

# **Licensing Process for Nuclear Power Plants in Pakistan and its comparison with other Countries**

Javed Iqbal <sup>a\*</sup>, Kwang Sik Choi <sup>b</sup>

<sup>a</sup>KINS-KAIST International Nuclear Safety Masters Degree Candidate, Department of NQe, KAIST

<sup>b</sup>KINS, Adjunct Professor at KAIST

\*Corresponding author: [javed\\_pnra@yahoo.com.sg](mailto:javed_pnra@yahoo.com.sg)

## **1. Introduction**

Pakistan Nuclear Regulatory Authority (PNRA) was established in January 2001 with the promulgation of the Ordinance, No-III of 2001[1]. Pakistan is one of the countries in the world who intend to expand its nuclear power program for energy generation upto 8800 MWe by 2030. Presently, there are two research reactors and three nuclear power plants in operation and two power plants are under various stages of construction which are expected to be in commercial operation in 2016.

It is obvious that the primary responsibility of ensuring safety of nuclear power plants (NPPs) operation rests with the Pakistan Atomic Energy Commission (PAEC). However, PNRA's prime mission is to ensure the safe operation of nuclear & radiation facilities, safe use of radioactive sources and protection of the radiation workers, general public and the environment from the harmful hazards of radiation by formulating and implementing effective regulations.

Pakistan Nuclear Regulatory Authority issues authorizations for nuclear power plants in three stages i.e. site permit, construction license and operation license after detailed safety review.

This paper presents the licensing process for NPPs in Pakistan and its comparison with SSG-12, USA and Finland.

## **2. Licensing Process for NPPs in Pakistan**

Regulation for Licensing of Nuclear Installation(s) in Pakistan- PAK/909 [2] lay down the requirements for the licensing process of NPPs which covers site registration, construction license, permission for commissioning, permission to introduce nuclear material in to the facility, operating license, revalidation of operating license, licensing beyond design life, authorization for decommissioning/closure and removal from regulatory control.

First of all, the applicant notifies in writing to the Chairman PNRA as early as possible of his intention to establish and operate nuclear power plants from the relevant departments of the Federal, Provincial and Local governments. Then the applicant submits an application to PNRA along with a Site Evaluation Report (SER) for review and approval. PNRA approve the SER after satisfactory detailed review and issue Site Permit to the utility.

After registration of the site, the applicant establishes design and safety criteria according to the requirements to

be followed (regulations, IAEA nuclear safety standards, 10CFR), regulatory and safety guides (PNRA, IAEA, NRC), industrial codes and standards and experience feedback & practices to be followed (TECDOCS, SRS, INSAG, IRS, NUREG reports, etc.). After completion of the preliminary design the applicant submits Preliminary Safety Analysis Report (PSAR), Quality Assurance Program for design and construction and design PSA to PNRA for review, approval and issuance of construction license.

The applicant obtained the license for construction of nuclear power plant on a site and after that, starts pouring of the concrete in the foundation of the safety related structure on the site deemed to be the beginning of the construction.

When the detailed design and the safety analysis are completed, then the licensee submits an application for seeking permission for commissioning along with commissioning program and Quality Assurance Program for commissioning phase.

After that the applicant submits Final Safety Analysis Report (FSAR), Probabilistic Safety Analysis Level One Plus Report (PSA Level 1 plus), Physical Protection Program, Emergency Preparedness Plans, Radiation Protection Program, Environmental Monitoring Program, Radioactive Waste Management Program, Fire Protection Program, initial decommissioning plan, In-service inspection Program, QAP for Operation, etc. for obtaining permission to introduce nuclear material in the reactor.

On approval of these documents, permission to introduce nuclear material in the reactor may be granted subject to the availability of licensed operating personnel. After completion of commissioning but before the issuance of operating license, and in any case, no later than six months after introduction of nuclear material in the reactor, the licensee apply for operating license and submit the results of the first start-up and full capacity tests (low power tests, power ascension test and full power tests at nuclear power plant) and all the updated documents.

On the basis of the reviews and all other information that PNRA may have, Director Nuclear Safety take the decision in regard to issuance of the license for ten years.

Six (6) months before the expiry of license, the licensee has to apply for revalidation of the same along with updated report of latest Periodic Safety Review (PSR).

PNRA also issues and renews licenses for nuclear power plants to operate for up to design life. Licensee can apply to PNRA for re-license as early as 10 years before end of

expected design life but no later than 3 years before expiration of its current license.

Regarding authorization for decommissioning, the licensee is required to apply at least three years before termination of operation along with final decommissioning plan, technical specifications during decommissioning, emergency preparedness plan (EPP), environmental monitoring program, physical protection program, radioactive waste management program, radiation protection program.

However, for removal from regulatory control, the licensee is required to submit application after the completion of decommissioning activities along with decommissioning completion report and final radiological survey report.

Regarding inspection, the licensee is required to submit its detail program of how it intends to inspect the various steps of manufacturing, construction, commissioning, operation and decommissioning of the nuclear power plant. Thereafter, PNRA provide its regulatory inspection program to the licensee. PNRA sent inspector(s) to the site of manufacturing, construction and operation of nuclear installation(s) to perform the inspections.

### 3. Licensing Process for NPPs in USA

USA has different approach for licensing of NPPs. The licensing process covers one step licensing -combined licensing approach as described in 10 CFR Part 52 [3] and two step licensing i.e. construction license and operation license. The combined licensing process describes an early site permit process and standard plant design certification process which authorizes construction and conditional operation of a nuclear power plant. This approach allows early resolution of safety issues, environmental issues and required no public hearing.

For construction, the applicant submits preliminary safety analyses, environmental review and financial and antitrust statements (Public Hearing). Whereas for operating license, the applicant submits final safety analysis report and updated environmental report.

However, for early site permit, the applicant submits to NRC site safety analysis report, complete environmental report and emergency plans. Whereas for design certification NRC requires final safety analysis report, proposed inspections, tests, analyses and acceptance criteria for the standard design and environmental report.

### 4. Licensing Process for NPPs in Finland

Finland (STUK) licensing processes [4] for NPPs is two stages as it issues construction license and operation license.

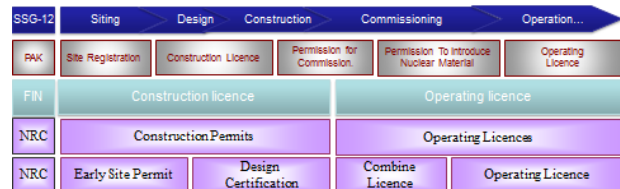
For construction license, the applicant has to submit the preliminary safety analysis report, a probabilistic risk assessment of the design stage, a proposal for a classification document, which shows the classification of structures, systems and components important to the safety of the nuclear facility on the basis of their significance with respect to safety, a description of quality management during the construction of the nuclear facility, preliminary plans for the arrangements for security and emergencies, a

plan for arranging the safeguards control that is necessary to prevent the proliferation of nuclear weapons and an applicant for a license shall also provide the radiation and nuclear safety authority with any other reports that the STUK considers necessary whereas the applicants submits) the final safety analysis report, a probabilistic risk assessment, a classification document, which shows the classification of structures, systems and components important to the safety of the nuclear facility, on the basis of their significance with respect to safety, a quality management programme for the operation of the nuclear facility, the Technical Specifications, a summary programme for periodic inspections, plans for the arrangements for security and emergencies, a description on how to arrange the safeguards that are necessary to prevent the proliferation of nuclear weapons, administrative rules for the nuclear facility, a programme for radiation monitoring in the environment of the nuclear facility, a description of how safety requirements are met and a programme for the management of ageing.

### 5. Comparison of Licensing Process with SSG-12 and other Countries

IAEA Safety Standard Guide (SSG-12) addresses licensing process in the five different phases such as siting, design, construction, commissioning and operation. Pakistan licensing process as described above is almost in accordance with the SSG-12 whereas USA and Finland has different licensing process and documents requirements with respect to the stage.

The licensing process for NPPs in different countries is different as shown below:



### 6. Conclusion

From the study, it is concluded that different countries have different approaches for the licensing of NPPs. However, the more important is that regulatory bodies should work independently with effective regulations to achieve their missions.

### References

- [1]. Pakistan Nuclear Regulatory Authority Ordinance, No-III of 2001.
- [2]. Regulation for Licensing of Nuclear Installation(s) in Pakistan- PAK/909 issued in 2001
- [3]. United States Nuclear Regulatory Commission, 10 CFR, Part 52—"Licenses, Certifications and Approvals for nuclear power Plants"
- [4]. Licensing process for NPPs in Finland
- [5]. IAEA Safety Standards Series, SSG-12 "Licensing Process for Nuclear Installations"
- [6]. S.H. Cho, Kwang Sik Choi, class notes