中华人民共和国生态环境部
Ministry of Ecology and Environment of the People's Republic of China

Regulatory Practice on the FOAK HPR1000

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Outline

- Overall status of the projects
- Regulatory practice
- Regulatory Experience and Challenges

Overall status of the projects

As a third generation nuclear power technology developed by China with independent intellectual property rights, HPR1000 nuclear power projects has been successfully constructed and operated.

Fuqing-5/6

Please refer to the following website for details:
http://spi.mee.gov.cn:8080/spi/

Overall status of the projects

I. Operational project

Fuqing-5/6

- Fuqing-5/6 are generally operating well, with 5 WANO indicators of Unit 5 and 12 WANO indicators of Unit 6 reaching the advanced level.
- The refueling outage was carried out as planned in a safe and controllable manner,the safety and reliability of HPR1000 reactors was confirmed

Fangchenggang-3

- The construction of Fangchenggang-3 commenced on December 24, 2015, and the first fuel loading began on December 9, 2022.
- On January 10, 2023, it first connected to the grid for power generation.

Karachi K-2/K-3

- Karachi K-2/K-3 is the largest nuclear power plant in Pakistan, with CNOS as the general contractor.
- On February 2, 2023, two units K-2/K-3 were officially delivered to Pakistan.

Overall status of the projects

II. The UK Generic Design Assessment of the UK HPR1000 Projects

The HPR1000 GDA was officially launched on January 19, 2017, and it took five years to complete the four stages of review.

On January 19th, 2022, the Office for Nuclear Regulation (ONR)and the Environment Agency (EA) officially issued a Design Acceptance Confirmation(DAC) and a Statement of Design Acceptability(SoDA).

Office for Nuclear Regulation

ONR-GDA-DAC-22-001

GENERIC DESIGN ASSESSMENT

DESIGN ACCEPTANCE CONFIRMATION

FOR THE UK HPR1000 NUCLEAR REACTOR

The Office for Nuclear Regulation (ONR), in accordance with the document 'New Nuclear Reactors: Generic Design Assessment Guidance to Requesting Parties for the UK HPR1000', ONR-GDA-GD-001 Revision 4, October 2019, hereby gives China General Nuclear Power Corporation, Électricité de France S.A., and General Nuclear International Limited a Design Acceptance Confirmation (DAC) for the UK HPR1000 nuclear reactor.

This DAC:

1. is given following the assessment of the material included in the Generic Design Assessment (GDA) submissions described in the Annex;
2. does not guarantee that ONR will grant permission for the construction of a power station based on the UK HPR1000 nuclear reactor design at a particular site in Great Britain. Any organisation intending to build and operate a UK HPR1000 reactor in Great Britain must first obtain from ONR a nuclear site licence, as required under the Nuclear Installations Act 1965; and
3. is valid for a period of ten years beginning on the date on which it is issued.

Signed

Date of issue

19th January 2022

Mr Mark Foy
Chief Executive and Chief Nuclear Inspector
Office for Nuclear Regulation

Environment Agency

Generic Design Assessment
of nuclear power plant designs

Statement of Design Acceptability
for the UK HPR1000

Requesting Party:
China General Nuclear Power Corporation
Électricité de France S.A.
General Nuclear International Limited

The Environment Agency has undertaken a Generic Design Assessment of the UK HPR1000 nuclear power plant design as submitted by General Nuclear System Limited acting for the requesting party China General Nuclear Power Corporation, Électricité de France S.A. and General Nuclear International Limited

The Generic Design Assessment was carried out during the period January 2017 to January 2022 in accordance with the process set out by the Environment Agency in its guidance document 'Process and Information Document for Generic Assessment of Candidate Nuclear Power Plant Designs [1].

The conclusions and outcome of the Environment Agency's assessment is summarised in **Generic design assessment of the UK HPR1000 design - Decision document** [2]

The Environment Agency is satisfied that the Requesting Party has demonstrated the acceptability for environmental permitting in England of the UK HPR1000 on the generic site, as defined in Schedule 1 to this Statement of Design Acceptability. This statement is provided as advice to the Requesting Party, under section 37 of the Environment Act 1995.

This statement will remain valid for ten years from the date of issue. This is subject to any significant relevant new information which arises during that period which necessitates review or revision of the assessments carried out for this Generic Design Assessment for the UK HPR1000.

Provision of this Statement of Design Acceptability by the Environment Agency does not guarantee that any site-specific applications for environmental permits for the UK HPR1000 will be successful.

S J Price Finnerty

Saffron Price-Finnerty
Manager, Nuclear Regulation Group (North)
Authorised on behalf of the Environment Agency

10 January 2022

DAC and SoDA

Overall status of the projects

III. Construction projects

There are 10 HPR1000 nuclear power units under construction in China.

The FCD of Zhangzhou-1

NNP	Unit	ID	FCD
Fangchengang	Unit 4	CN56	2016/12/23
Zhangzhou	Unit 1	CN59	2019/10/16
	Unit 2	CN60	2020/9/4
TaiPingLing	Unit 1	CN61	2019/12/26
	Unit 2	CN62	2020/10/15
San'ao	Unit 1	CN63	2020/12/31
	Unit 2	CN64	2021/12/30
ChangJiang	Unit 3	CN65	2021/3/31
	Unit 1	CN66	2021/12/28
Lufeng	Unit 5	CN76	2022/9/8

Regulatory practice

I. Improve regulation system

NNSA has established a relatively complete nuclear safety regulatory system based on the standards issued by the IAEA.

The current regulatory system consists of :

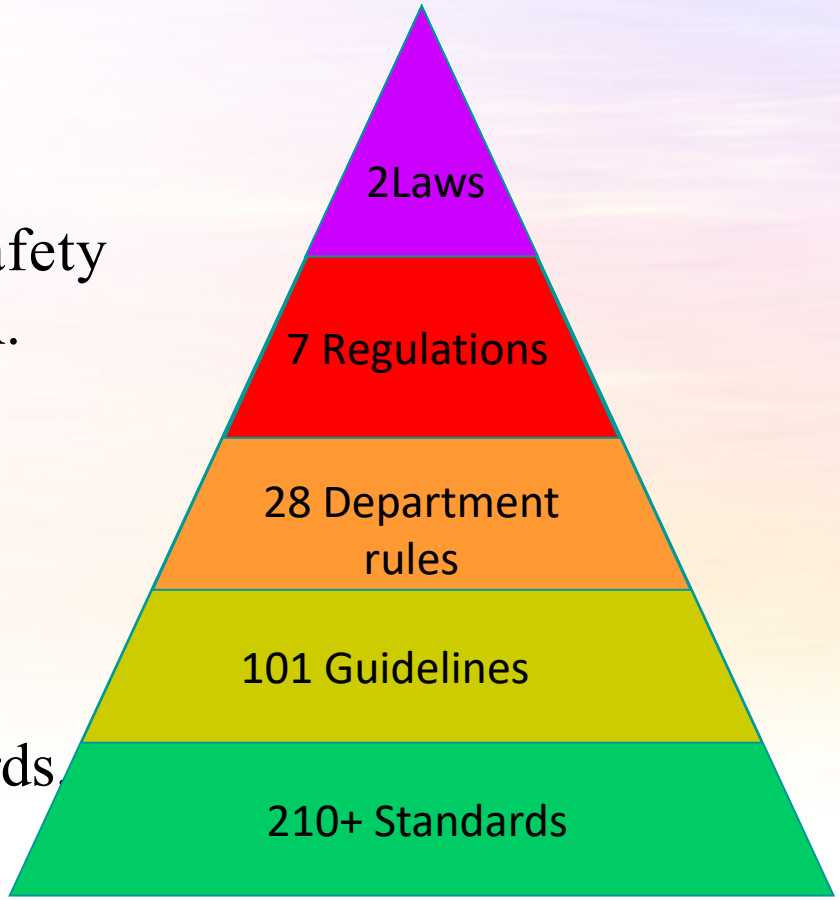
2 laws

7 administrative regulations

28 departmental rules

101 guidelines

33 national mandatory standards and 183 industry standards.



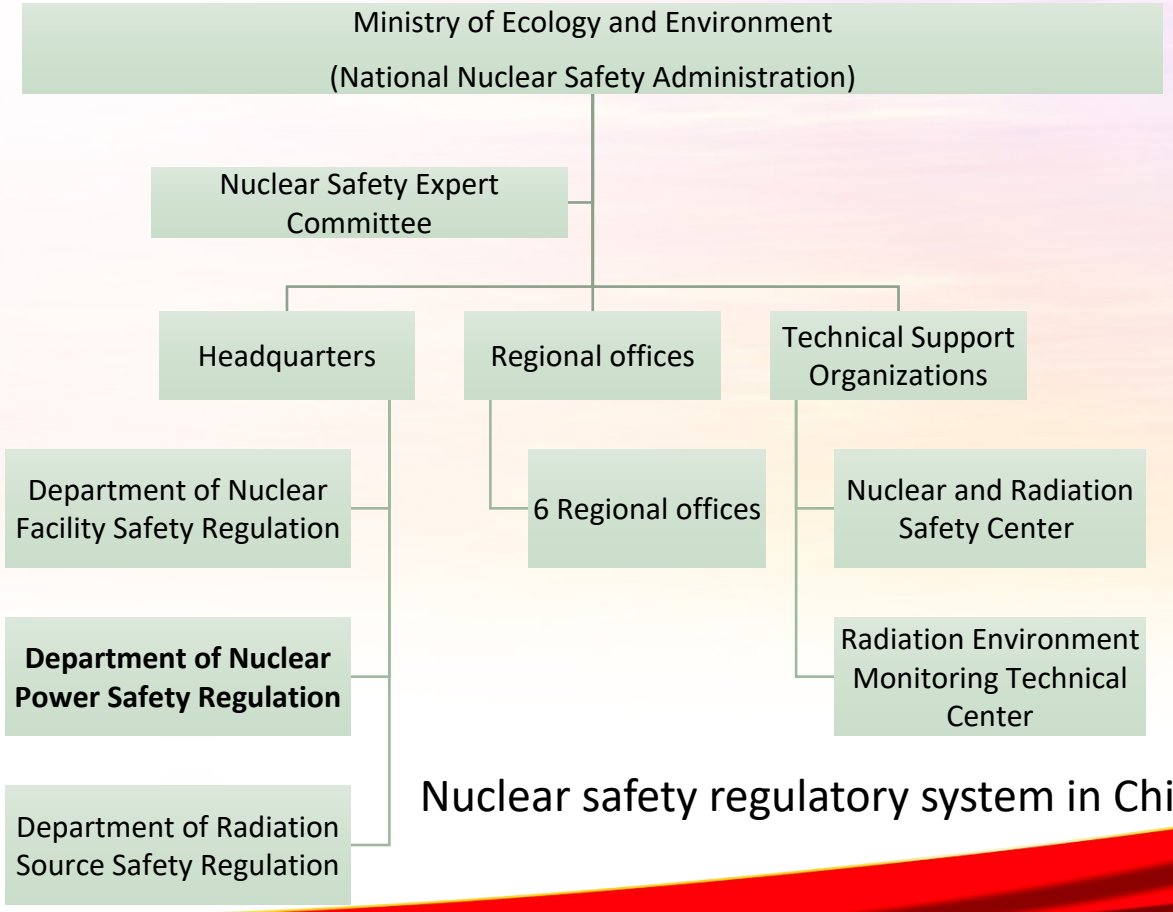
Regulatory system in China

Regulatory practice

I. Improve regulation system

NNSA performs independent nuclear safety regulation on civil nuclear facilities, ensuring that nuclear safety decisions are not affected by any nuclear power development department.

NNSA sets up 6 regional nuclear and radiation safety regulation offices to conduct on-site inspection.



Nuclear safety regulatory system in China

Regulatory practice

II. Strict Review

In construction license review：

Technical groups were organized to conduct detailed review of FOAK HPR1000 Project.

Special teams： experts from domestic design institutes, research institutes, and universities

Three special topic reviews were conducted, include: Adequacy of testing and suitability of computer programs, seismic design and containment structural integrity, active and passive safety system design

Independent calculations

Test witnessing

Regulatory practice

II. Strict Review & Special Examination

In operation license review

NNSA organized a technical force of over 130 people

Reviewed 9 technical documents such as the Final safety analysis report

Reviewed 13 special problems reports and 5 FOAK reactor test procedures

Formed 27 review comments

Finished 1 independent verification calculation report

The review results showed that HPR1000 adopts a safety design that combines active and passive features, and utilizes complete accident prevention and mitigation measures to meet the requirements of nuclear safety regulations and standards.

Regulatory practice

III. Whole-process Oversight

The Nuclear Safety Inspection Program for HPR1000 Nuclear Power Unit under Construction is prepared and issued, making sure that:

Firstly, activities during construction are verified to meet the requirements, and defects and abnormal conditions are urged to be correctedpromptly.

Secondly, quality assurance program is verified for its implementation effectiveness from several aspects: organization, design, procurement, nonconformities, corrective measures, records, and supervision and so on.

Regulatory practice

III. Whole-process Oversight

From FCD to its official commercial operation of FOAK HPR1000, NNSA (include the Eastern Office) organized 64 inspections, highlighting a total of 112 requirements.

At the same time, the implementation of management requirements was tracked to confirm that the management requirements were effectively implemented.

2019-6-24 Main pipeline welding completed For FuQing6

Regulatory practice

IV. Strengthen commissioning test surveillance

A total of 81 surveillance tests were selected, which were 57 tests before the first fuel loading (including 4 FOAK reactor tests) and 24 after the first fuel loading (including 1 FOAK reactor test).

For the FOAK reactor tests, NNSA organized teams to review the test procedures, prepare inspection procedures, and conduct test surveillance.

In addition, the Eastern Office also supplemented and reviewed more than 130 commissioning reports.

Regulatory practice

IV. Strengthen commissioning test surveillance

The review and surveillance results indicate that the FOAK reactor tests results meet the acceptance criteria, and the overall tests has reached the original goal.

2019-4-27
Cold hydrostatic test completed for FuQing 5

2019-8-31
Turbine turning gear available for FuQing 5

Regulatory practice

V. Strengthening International Cooperation

Relevant international conventions are actively implemented
The development trend of international nuclear safety is closely tracked
Continuous improvement
Strengthened cooperation with the IAEA and OECD NEA

2016-10-17
visit to AP1000
HaiYang1

2018-4-2
visit to FOAK
HPR1000
FuQing5

Regulatory Experience and Challenges

I. Transparency, sharing and cooperation

Nuclear safety has no national boundaries.

Transparency, sharing, and cooperation are also the core concepts of the MDEP organization.

All countries should maintain a transparent attitude towards nuclear safety information, share experiences, strengthen communication and cooperation, and jointly deal with various nuclear safety challenges.

The FOAK of AP1000, EPR, and HPR1000 projects were all put into operation in China. China has actively shared relevant experiences, and provided assistance to other countries.

Regulatory Experience and Challenges

II. Strengthen cooperation and establish stable nuclear safety regulatory policies

Globalization of the industrial chain of nuclear power design, construction, and operation is deepened.

MDEP provides an efficient and flexible platform for new design issues.

Stable nuclear safety regulatory policies are required, especially for new technologies.

Intenetional cooperation can promote technological progress .

Technical standards should not be used as barriers, but should actively promote mutual recognition of technical standards.

Regulatory Experience and Challenges

III. Provide experience feedback and leverage the demonstration role of FOAK projects

FOAK is to provide construction experience and improvement directions for the subsequent large-scale construction， then the designer can improve and optimize the design.

NNSA established a nuclear power plant experience feedback platform.

HPR1000 have been optimized in subsequent projects.

NNSA has formulated *the nuclear safety review principles for the HPR1000* based on these practices..

Regulatory Experience and Challenges

IV. Risks to the safety and stability of the supply chain

A series of counterfeiting incidents has been exposed in the world recently.

China also experienced several similar problems, resolved at a high cost.

In addition, the unstable international practice has also posed challenges to the supply chain.

Due to the unique features of nuclear projects, nuclear safety requires countries to take measures and strengthen cooperation.

Regulatory Experience and Challenges

V. The Challenge of Network Security in Nuclear Power Plant

Digital instrument and control systems are widely used, that bring potential network security issues.

China has also taken a series of measures in the field of cybersecurity and formulated relevant standards.

However, there is still a lack of specialized standards and regulatory requirements to guide the cybersecurity work of nuclear power plants internationally.

We hope to jointly promote technological progress through international cooperation.

Thank you for your attention!