ASSESSMENT OF THE LICENSING ASPECTS OF HTGR IN YUGOSLAVIA

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Abstract

This paper deals not only with the licensing procedure in Yugoslavia, but also reflects the Utility/Owner approach to the assessment of the licensability of the HTGR during the site selection process and especially during bid evaluation process.
Besides the description of the existing procedure which was implemented on licensing of LWR program, the assessment of some licensing aspects of HTGR has been presented to describe possible implementation on licensing procedure.

Contents

1. Introduction and background

The "Institut za elektroprivredu" (IE) was founded in 1953. as an organization for research and development in electric power industry and electric power generation and supply. The IE carries out research related to energy problems and works on practical technical problems of electrical power plants and their equipment. IE covers different areas of planning, construction and operation of power plants and energy distribution network.

The activities of IE in energy field are mainly oriented towards planning of the development of the complex energy system of Yugoslavia as a whole, republics and regions. For the performance of above mentioned activities the IE avails with improved modern methods for: - energy supply grid analysis and demand forecast, - determination of optimum energy structure, - modeling of energy and cash flows.
In the field of forecasting of electric energy consumption IE has mainly performed projections of energy needs for the Electric Utility of Croatia (ZEOH) and for the electric energy system of Yugoslavia. Since the very beginning IE has been engaged in the resolution of problems connected with energy supply and in particular electric energy supply of the country. In the field of planning, construction and operation of the thermal power plants IE is particularly active in the following fields: - energy supply in urban areas, - planning, design and construction of thermal power plants in the electric energy system, - site selection & environmental impact studies and investigations of conventional and nuclear power plants.

IE has been also engaged in the studies for optimization of production capacities and transmission networks. This has resulted in improvement of existing and development of new methods for research and gained experiences qualify the IE to perform the Nuclear power plant construction planning.

In the area of environmental studies IE is actively engaged in coordination of environmental studies for all planned NPP in SR of Croatia. Several programs supported by IAEA are carried out by IE related to the risk-benefit analysis and comparison between conventional and nuclear power plants.

2. Nuclear licensing procedure in Yugoslavia

According to the current practice in licensing process it can be assumed that the procedure for obtaining the license involves the the following :

1. Including the NPP in general urban plan
2. Site permit
3. Construction permit
4. Operating License

as it is schematically shown in fig.1.

The early phase of licensing procedure is inclusive of the nuclear power plant site in The General Regional Plan of the State. This is the responsibility of the State Commission of the Civil construction ,Urban planning and Environmental protection as a State Licensing Authority.

The Applicant for the nuclear license applies to the State Licensing Authority of the state where the plant will be located. After reviewing the documentation of the all site investigation, in standardized format, according to the requirements of Regulations, Preliminary Site Report is prepared and submitted with requirement for including the facility into The General Regional Plan. This phase consists of discussion with the local authorities which includes public hearing and possible additional local requirements to the Applicant. After reviewing, the documentation is submitted to the State Parliament, for the approval to include the facility and its site into the General Regional Plan.

The process of issuing the site permit is performed on specific Federal regulations which includes study work relevant for site verification from the nuclear safety aspects. Format of proposed documentation is standardized, mainly on U.S. NRC RG 1.70 and IAEA recommendations. During the licensing procedure The State Licensing Authority uses outside technical experts and technical experts agencies for reviewing and advising on reactor safety, generic safety issues and radiological protection. This corresponds, for example, to U.S. Advisory Committee on Reactor Safeguards. The procedure for issuing the construction permit is under responsibility of State Commission of the Civil construction, Urban planning and Environmental protection, and issuing of the operational license is under responsibility of State Commission for Industry, Energy and Mining, which also provides supervision of the plants in operation.

However, the Federal Government has the responsibility and authority under Nuclear Law to ensure state compliance with the law and to coordinate the activities of the other federal states to obtain consistency.

2.1 Preparatory phase of nuclear power plant planning performed by Utility/Owner

The preparatory phase of the Nuclear power construction planning consists of the following activities, which are based on practice of Utility in Socialist Republic of Croatia , and mainly carried out by IE:

A - Planning of Nuclear Power Plant Construction
- optimization of the long-term energy strategy with forecast of energy consumption and determination of optimal energy sources and source distribution study for any region or a complex urban structure
-The Feasibility Study Report for implementation of nuclear power plants in electric generation system of any given region, choice

of unit size, technical aspects analysis, nuclear cost estimates, generation costs, total costs estimates and comparison of alternative sources, financial review, project development, domestic participation
-optimization and development of complex centralized district heating systems using nuclear or conventional power sources

B - Nuclear Power Plant Site Selection and Environmental Studies
One of the earliest stages of a NPP construction planning is site selection study with respect to:
- characteristics of the site influencing a NPP design i.e.: seismic characteristics, extreme meteorological characteristics, flooding probability, external man induced effects etc.
-characteristics determining the impact of a nuclear power plant on its environment i.e.: population density distribution, atmospheric characteristics etc. (This study work results with Environmental Report of standardized format according to Yugoslav regulations, mainly based on U.S. documents, USNRC Reg.guide 4.2, USNRC NUREG-0555 and IAEA recommendation.)
-other characteristics of site having impact on design of a nuclear power plant, its economic basis or effects on the environment.

Site selection for nuclear power plants is performed in three phases:

1-NPP oriented Site Survey for any region. Based on the defined elimination criteria with included safety, economical and ecological aspects a number of potential microlocations is determined. Definition and collection of early site data.

2-Site Qualification process with evaluation of several potential microlocations. Establishment of standard report form for geological, seismological, hydrological, meteorological and population data ,to be used throughout the site approval process.

3-Site Confirmation process with collection of all necessary data to obtain a site permit for preparing the construction of a nuclear power plant. Detailed field investigation and analysis to assess all of the site characteristics and their influence on the design basis for a NPP. Determination of detailed environmental impact in the phase of site selection.

C - Optimization and Selection of Technical Characateristics and Parameters for NPP Equipment and Fuel Cycle
This phase is performed before preparation of Bid invitation documentation in order to assess the technical characteristics and parameters of NPP components of different type.

During this phase particular attention is given to various types of nuclear power plants in order to assess their differences in technical characteristics and parameters, which will be used for preparation of Bid Invitation Specification.

D - Preparation of bid invitation documentation and bid evaluation
This phase includes preparation of Bid Invitation Documentation for construction of a NPP with various contracting combinations such as turn key or split package. Specific requirements of the site , requirements of the respective Regulatory body, as well as the requirements and specific conditions of the electric Utility/owner are incorporated in Bid Invitation Documentation.

There is a great interest of domestic industry for participation with a foreign partner in NPP construction and production of components, and according to the prior experience on NPP Krško and up to date studies of potential capabilities of domestic industry it can be approx. 70 % (estimated for PWRs NPP).

2.2 Applicable Codes and Guides for HTGR

All domestic regulations that apply to that type are valid. It is also expected that the regulations of the Supplier's country will be partly adopted, considering the requirement that offered design must be licensed in Supplier's country.
Also valid would be IAEA , Design for safety of Nuclear Power Plants, A Code of Practice, Vienna, 1978., which can be applied to HTGRs without greater difficulties.

It may be pointed out that Yugoslav nuclear regulations are based on IAEA-ICRP recommendations and U.S. regulations with regard to NPP Krško, except that they are particularly somewhat stricter. This particularly applies to 10CFR20.

The design criteria and the technical codes must be supplemented with regard to the requirements of HTGRs. Efforts in this direction and experience in the application of the relevant codes to HTGRs , which are mostly prepared for Light Water Reactors,have to be adopted mainly from the countries which have already licensed HTGRs. It can be concluded that the design criteria and technical codes can mainly be applied on HTGR.

2.3 Licensing documentation

According to the Yugoslav Atomic Law, licensing comprises following main steps - documents :
- Site selection and Environmental studies - Site permit
- Construction of the NPP - Construction Permit
- Commissioning and Operating of NPP - Operating License
- Decommissioning - Decommissioning License

Documentation is prepared to serve as an overview of all site investigations performed in accordance with Standard format for Environmental Impact Study.

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The volume of investigations is based on regulations taken over from the recommendations of IAEA and mostly U.S. (10CFR100 and Reg.guide 1.4). This is the case mainly due to fact that our first NPP is PWR - 632 MW (Westinghouse design).

One of the basic assumptions for a quality licensing process is establishing a good communication between the Utility and Regulatory body. This can be ensured through careful preparation of materials needed in the licensing procedure in standard format. The basis for determining the format was U.S. regulation as follows: -USNRC Reg.Guide 1.70:Standard format content of safety analysis report for NPPs, rev.3,1978. ,- USNRC Reg.Guide 4.2:Preparation of environmental reports for NPPs,Rev.2, 1976. ,- USNRC,NUREG75/087:Standard review plan for the review of safety analysis reports for NPPs, LWR, edition 1975. , - USNRC,NUREG-0555:Environmental standard review plans for the environmental review of construction permit applications for NPPs, 1979.
Also in use IAEA No.50-SG-G2: Information to be submitted in support of licensing applications for nuclear power plants,1979., which is suitable even it is not very precisely elaborated. On the basis of the aforementioned documents, the Standard Format for the Environmental Impact Study (Rev.1, 1985.) was proposed by IE and approved by the State Licensing Authority.
In the case of NPP Krško, U.S. regulations were used throughout and the documentation was elaborated and reviewed according to current standard format available in U.S.A. at that time, which resulted in submittal of Preliminary Safety Report and Final Safety Analysis Report.

One of the main differences from U.S. licensing procedure is that we have requirement for issuing the Site permit which as a formal document does not exist in U.S.

3. Licensing during bid evaluation process from Utility/Owner point of view

Starting off with the fact that the licensing is the responsibility of the Utility/Owner, in the BID evaluation stage the special criterion is the assessment of licensability of the offered designs. In this, the basic assumptions are that the plant must be licensable in the country of the reference plant, and that the plant must be licensed in Yugoslavia.

Assessment of the licensability for the nuclear power plant from the BID consists of evaluating the following licensing aspects:

- licensing assistance as bidder s contribution to prepare licensing documents
- licensability
- codes,standards & regulations
- inputs to PSAR,FSAR,Environmental Report
- accident analysis
- unresolved safety issues
- The Reference plant

During the bid evaluation phase of the licensing aspects it is particularly important to devote attention, analyze and assess the Supplier's approach related to:

-licensing documents (PSAR,FSAR)
-analysis of the safety report contents
-Bidder responsibilities for the development of safety reports
-evaluation of the type of safety analysis and studies to be furnished by the bidder for the PSAR and FSAR (safety classification of structures,systems and components in relation to their safety function,safety concept application,plant operating conditions ;normal-abnormal-accident, safeguard system design capabilities, deviations from the Reference Plant that can affect plant safety, shielding design,ALARA design)
-Number of revisions for safety report documentation included in the scope
-Supplier's responsibilities in preparing answers to questionnaires from licensing Authorities
-Planning and scheduling proposed by Supplier to develop his licensing scope of services

Approach with the Reference plant for licensing has advantages , for example the offered design refers to the specific plant as a pattern for defining safety criteria, but on the other hand with such approach there is a problem because of interface problems with different sites characteristics. In this light the Reference design as a reference concept can offer: envelop of latest design of same generation, take advantages of all modern designs and is more flexible.

4. Licensing aspects of HTGR

The basic requirement that is applied in our country is that the offered design of the power plant is not contrary to the IAEA regulations or Supplier's country regulations and that it is licensable in the Supplier's country. In the BID document the principle of the reference power plant would naturally be used.

In accordance with the established procedure in evaluation of potential sites for a NPP , where the evaluation was done for PWR, BWR and CANDU, HTGR would have the same treatment naturally taking into account the corresponding source term.

The effect and evaluation of the designed layout from the aspect of the seismic effects is one of the decisive factors in assessment of safety characteristics of a NPP, which could have a significant impact in the licensing process involving HTGR.

Furthermore , the collected data from HTGR power plants in operation would be used to assess the probability of accident occurrence according to models of probabilistic risk analysis. This ,however, requires a great deal of data concerning operation of commercial plants of HTGRs.

Finally, the need for a complex safety analysis seems obligatory by means of which a detailed comparative analysis of advantages of HTGR type of power plant in relation to other alternative commercial power plants could be carried out.

As an example , the permitted radioactive releases to the environment defined by our regulations are considerably stricter than values prescribed in 10CFR20 and 10CFR50,App.I, and lower than IAEA ICRP Pub.30, making the data on releases stated in Ref.5 regarding MHTGR very interesting.

High degree of passive safety features and exclusion of any evacuation requirements for HTGR power plants, increases the number of potential sites and influences the utilization of existing ones, especially because of the standardization of reactor unit and conventional BOP with no requirements regarding safety related tasks.

If this is applied to MHTGR, assuming an acceptable approach of the Supplier judged according to other criteria, the conclusion is, that high level standardized design of NSSS offers many advantages from the aspect of licensing in relation to LWR.

5. Conclusion

HTGR represents a very interesting option particularly for developing countries and relatively developed industrialized countries, especially if it is considered that the status of already achieved quality standard , safety standard and degree of proveness of LWRs is the minimum requirement and scale for the HTGR layout.

The basic advantage of this second generation nuclear power system is remarkable for its safety characteristics which do not depend on active engineered safety features or human actions for safety of the public or the investor.

It can freely said that a high degree of licensability of HTGR exists in Yugoslavia. Here , it has also to be mentioned that by the Federal Regulation the construction of the NPPs in Yugoslavia is suspended for the time being. However this law does not extend to research and progress in nuclear energy by the still interested electric utilities.

From the aspect of licensing it is believed that in case HTGR type is selected, promoted by the correct support of the Supplier, HTGR would successfully pass the licensing procedure. In any case this would cause certain moves to be made regarding the existing regulations.

The design criteria complying with the valid regulations regarding PWR should definitely be supplemented with regard to the requirements of criteria for HTGRs especially on HTGR design related to pre- and inservice inspections,the criteria for shutdown systems ,residual heat removal systems, reactor coolant boundary and reactor containment.

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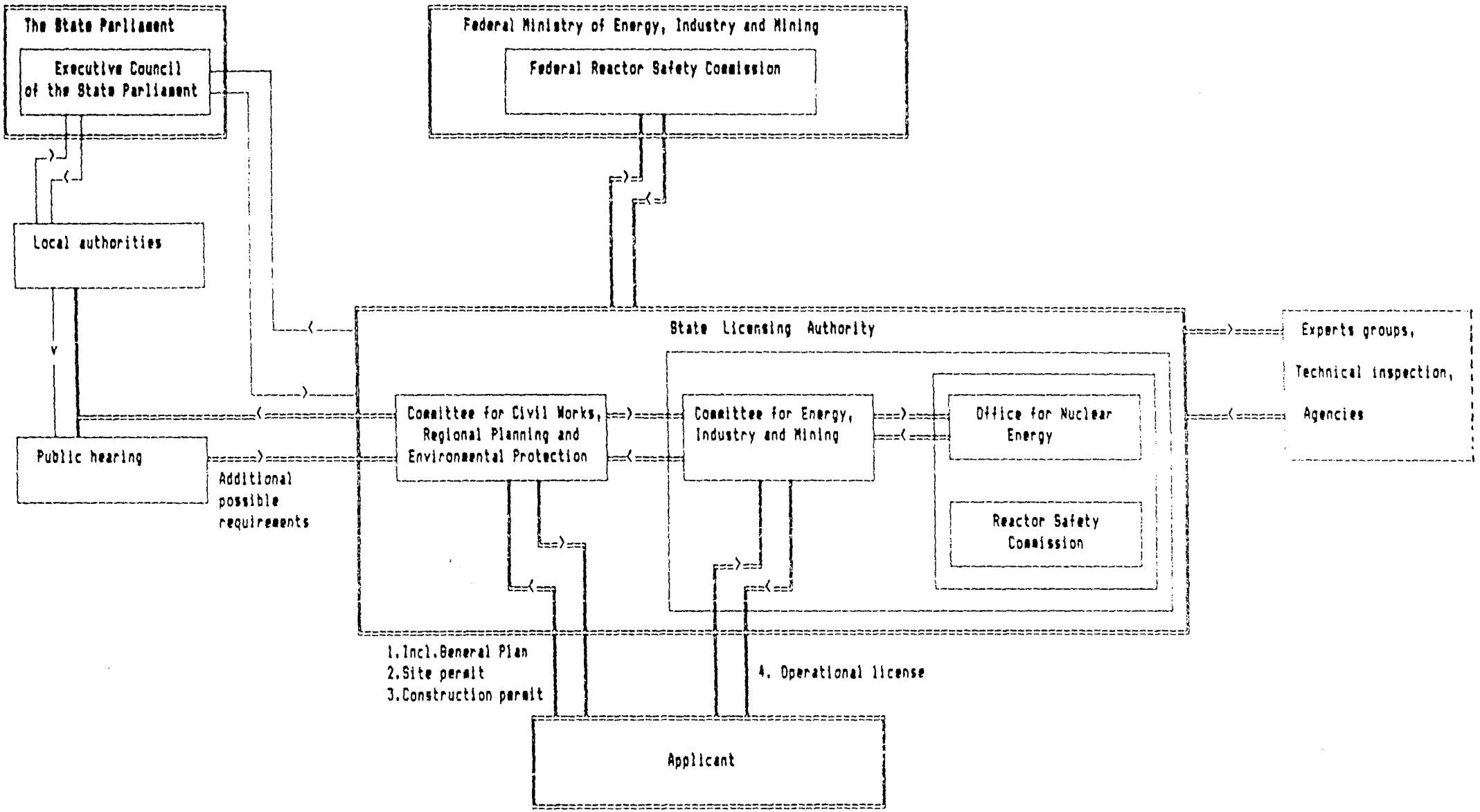

Fig.1 : Licensing process in Yugoslavia