

# Development and Application of Integrated Management System in Nuclear Power Plant Construction Project

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*Abstract: Nuclear power plant construction project can be called essential to establish a systematic project management system compared to other construction projects, taking into account the size and complexity and safety. To develop into a project management system for the Korea situation with the ongoing construction of the nuclear power plant was directed to promote nuclear power project management. In this paper, we introduce a comprehensive project management system for nuclear power projects. Currently considering the nuclear life cycle design, construction, and was developed by considering the flow of information to operate and test each step linkage. The systems in English were developed to meet owner's requirements for advancing into overseas projects. Another point is that the systems were developed by management module, so that functions of each area can be selectively applied. It is expected that the system will establish itself as one that can be used for the entire lifecycle of nuclear power plants through gradual and systematic establishment of necessary data.*

*Keywords: Nuclear Power Plant construction, Integrated Management System, Project Management Advancement*

## I. INTRODUCTION

The nuclear power plant construction industry of Korea has passed through a period of technical independence and a period of growth, accumulated knowhow based on a number of construction projects, and reached a period of stabilization. Now, its construction management mechanism should be transformed to an advanced one that surpasses the level of foreign competitors, in order to satisfy the level of owner's requirements in the global nuclear power plant construction market, and to improve safety and economic efficiency of nuclear power plants. Accordingly, it is required to re-engineering a project management mechanism in terms of the lifecycle of nuclear power plants ranging from construction planning to designing, installation, pilot operation, commissioned operation, and dismantling. The existing business process and advanced management techniques of nuclear power plant construction is being analyzed, improved processes and procedures are being proposed, and system elements are being derived for developing improved systems. This study reviews the trend of construction management mechanisms, and the nuclear power plant construction management systems operated in Korean nuclear power plants. In addition, it introduces an advanced system that has been developed for solving the problems, and utilizing advanced processes and IT.

## II. TREND OF CONSTRUCTION MANAGEMENT MECHANISMS

Large Korean construction companies are developing advanced technologies of plant project management relating to various standards on plant construction projects, and information management system for project management, in order to improve overall implementation technology of domestic plant-related companies, and to secure sustainable competitiveness. In addition, they put

emphasis on the necessity of the development of management techniques on the global level in terms of the lifecycle process in order to achieve sustained growth and high added value of the plant industry including nuclear power plant construction. It is being pointed out that a mechanism is important in which participators in the lifecycle of a construction project can share and manage information in an effective manner. As the domestic nuclear power plant construction industry has a fixed production structure and a fixed roles/responsibilities structure. Therefore, as the global market demands construction management mechanisms which can manage owner's requirements in an integrated and flexible manner, development of a such integrated system is required to satisfy such demand.

## III. STATUS OF DOMESTIC/FOREIGN CONSTRUCTION MANAGEMENT SYSTEMS

A nuclear power plant construction management system mainly comprises process management, construction cost management, material management, document management, installation management, pilot operation management, and Project Numbering Systems (PNS), wherein each system is operated by a computing system based on specified procedures. Normally, two systems are operated in which a Nuclear Power plant Construction Management System (NPCMS) is developed for operation of construction projects, and an Enterprise Resource Planning (ERP) system is operated in linkage with the NPCMS for management of quality, project costs, and documents as a corporate integrated management function. The NPCMS was developed in 2003 by the Korea Hydro and Nuclear Power Co., Ltd., and has been operated for constructed nuclear power plants. It manages construction-related information on processes, installation, civil engineering, building, machinery, piping, electric, and

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instruments. Such information is submitted to the owner by equipment suppliers, engineering companies, and construction companies for fulfilling phased works of construction. When the construction and the start-up operation have been completed, most of the information is handed over to the ERP system.

Overseas advanced companies have established consistent work processes and correct information linkage processes from the Front-End Engineering & Design (FEED) to the EPS stage and handover of technical information. In addition, they have established data-based work processes, so that overlapping of data input can be minimized and utilized for overall projects. They have the benefits that correct and timely information is distributed among engineering companies, manufacturers, and construction companies, which enables record maintenance of information on projects regarding matters that occur during project implementation, as well as practicable measurement of progress and cost reporting.

#### IV. DEVELOPMENT OF THE KNOWLEDGE-ORIENTED CONSTRUCTION PROJECT MANAGEMENT SYSTEM (KOCOMS)

Along with the growing necessity of developing a global-level management technology for lifecycle process, and the importance of a system which can share and manage information on the entire lifecycle effectively, industrial standard management systems such as the PMBOK, PRINCE2, and CII have been analyzed regarding the process of the construction stage for the management of lifecycle of nuclear power plants. Based on such analysis, scope of project management has been expanded to the level on which global competitiveness can be secured. The major focus of the system has been put on securing of flexibility of the project management system; integration of processes, data, and systems in terms of lifecycle; securing of work process linkage between the owner and the contractor; establishment of an information sharing system; reinforcement of project planning function, and adoption of a new project management function.

In process reengineering, systems of each area have been developed in the modular manner for securing flexibility of the project management system in foreign markets in terms of international standards. As the domestic project management method should be changed to one based on international standards for participating in overseas nuclear power plant projects, the KOCOMS was developed so that it can be applied in an expanded manner to such areas as HSE (Health, Safety and Environment) management, EVM (Earned Value Management), risk management, and configuration management, which have never or insufficiently been adopted nuclear power plant sector in Korea.

Also considered in the development is work process automation based on Business Process Management (BPM) in accordance with project management procedures, project-flexible systems which can manage multiple projects on the program level while the systems are established as real-time data-based information systems, development of standardized modules, realization of

system-module integrated functions, and securing of inter-modular compatibility. For the existing systems such as process management, material management, and document management systems, processes were improved through process reengineering. Systems were established for such area as administrative management, and license/permission that have been lacking. Also implemented was the information system environment consisting of the virtual construction management system, the Nuclear power plant Total capital investment cost Estimating System (NTEP), and the Earned Value Management System (EVMS). The systems in English were developed to meet owner's requirements for advancing into overseas projects. Another point is that the systems were developed by management module, so that functions of each area can be selectively applied.

#### V. CONCLUSION

In order to manage the entire lifecycle of nuclear power plants, reengineering of the entire construction processes is being carried out and the system is being expanded through integrating with IT functions, wherein engineering processes and system-based engineering data are received from design companies in the designing stage, and installation quality is managed with a given schedule and cost through purchasing equipment/material needed for installation and start-up operation stages. It is expected that the system will establish itself as one that can be used for the entire lifecycle of nuclear power plants through gradual and systematic establishment of necessary data. As a system that has a function of information exchange between the owner and the contractors, and of mutual sharing of information even among the contractors, adoption of a security function which considers uniqueness of nuclear power plants is also expected. Consequently, establishment of a win-win strategic structure between the owner and the contractors through continual communication with construction participants and functional development will contribute to technical improvement and cost reduction of the entire domestic nuclear power plant construction projects.

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