A Comparative Study on Licensing and Inspections of Nuclear Power Projects in USA, France and Japan

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After over 4 decades of development, nuclear power is currently at a crossroads. Different countries adopt different policies on nuclear power. A critical factor in deciding the future of nuclear power is nuclear regulations in which main parts is licensing and inspection because they are closely related to both nuclear safety and nuclear competitiveness. This paper tries to analyze general advantages and disadvantages of different licensing and inspections in three countries, namely USA, Japan and France through case studies. The paper is composed of six parts: background, case description, common features, different features, general analysis of advantages and disadvantages and conclusion.

【keyword】License Inspection Nuclear Project

1 Background:

Forty years has passed since the first commercial operation of nuclear power was inaugurated. Nuclear power has grown up to the point that it currently provides about 16% of electricity generating capacity and about 23% of electricity supply in countries of OECD, roughly one-half of which is located in Japan and America. Nuclear power is at a crossroads for many nations in the world at present. Australia and Austria have decided to follow a non-nuclear energy path. Sweden and Italy are turning away from nuclear power while Germany, Holland, Spain and Switzerland have actually suspended any new expansion of its use. On the other hand, France and Japan are likely to maintain and even expand their high level of reliance on nuclear power. USA held up its nuclear pace for the time being, but recent federal policy shows signs of moving toward new construction of nuclear plants.

The main factors deciding the destiny of nuclear power are safety and economic competitiveness. Licensing and inspection, which comprises the main parts of nuclear regulations, are much related to both safety and competitiveness. Strict and time-consuming licensing and inspections will increase cost of nuclear power drastically. Statistical analysis made by the Department of Energy of USA shows that among cost escalation of nuclear

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power plants completed in 1970s and 1980s, about 50% was attributed to licensing and inspections, which had been extremely strict because of the Three Mile Island accident in 1979. On the other hand, it is no doubt that such stricter licensing and inspections would assure higher expectancy of nuclear safety. The establishment of a specialized regulatory system is of primary importance for ensuring public concerns on health and safety with respect to nuclear power plants and other nuclear facilities.

In the past 40 years' development of nuclear power, each country established their own legal framework, regulatory authority, regulatory organization and respective licensing procedure and inspection rules depending on their own political structure, legal system and administrative practices. The author will try to evaluate and compare different cases to find commonality and difference in licensing and inspections of nuclear power projects among USA, France and Japan, and tries to analyze their advantages and disadvantages.

2 Description of Cases:

(1) Case in Japan:

a) Legal framework :

In Japan, the basic legal framework lies in the Atomic Energy Law enacted in 1955. The establishment, construction and operation of nuclear installation are governed by the Law for the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors—LRNR (Law No.166 of 10th June, 1957, as amended), the Electric Utility Industry Law—EUIL (Law No.170 of 11th July, 1964, as amended) and the Shipping Safety Law—SSL (Law No.11 of 15th March, 1963).

b) Competent authorities:

The competent authorities for nuclear installation are shown in Table 1. In addition to the authorities listed in the table, the Nuclear Safety Commission (NSC) and the Atomic Energy Commission (AEC) play an important role in the licensing procedure.

c) Licensing procedure:

For power reactors, the licensing procedure consists of **reactor installation license** and **license of construction.** They must be issued before construction. Actually, the procedure of licensing is often decided by negotiations between MITI and electricity company although the critical factor such as criterion is legally in place. However, before starting construction and operation of reactor installations, the license must comply with certain procedures which require the approval of the related competent authorities.

Apart from licensing, Japan set up **safety regulations for operation and maintenance** to assure better nuclear safety, which is Japanese character, namely self-regulation. Safety measures includes: **operating plan, qualified chief engineer for the nuclear installation** and **shifting of qualified supervisors.**

d) Inspection of nuclear installations

Inspections are carried out by MITI according to the specified law. During construction, site inspection and review of construction records are carried out. During site inspections, MITI re-inspects about 1/5 of those items which have been inspected by contractor except important items which will be fully re-inspected and electricity company inspects 1/3 of those items. During operation, two forms of inspections are carried out. The first is the complete site inspection on reactor system and turbine generators one time every two years. The second is a continuous monitoring and supervision by resident inspectors. However, the safety regulation is mainly observed by utilities' self-regulation manual under the direction of MITI's guideline.

(2) Case of the U.S:

a) Legal framework

The regulations concerning nuclear power installations in USA are governed by the Atomic Energy Act of 1955 as amended, and the Energy Reorganization Act of 1974 as amended. In addition, several other statues bear substantially on the practices and procedures of the commission. Nuclear installations, defined in several categories such as nuclear reactors, uranium mills, solution recovery plants and so on, must be licensed by the Nuclear Regulation Commission (NRC), except those governmental facilities defined in the Atomic Energy Act and the Energy Reorganization Act. Rules and regulations governing the licensing and inspections are set down in "Title 10,Code of Federal Regulations (CFR), Chapter 1—Nuclear Regulatory Commission".

b) Competent authorities:

The authority to issue, amend, renew and deny reactor licenses is delegated by NRC to the Office of Nuclear Reactor Regulation, except when public appeal is brought in court. When public appeal happens, the decision to license and the condition of the license rest with an Atomic Safety and Licensing Board. Such decisions are subject to review by an Appeal Board and NRC itself. The NRC staff can not communicate directly with the Board and the Commission during the proceeding of appeal until there is a final Commission decision rendered. Thus, in understanding licensing in USA. it is necessary to distinguish between actions, positions and decisions of the NRC staff, the Board and those of the Commission itself for all matters involving the hearing process on individual cases. The related competent authorities in licensing procedure in different cases is shown in Figure 2.

Within the NRC, support for the licensing activities of the Office of Nuclear Reactor Regulation comes from Office of Nuclear Regulatory Research and Office of Inspection and Enforcement.

c) Licensing procedure:

The licensing process in the U.S is a two-step procedure. A **construction license** is required before a utility is authorized to build a plant and an **operating license** is required prior to fuel loading and subsequent operation. The scope of the license proceeding covers matters

of radiological safety, environmental protection and antitrust considerations. Public hearing are required at the construction permit stage, and may be held at the operating stage if requested by the NRC, the utility applicant, or a member of the public. All activities during licensing and inspections are required to be accessible to all publics.

d) Inspection of nuclear installations:

Through its inspection and enforcement activities, the NRC maintains surveillance over construction and operation of a plant throughout its lifetime to assure nuclear safety. Inspections are categorized into five distinctive types, according to when such type of inspections are required in the facility cycle, namely, they are pre-construction, construction, pre-operational testing and operational preparedness, startup testing and operations. In construction stage, review of site records, resident inspectors and random site inspections are carried out. In operation stage, review of operation report and random site inspection are carried out.

(3) Case of France:

a) Legal framework:

Large nuclear installations are governed by the Decree of 11th December 1963, amended by the Decree of 27th March 1973. These regulations have been supplemented in regards to procedure by an Instruction of 27th March 1973 and a Decision of the same day, amended by a Decision of 17th December 1976, which are internal instruments or managerial instruments issued by the Ministry for Industry.

b) Competent authorities:

The authority primarily involved in the licensing procedure for the setting up of large nuclear installations are the Ministry for Industrial Re-deployment and Foreign Trade (former Ministry for Industry) and the Ministry for Social Affairs and National Solidarity (former Ministry for Health).

Set up in 1973 within the Ministry for Industry, the Central Service for the Safety of Nuclear Installations (SCSIN), is responsible for administering the licensing procedure.

Set up in 1945, the Atomic Energy Commission (CEA) is responsible particularly for proposing measures designed to ensure the protection of persons and property against the effects of atomic energy and for contributing to their application. Afterwards, the Institute for Protection and Nuclear Safety (IPSN), the main advisory body, was set up in 1976 within the CEA.

The Central Services for Protection against Ionizing Radiation (SAPRI) was set up within the National Institute for Health and Medical Research in 1956, provides its technical support to the Ministry for Health as well as the Ministry of Labor.

c) Licensing procedure:

For nuclear power reactors, there are generally two stages: firstly **license for setting up of large nuclear facilities** and secondly **license for commissioning tests and commencement of normal operation**—both

conditional on approval being given by the Ministry for Industry. Apart from the licensing system described above, it should be pointed out that nuclear installations also require separate licenses regarding: (Ⅰ) Pressurized components they contain; and (Ⅱ) Gaseous and liquid effluent release.

d) Inspection of Nuclear Installations:

Nuclear installations are subject to two types of supervision by competent authorities. The first is executed by the inspectors of large nuclear installations under the authority of the Ministry for Industry. This inspection is mainly related to nuclear safety. The second is carried out by the officials from the SCPRI which is responsible for ensuring that the regulations with regard to the discharge of liquid or gaseous radioactive wastes are properly observed. The SCPRI also has duties on the protection of workers in large nuclear installations. Two forms of inspections are adopted, namely, review of site records and periodic site inspections.

The Table 2 summarizes the basic characteristics of licensing and inspections of nuclear power projects in the three countries.

3 Common features:

(1) Legal framework:

From the above case studies, it is understood find that adequate legal and institutional framework is of vitality within which the execution of nuclear power plants is carried out, subject to appropriate authorization, co-ordination, control and supervision. There are common aspects in their framework which include the following contents at least:

- providing legislative authority for regulating and ensuring the safe development and use of nuclear energy in the national interests.
- vesting a specialized body with functional status and powers to the extent that it is empowered to discharge its regulatory responsibilities independently .
- setting forth the principles and conditions under which the regulatory authority may authorize the carrying out of nuclear activities.
- establishing the principles and rules consistent with international conventions with regard to third party liability for nuclear damage.

(2) Fundamental objectives of regulatory authority:

The primary objectives of the regulatory authority are:

- establishment of regulatory standards, codes and criteria, which will govern the design, construction and operation of nuclear power plants.
- review and evaluation of the safety analysis and environmental reports submitted by the owner; issuance of licenses.
- conduct of inspection program to ensure compliance with established rules and regulations.

(3) Functional autonomy of regulatory authority:

Depending on the governmental structure, legal traditions and administrative practices of the state, the regulatory authority may be established as a separate collective executive or within a greater governmental unit. However, it should be vested with a broad statutory of functional autonomy for the exercise of its powers and duties.

Figure 1 illustrates the general common features mentioned above.

(4) three forms of.inspection are used:

The first is resident inspectors which means some staff members station on site to carry out all-time monitoring. The second is site inspections which means sending inspection team to site from time to time to carry out inspection. The third is review of site records submitted to offices of regulatory authority by utilities. Different country uses different forms of inspection in different stages. This implies emphasis on safety measures is put on different stage in different countries.

4 Different features:

First, a central requirement of nuclear safety in USA is that the project comply fully with NRC regulations and the only task of NRC is to assure that nuclear installation are constructed and operated according to regulations formulated by NRC. The NRC is a pure regulatory department. It is observed that there is strict definition about within what time limit and under what conditions NRC should give its decision to applicant. In Japan, the emphasis of nuclear safety is more likely put on voluntary observation on regulations, which are more flexible and self-administered in many respects. For example, there is no clear regulation to within what time limit the applicant should get reply from MITI and how long the licensing procedure can be finished is often based on negotiation between MITI and electricity company. Some important safety measures are put into effect also based on agreement between MITI and company, not regulation. France is another situation. Nuclear safety is more likely attained through managerial instrumentation because the nuclear power is operated by public sector.

Second, the functions and management practices of the respective regulatory agencies differ among three countries. In USA, other regulatory authority is hardly engaged in nuclear safety except NRC. In Japan and France, the regulatory system as a whole is concerned with energy security and stability of the energy supply system as well as nuclear safety. It is also observed in both countries that industrial regulatory agencies other than nuclear regulatory agency are involved in the licensing and inspections of nuclear power projects.

Third, in USA, the relations between the nuclear industry and regulatory bodies have been frequently found to be confrontational and antagonistic. What combine NRC and electricity companies is only regulations or laws. In Japan, because of shared basic values

and a long history of close collaboration, MITI and the utilities have often jointly arrived at effective solutions to safety problems , usually behind the scenes. In France, because the nuclear power is controlled by public sector, many safety measurements are executed through managerial system, such as decision made by Ministry for Industry or other Ministries. In terms of management, electricity companies are subordinate of ministries.

5 General analysis of advantages and disadvantages:

In USA, because of so-called antagonistic relation between NRC and electricity companies, NRC has to make very complicated nuclear regulations to control the behavior of electricity companies. Moreover, because of the low level of standardization of reactor systems, NRC has to pay almost the same time or work to each application to finish assessment, which directly bring about long time of licensing procedure. It has become an important reason why the cost of nuclear power projects was becoming higher and higher since early 1970s. It also partly explains why electricity companies is declined to invest into nuclear power. Under this situation, the NRC, approved by Congress, has begun to promote the standardization of reactor system and develop step-by-step licensing method, which means electricity companies can start up some site work after some items related to nuclear safety are licensed by NRC.

In Japan, the long history of close cooperation between MITI and electricity companies has greatly benefited Japanese nuclear power industry in the past time. The benefit is high growth rate of nuclear electricity capacity and generation, rapid nationalization of reactor manufacture and good operation records. On the other hand, MITI is more and more confident of self-regulation carried out voluntarily by electricity companies and electricity companies is more and more likely to think nuclear safety can be achieved even without supervision of regulatory authority. Moreover, because the nuclear safety is contradictory to smooth supply of electricity in nature, the regulation system in which MITI undertake responsibility of nuclear safety and energy security and energy stability in the meantime might be negative to better assurance of nuclear safety.

In France, because the national aim on nuclear power is the same as Japan, we can find many of its regulatory and administrative practice are the same as Japan. The difference is that many safety measures are executed through managerial systems because nuclear power in France is a public sector. This point make France convenient and rapid to adopt safety measures, such as establishment of new specifications, stricter inspection procedures or others which are reasonable according to development of nuclear technology because they do not need to draft so-called legislation and to get it passed by parliament.

6 Conclusion:

First, although the Nuclear Safety Standard published by the International Atomic Energy Agency (IAEA) emphasizes autonomy of nuclear regulatory authority and recommends that this authority should be separated from those responsible for promotion of nuclear power, the practice of licensing and inspections in France and Japan indicates that one agency assuming both nuclear safety and promotion of nuclear power can also achieve nuclear safety. Actually, Japan appears to have achieved better safety performance according to comparative study of nuclear safety performance between USA and Japan.

Second, apart from regulatory activities, cooperation between regulatory authority and utility companies, non-institutional instruments are also very important to achieve nuclear safety. There must be some kinds of balance between regulatory activities and non-regulatory instruments. The former is to assure that critical principle must be observed without any discount. The latter is to facilitate good cooperation among partners to set up "culture of nuclear safety".

For those developing countries who are planning to develop their nuclear power, the balance mentioned above is specially important because they can not establish complete legal system and the nuclear powers are controlled by public sectors in general in the beginning stage of nuclear power development. In order to assure nuclear safety, they have to explore how to set up non-regulatory instruments for nuclear safety while trying to establish nuclear regulatory systems.

FIGURE 1: the General Legal Framework and Organization of Regulation Authority:

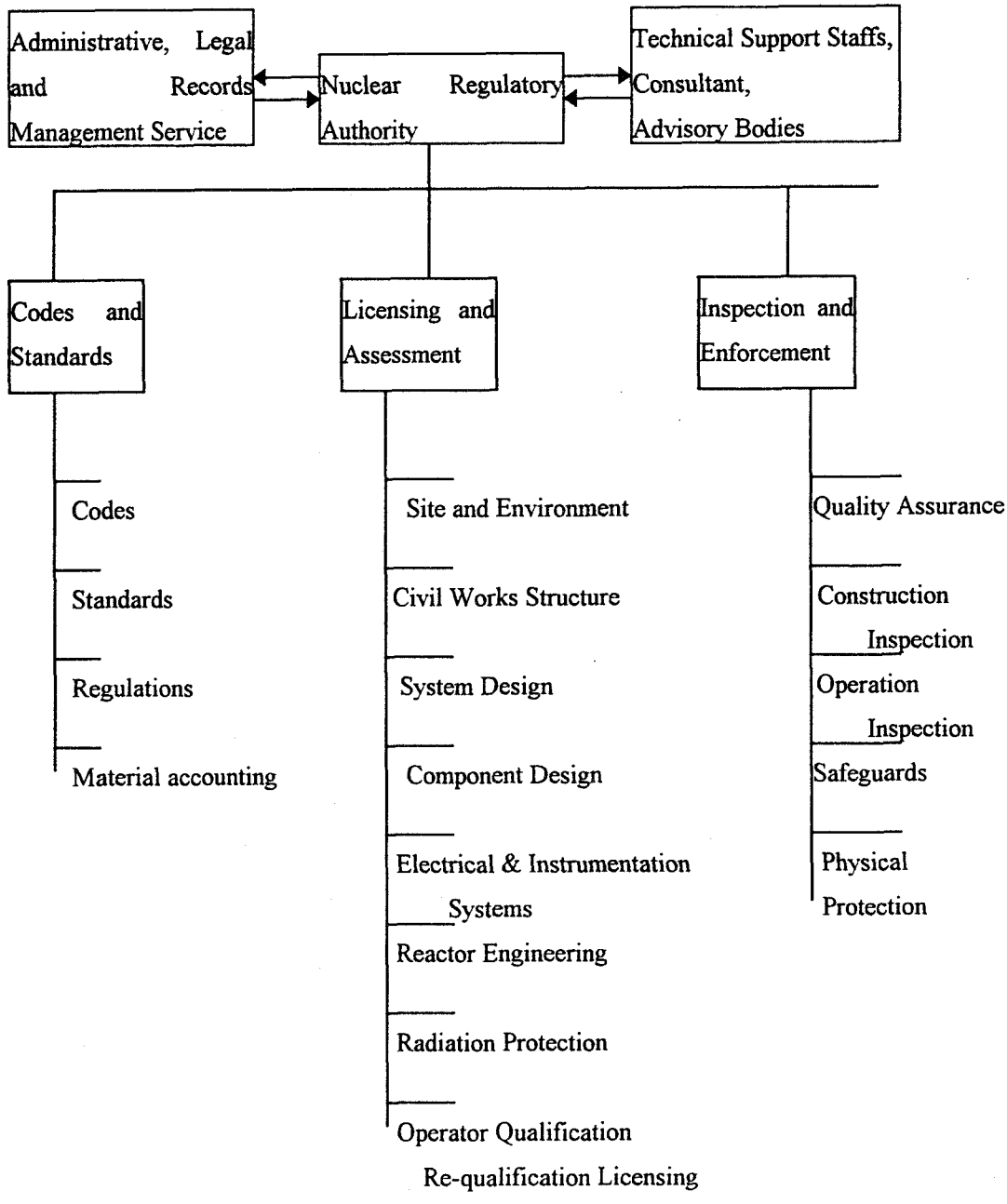
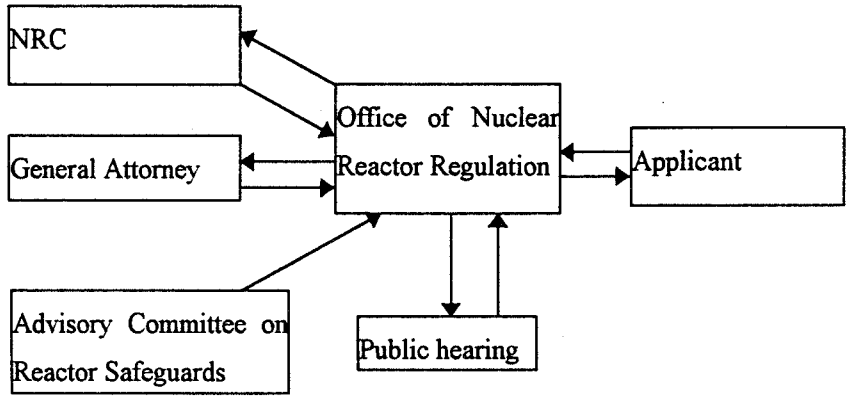


FIGURE 2: Flow Chart of Licensing of Nuclear Power Projects in USA:

1. when public no appeal is brought in court:



2. when public appeal is brought in court:

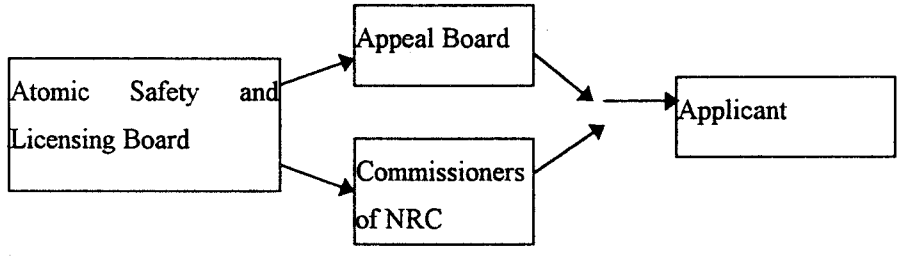


TABLE 1: the Competent Authority of Nuclear Power Plants in Japan

Type of application of reactor system	competent authority
commercial power plants	Ministry of International Trade and Industry(MITI)
commercial ship reactors	Ministry of Transport(MOT)
research reactors, reactors under development, fabricating and reprocessing	Science and Technology Agency(STA)

TABLE 2: A Comparison of Licensing and Inspections in USA, France and Japan:

Item	USA	France	Japan
Utility	Public + private	Public	Private
Standardization of reactor system	Low level of standardization	High level of standardization	High level of standardization
Main regulatory Agency	NRC	Ministry for Industry	MITI
Responsibility of regulatory agency	Nuclear safety	Energy security, energy stability and nuclear safety	Energy security, energy stability and nuclear safety
Public accessibility	Complete public accessibility	Limited public accessibility	Limited public accessibility
Timing of license	One is before construction, the other is before operation	One is before construction, the other is before operation	Both are before construction
Licensing procedure	Regulation	Regulation + managerial instrument	Regulation + negotiation
Methods of construction inspection	Review of records, resident inspectors, random site inspection	Review of records, periodic site inspection	Review of site records, site inspection
Methods of operation inspection	Review of operation records, random site inspection	Review of operation records, periodic site inspection	Review of operation records, site inspection one time every two years, resident inspectors

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