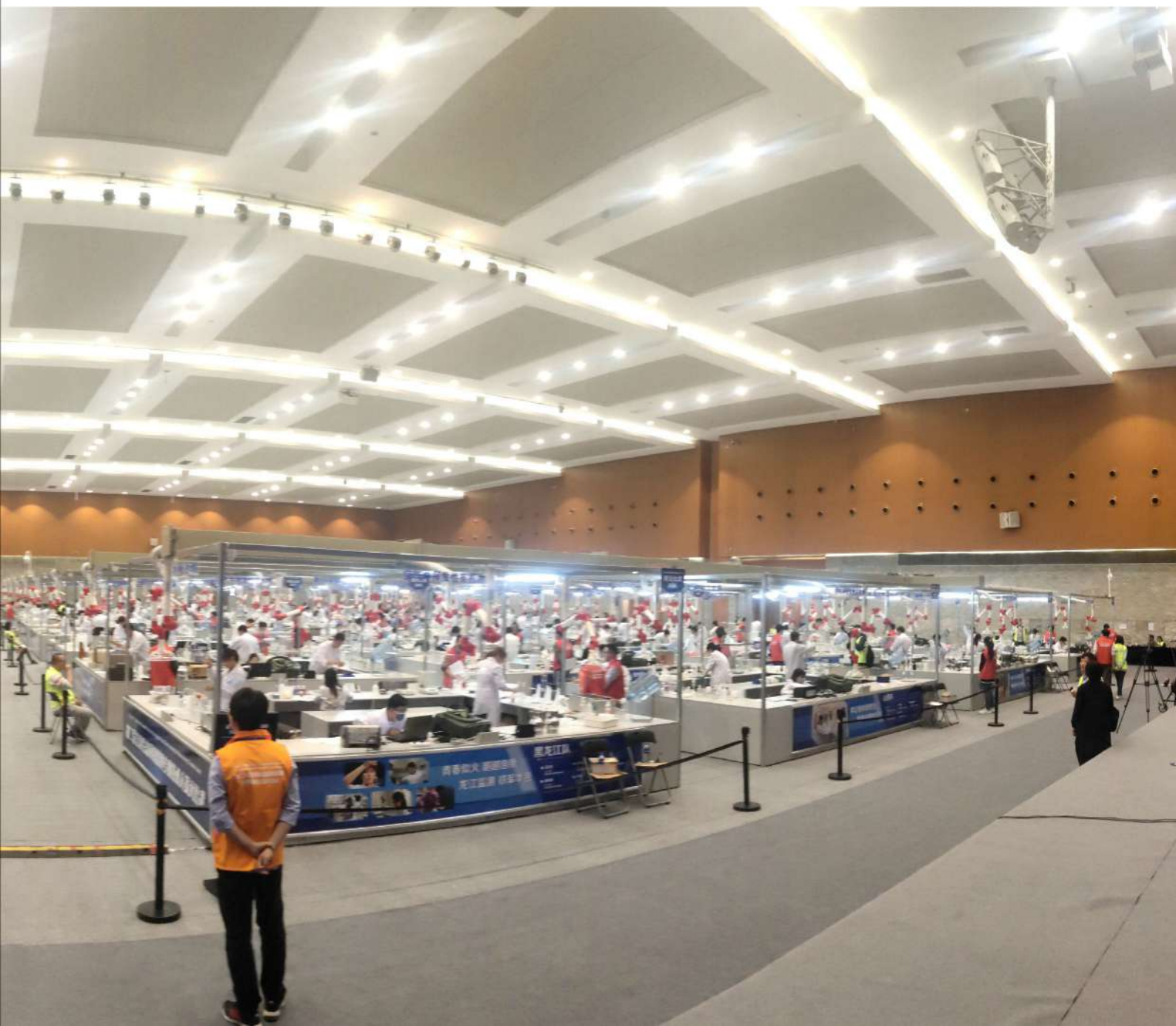
December 5th, 2019—Liu Hua, Vice Minister of the MEE and Administrator of the NNSA, attended the Summary Meeting of Sino-EU Nuclear Safety Cooperation Project Phase II in Beijing.

December 5th, 2019—Liu Hua, Vice Minister of the MEE and Administrator of the NNSA, met with Long Shang, Deputy Director of the French Nuclear Safety Administration, in Beijing.

December 19th, 2019—Tang Bo, Vice Administrator of the NNSA and Director General of Department of Nuclear Power Safety Regulation of the MEE, met with a delegation which included the Deputy Secretary General of the Hong Kong Security Bureau, in Beijing.

December 20th, 2019—the operating licenses for Liaoning Hongyanhe NPP Units 3 and 4 were issued.

December 25th, 2019—the construction licenses for Guangdong Taipingling NPP Units 1 and 2 were issued.





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