

The Nuclear Safety Regulation on Research Reactors in China

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1. Preface

Since its creation in 1984, the National Nuclear Safety Administration (NNSA) has put emphasis on the safety regulation on nuclear power plants during their period of design, construction, commissioning and operation. Besides, NNSA has also gradually implemented a lot of regulatory activities to other civilian nuclear installations such as research reactor, nuclear fuel fabrication factory, radioactive waste reprocessing and disposal facility.

More exactly from 1988, the NNSA as the nuclear regulatory body began to implement the surveillance and control on the nuclear safety of civilian research reactors in China. With the active coordination of the operating organizations during past years, the safety regulatory activities have been smoothly conducted, and have achieved a considerable success, thereby the safety level of research reactors in China has been improved a lot.

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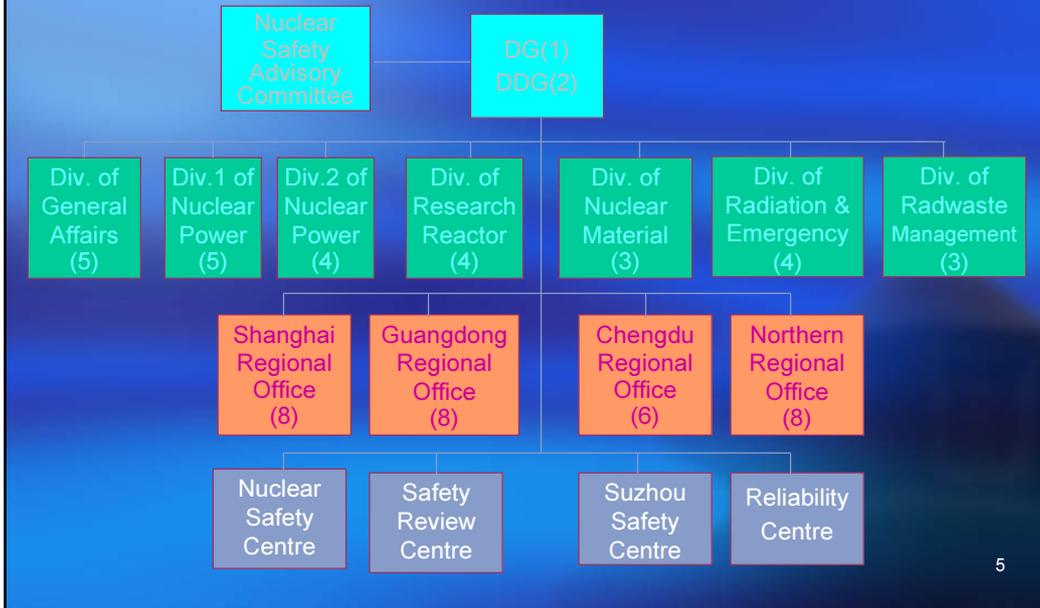
1.1 The Present Status of RRs in China

RRs Location in China



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1.2 The Organization of Regulatory Body in China (NNSA)



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2. The Fundamental Safety Policy for RRs Regulation in China

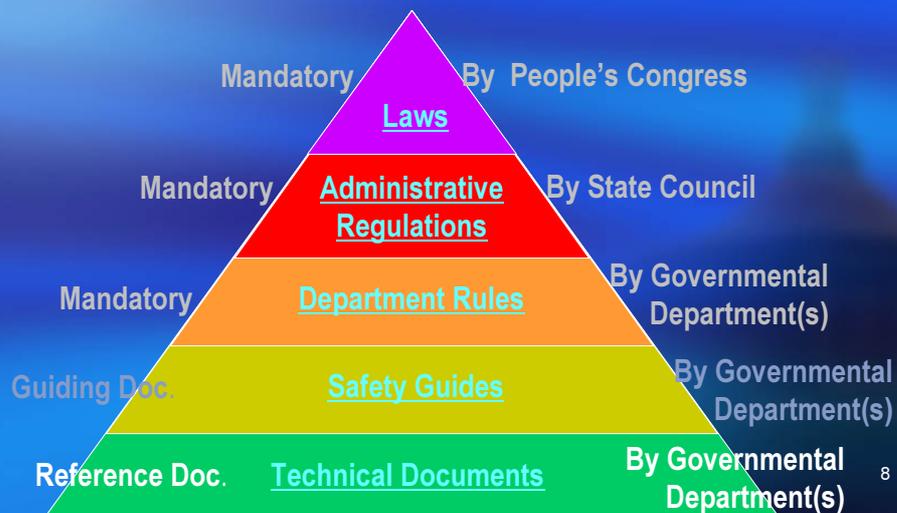
The fundamental safety policy for research reactor regulation in China basically is the same as the safety policy for nuclear power plants, and it can be described briefly as follows:

- **Based on**
 - *The “as low as reasonably achievable (ALARA)” principle for normal operation
 - *The “defense in depth” principle for deviations from normal operation
- **Prevent of**
 - *The occurrence of anomalies
 - *The escalation of anomalies into accidents
 - *The excessive release of radioactive materials into environment
- **Through**
 - *The establishment of safety guides and standards
 - *The suitable site selection and safety design
 - *The quality assurance for manufacturing, construction and operation
 - *The periodic testing and inspection, etc.

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3. The Legislation on RRs in China

The Hierarchy of Legislation in China



The Legislation on RRs in China

- ★ **National Laws:** Radioactive Pollution Control Act
 - Approved and promulgated by Committee of the National People's Congress on June 28, 2003
- ★ **Administrative Regulations:**
 - Regulations on the Safety Regulation for Civilian Nuclear Installations
 - Regulations on Nuclear Materials Control
 - Emergency Management Regulations for Nuclear Accidents of NPP

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The Legislation on RRs in China

Regulations on the Safety Regulation for Civilian Nuclear Installations

- Promulgated by the State Council on October 29, 1986
- Facilities to be Regulated
- Responsibilities of Every Relevant Organization
- Licensing System
- Advisory Committee on Nuclear Safety
- Public Hearing Mechanism
- Review and Appeal Mechanism
- Enforcement

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The Legislation on RRs in China

The national laws and the administrative regulations are suitable for all nuclear installations, however the department rules for research reactors have only three:

(1) Code on the safety of research reactor design

(HAF201) issued by NNSA on June 6, 1995.

(2) Code on the safety of research reactor operation

(HAF202) issued by NNSA on June 6, 1995.

(3) Code on the Application and Issue of the Safety Licenses of research reactor

issued by NNSA on March 1, 2006

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The Legislation on RRs in China

Code on the safety of research reactor design (HAF201)

- Promulgated by NNSA on June 6, 1995
- Safety objectives
- Siting requirements
- General design requirements
- Specific design requirements

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The Legislation on RRs in China

Code on the safety of research reactor operation (HAF202)

- Promulgated by NNSA on June 6, 1995
- Responsibilities for safe operation
- Safety analysis for operation
- Operational limits and conditions
- Operating procedures
- Commissioning
- Maintenance, periodic testing and inspection
- Management of core and fuel

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The Legislation on RRs in China

Code on the safety of research reactor operation (HAF202)

- Records and reports
- Reactor utilization
- Modification
- Radioactive wastes
- Radiation protection
- Emergency planning
- Security
- Quality assurance
- Decommissioning

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The Legislation on RRs in China



Guiding documents:

- (1) **Format and contents of the safety analysis report for research reactors** (HAF1001) issued by NNSA on Dec.16, 1996
- (2) **Management of research reactors for safe operation** (HAF1002) issued by NNSA on April 3, 1989
- (3) **Management of critical assemblies for safe operation and experiment** (HAF1003) issued by NNSA on April 3, 1989
- (4) Decommissioning of research reactors and critical assemblies** (HAF1004) issued by NNSA on April 18, 1992
- (5) **Application and modification of research reactors** (HAF1005) issued by NNSA on Dec.16, 1996
- (6) **Emergency plan and preparedness of research reactors** (HAF1006) issued by NNSA on Aug.27, 1991

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The Legislation on RRs in China



Technical Documents (for RRs Decommissioning) :

- **Methodology and Technology of Decommissioning Nuclear Facilities**(HAF-J0063)
- **Factors Relevant to the Decommissioning of Land-Based Nuclear Reactor Plants**(HAF-J0064)
- **Format and Content of the Safety Analysis Report for Research Reactor Decommissioning**(HAF-J0072)

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4. The Nuclear Safety Regulatory Model on RRs in China

According to the Regulations on the Safety Regulation for Civilian Nuclear Installations of the People's Republic of China promulgated in 1986, on behalf of the State Council, the NNSA exercises the safety regulation to all civilian nuclear installations, including civilian nuclear research reactors. Adopting also a safety licensing system for research reactors as for nuclear power plants, the NNSA is responsible for examining and approving the granting of safety licenses, carrying out the inspection and enforcement during the five major stages of research reactor design, construction, commissioning, operation and decommissioning.

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4.1 Documents Review

In terms of the regulatory requirements, the applicant of research reactor shall submit the application and the attached documents to the NNSA one to twelve months before the beginning of every stage. The NNSA should make response whether the application is accepted or not within one month after receiving these documents.

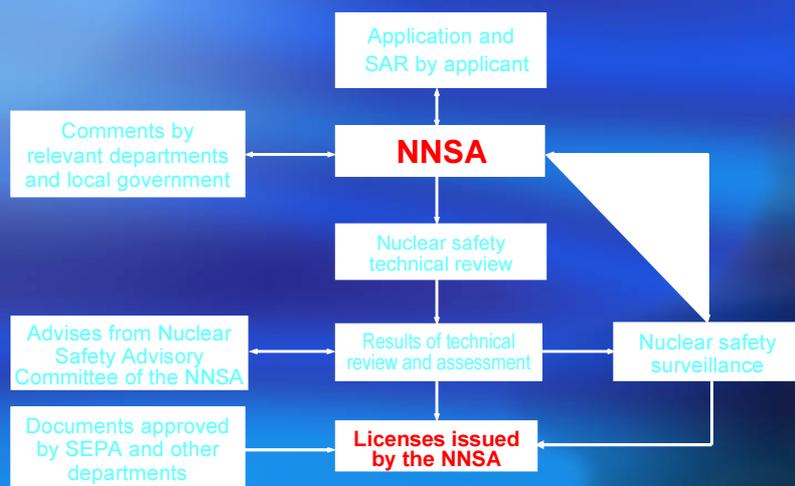
The NNSA will organize a reviewing team which is composed by experts from the technical supporting units for executing the evaluation on the relevant documents forthwith after the acceptance of the application. Review questions will be sent to and responses be received from the applicant. Generally, there are two or three review dialogue meetings held by the NNSA in which the reviewing team and the applicant will discuss and resolve any problems or disputes unsolved during the process of questions and responses. Finishing the technical review, the reviewing team shall provide the comments to the NNSA.

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On the basis of the review and assessment comments, the NNSA shall consider the opinions of other administrative aspects, form the review conclusions, and then submit the conclusions to the Nuclear Safety Advisory Committee (NSAC). The committee will assess the conclusions and provide valuable advice. At last, the NNSA makes the decision to issue the safety license to the applicant or not.

Because of the specified uses, there are often a number of experiments, utilization and modifications in the operation process of research reactors. For these experiments, utilization and modifications which have major safety significance to the reactor safety, they shall be subjected to the similar application, review and approval procedure as above safety licensing procedure.

The Procedure of Application and Issuing of Licenses



Instrument of Ratification for RR Decommissioning

- *There are two instruments of ratification for decommissioning of research reactor, namely, “Ratification for the Beginning of Decommissioning of Research Reactor” and “Ratification for the Final Decommissioning of Research Reactor”.*
- Before implementing the decommissioning work, the applicant shall submit to the NNSA :
 - *a. Safety Analysis Report of RR Decommissioning*
 - *b. Instrument of ratification of the environmental impact statement for Decommissioning of RR*
 - *c. Quality Assurance Programme (in the decommissioning stage)*
- After finishing the review on above documents, the NNSA will issue :
 - “Instrument of Ratification for the Beginning of Decommissioning of RR”
 - After finishing the decommissioning work, the applicant will submit to the NNSA “Decommissioning Report of RR” for evaluation, and then the NNSA will grant:
 - “Instrument of Ratification for the Final Decommissioning of RR”

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4.2 inspections

- According to the regulations, the NNSA shall carry out the inspections on the issues relevant to nuclear safety during the entire process of design, construction, commissioning, operation and decommissioning of research reactor.
- The inspections on research reactors are classified into *Daily inspections, Routine inspections and Non-routine inspections*. The daily inspections on research reactors as on nuclear power plants are also exercised primarily by the regional offices of NNSA. However, there is somewhat difference between research reactor daily inspections and nuclear power plants daily inspections, that the NNSA or its regional offices don't send daily resident inspectors on site for operational research reactors like for nuclear power plants. Generally, the daily inspections on operational research reactor mean daily or weekly or monthly or seasonally. The routine inspections and non-routine inspections are normally conducted by the NNSA headquarter, but sometimes by the regional offices.

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- On the basis of experiences of the inspections carried out on research reactors during several past years, the NNSA is planning to formulate a set of nuclear safety inspection programmes and procedures for the five major stages of design, construction, commissioning, operation and decommissioning, in order to increase standardization, decrease blindness and randomness of the research reactor inspections. So far, the inspection programmes and procedures concerning research reactor building structure construction, operation and decommissioning have already been drafted, and now are coming into being implemented.
- Regarding to the inspections *in the stage of research reactor building structure construction*, the inspecting items and frequency are as follows:

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Inspecting Items and Frequency in the Stage of RR Decommissioning

- QAP Implementation : yearly
- Removal of fuel : when necessary
- Decontamination and washing : when necessary
- Dismantlement : when necessary
- Radiation monitoring : yearly
- Radioactive waste management : yearly
- Safeguard : yearly
- Final status of decommissioning : when necessary

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The main methods of the nuclear safety inspections on research reactors include:

- a. Examination of documents and records
- b. On-the-spot observation
- c. Interviews and informal discussion
- d. Test verification and measurements
- e. etc.

In accordance with the national nuclear safety regulations, the inspector for research reactor should obtain the **“Nuclear Safety Inspector Certificate”** from the NNSA through the qualification assessment, training and examination, and then can carry out the inspection tasks in the name of the NNSA.

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5. Safety Challenges Encountered of the Research Reactors

5.1 Inborn safety deficiency

- The specifications and safety criteria existing at that time was far away from modern standards, so the design and construction were of course imperfect and had some back fittings. Their safety deficiency was inborn even the reactors had undergone some major refurbishments.

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5.2 Relative lack of human and budget resources

- At the beginning, the operating organization was constituted by young people, highly enthusiastic about the promises of nuclear energy; some of them had undergone training abroad (in the former Soviet Union). Sufficient budget was available, as the country wanted to acquire its own know-how in reactor technology. But nowadays China has a big nuclear power program and many experienced people were recruited by nuclear power plant, few experienced people left the reactor and many young inexperienced people had to be hired.

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5.3 Aging and material degradation problem

- In recently years, some problems due to aging and material degradation were discovered. For example, the primary heat exchangers of the HWRR had to be replaced due to accelerated corrosion.

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6. Safety Activities in China for Research Reactor Decommissioning

- At present, the HWRR and the Shanghai Miniature Neutron Source Reactor are planning to decommission.

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- In the end of 2007, the HWRR will be shut down. CIAE, the operating organization of the HWRR, has participated in a Agency's Technical Cooperation Project since 2003. The project offered the expert service, technical visit and training for decommissioning for HWRR. Now CIAE is preparing the decommissioning plan and program for it.

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- For Miniature Neutron Source Reactor (Shanghai), the main reason lead it to decommission is the groundwork of the reactor hall is going down because of the construction activities near the reactor and the lower groundwater in Shanghai. They plan to submit the safety analysis report of the removing, transporting and storing of the reactor core in July.

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Thanks!

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