

## A Study on the Approach to Quality Management in Construction of Nuclear Power Plants

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### 1. Introduction

The quality of works and services in nuclear facilities are important aspect of public safety and environmental protection. In the general legal framework for the regulation of nuclear power plants of each country, the requirement which effectiveness, overall quality management programme be established should be present. The organization having overall responsibility for a nuclear power plant shall be responsible for the establishment and implementation of the overall quality management programme for that plant. The construction methods available for new nuclear power plants are generally the same as those used for other big construction projects. The construction stage of a nuclear power plant includes a multitude of activities affecting quality which are performed by various organizations with specific responsibilities assigned to them. At the present, the IAEA source materials have been changing some documents for supporting tendency in the nuclear technology likewise in term of quality assurance concept to quality management concept. The principle goal for quality management is achieved assurance and sustainable with nuclear safety. This system brings all the requirements for managing facilities and activities together by only one system.

### 2. Quality Management

In a country embarking upon the implementation of its first nuclear power plant, prior consideration must be given to the effective assurance that all activities related to equipment, materials and services in the plant project are carried out with the required quality. An effective way to achieve this goal is to develop, implement and enforce a quality system at the onset of the project.

The evolution of quality as shown in Figure 1., since the strengthening of quality inspections only lead to the increase in defective products but cannot improve the quality of products (Quality Control). And then, the nuclear quality assurance is to establish and implement an overall system (Quality Assurance) to ensure compliance to the requirements necessary for design, construction and operation of the nuclear facilities<sup>1</sup>. The essential elements of quality assurance are the systematic approach to preventing errors or failures, checking and appraising. There are the steps taken to assure that tasks are done right first time including when failures occurred the process can be detected and corrected including performed satisfactorily in service.



Figure 1. Evolution to management quality systems<sup>2</sup>

The quality management system approach encourages organizations to define the processes that contribute to the achievement of product which is acceptable to customer, and to keep processes under the control. That is principle have been identified as customer focus, leadership, involvement of people, process approach, system approach to management, continual improvement, factual approach to decision making and mutually beneficial supplier relationships.<sup>3</sup> At the present, the management system are establishes policies and enable objectives to achieve integrated management systems.

### 3. Construction in Nuclear Power Plants

The standards most frequently encountered in construction work in the worldwide now will be described under two headings. There are general purpose standards and nuclear standards. Both general purpose and nuclear standards specify systems which will maintain and assured quality. The difference is that whereas the first category is oriented to the requirements of the market place, the second is aimed more at satisfying the statutory requirements imposed by regulatory authorities particularly in respect of safety. This results in a difference of emphasis, although the ground covered and the systems specified are not dissimilar. In this paper will be focus on nuclear standard. The processes for construction state concerned with system and component design, procurement documents and drawing, construction work plans and schedules. They are comprised civil and structural works activities, mechanical installation activities, instrumentation and control systems installation activities, electrical system, materials of construction, eco-friendly or clean environment design, control and

maintenance of nuclear documents during construction of nuclear power plants also.

### 3.1 Standards and Regulation in construction

Generally, nuclear power plants are very high standards and materials. However, the potential dangers it presents to the health and safety of the public are frightening to many people. Most countries exercise strict controls on the construction and operation of all nuclear facilities through the activities of regulatory authorities endowed with statutory powers. There are depending on each country how to setup the infrastructure and standards. The term of nuclear safety standards are covering the whole extent activities from concept design, detail design, procurement/manufacture, operation, construction, commissioning, and eventual decommissioning<sup>4</sup>. The nuclear facility that carries the burden of satisfies the regulatory body. The facilities is obliged to implement a quality system for the nuclear power plant project as a whole and to ensure that all participants including designers, contractors, sub-contractors and any other parties contributing to work all abide by requirements and safety standards. Exactly, a nuclear power plant is making from a lot of elements. Some of these, such as reactor vessels and containments have a direct impact on safety. Other elements are no hazardous more than previous structures. Therefore, the buildings and structures of nuclear power plants can be grouped into three categories. There are group A (Nuclear Island) represents safety-related structures, B (Turbine Island) represents structures and systems that support power generation and C (Balance of Plant) represents supplemental systems and structures required during plant operations<sup>5</sup>. The mechanism controlling bring about to very important in construction management. They are criteria, inspection, monitoring and any subjects that associated with the operation for construction method. Especially, regulator should be overseeing to comply with the criteria and approval on the basis of their safety significance.

### 3.2 Quality management for construction state of nuclear power plants

The requirements in construction state should be planned for site fabrication, installation, and inspection including testing of structures, systems and components are important to safety. The quality management is proper coordinating complex management structure for the satisfactory completion of a high quality which related techniques involve accelerated construction, value engineering, critical path schedules, life cost analysis, and range estimating. The success of the construction management will be achieved through planning, organizing and controlling<sup>6</sup>. The construction stage of a nuclear power plant includes a multitude of activities affecting quality which are performed by various organizations with specific responsibilities

assigned to them. These include building, manufacturing, erecting, installing, handling, shipping, storing, cleaning, inspecting, testing, modifying, repairing and maintaining. Each of the participated organizations is responsible to establish and implementation of a quality management programme to be accepted and supervised by the utility, regulatory authorities and commensurate with the construction activities being performed and their importance to plant safety. Organizational structures can be adopted depending mainly on the utility's prevailing practice.

## 4. Concluding Remarks

The quality management can function effectively only a part of an overall quality system. That has been developed continuously improvement. Today, producer or utilities enhance the quality management for the purpose of better practice. In the future, quality improved to the next level for sustainable development. The requirement before starting the project is to achieve the evident agreements both on the part of the responsibilities and regulations. In the construction technology development has continued as well both in terms of safety, cost and duration of the construction.

## REFERENCES

- [1] KINS/TR-159 "IAEA Regional Basic Professional Training Course (BPTC) on Nuclear Safety", International Nuclear Safety School, Korea Institute of Nuclear Safety, Daejeon, Korea, 2009.
- [2] Pal Vincze, "IAEA Safety Standards on Management Systems from Concept into Practice" Nuclear Special Interest Group Launch Events, 2008.
- [3] Nam-Jin Lim, Chan-Gook Park, Ji-Hee Nam, Kwan-Hyun Kim, Hyuk-il Kwon and Young-Gun Lee "New Paradigm in Nuclear Safety from Quality Assurance to Safety Management System", Transactions of the KNS Autumn Meeting, Gyeongju, Korea, 2006.
- [4] IAEA GS-R-3, "The Management System for Facilities and Activities", IAEA, Vienna, 2006.
- [5] J.L.ASHFORD, "The Management of Quality in Construction" E&FN Spon, London, 1989.
- [6] IAEA DS-349 (draft), "Application of the Management System for Nuclear Facilities", IAEA, Vienna, 2007.