Application of Configuration Management Information System for Operation NPP

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1. Introduction

Configuration management is one of the essential elements for safe, reliable and economical operation of nuclear plants.[1] It is very important to maintain the consistency of the three configuration management elements such as design requirement, physical configuration, and facility configuration information, throughout plant life. The IAEA reported that 25 % of accidents at nuclear power plants worldwide were caused by configuration management errors.[2] Therefore, Korea Hydro & Nuclear Power(KHNP) have implemented a configuration management process and integrated several change management systems into one system for configuration control as a Configuration Management Information System (CMIS) for operation unclear power plant as shown in Figure 1. It enables to classify the design documents systematically, enhance the interface between related documents, and reduce search time.
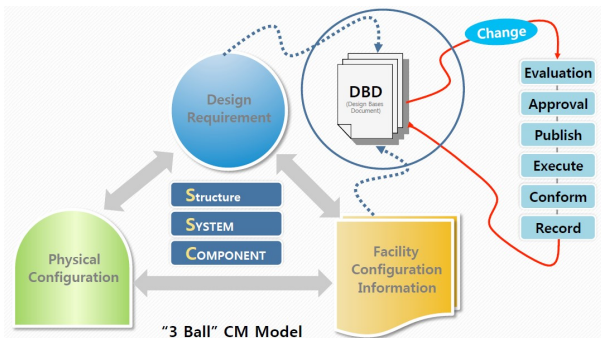

Fig. 1. Concept map of CMIS for operation NPP

2. Existing System Status

KHNP has operated Engineering Change Management System (ECMS) and Life-cycle Data Management (LDM) separately for configuration management. The ECMS is a suitable system for carrying out design changes, but it is weak in linkage with documents related to design change documents. The LDM is a data management system. However, from the viewpoint of configuration management, design requirement document and facility configuration information are not systematically classified. It is possible to search with a document title only, so that considerable effort and time are consumed for a user to find a necessary document for a design change.

In addition, some documents are missing or incorrect information because of lack of verification function for review in the design change procedure.

3. Development of Configuration Management Information System for operation NPP

3.1 Composition of CMIS

CMIS is an information system that supports consistency among three functions of configuration management which consists of design requirement management tool, facility configuration information management tool and integrated change management tool as shown in Figure 2.
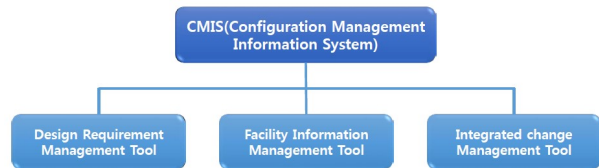

Fig. 2. Diagram of CMIS for operation NPP

3.2 Function of CMIS

3.2.1 Design requirement management

Design requirement management tools enable to classify design documents as a design requirement taxonomy with a hierarchy [3]. At the top level, there are design standard documents such as Atomic Energy Law, Public notification by the Nuclear Safety and Security Commission, 10CFR. And design requirement documents such as FSAR, System Design Criteria (SDC), System Functional Description (SFD), and Design Specification (DS) are located at the next level. Facility configuration information such as drawings, specifications, and procedures are classified at the bottom level.

It is very easy to find a related design document during design change if design documents are transferred with Optical Character Recognition (OCR) function.

3.2.2 Facility configuration information management

In order to easily access a large amount of facility configuration information, those were classified with mixed structures such as Physical Breakdown Structure

(PBS), Functional Breakdown Structure (FBS) and Organization Breakdown Structure (OBS) standards. For example, drawings were classified into piping drawings, electrical drawings, logic drawings, and etc., and those drawings were classified by a system as well to access by users.

In addition, when a specific word is searched, related documents are highlighted from the highest regulatory requirement to the function location of the lowest equipment, so that user can track and search design documents more conveniently.

3.2.3 Integrated change management

There are four different configuration change management systems which are design change, temporary change, document change, and software configuration change. Those systems are not inter related and controlled correctly. Those systems are integrated in a system and related documents such as design change proposal, design package, drawings, construction documents are inter related in a computerized system after design change work.

In addition, design change processes are computerized to prevent document errors such as omission of reviews and ensure reliability of design changes. It also enables to monitor a status of design change at each step and identify a cause of backlog.

4. Application of Configuration Management Information System for Operation NPP

Configuration Management Information System for Operation NPP (CMIS) was applied to Korean Standard Nuclear Power plants in December 2017.

First, the design documents were classified according to the design requirement taxonomy with a hierarchy, and the linkage between related documents was strengthened.

Second, the content search function was applied to about 3.6 million design documents (about 33 million pages) in the form of image file of Korean Standard Nuclear Power plants. Previous document management systems were only able to search titles. However, the system makes it possible to search the contents of design documents, which greatly enhances the search function. Therefore, it is possible to provide the necessary information to the plant operators and maintenance personnel quickly and accurately. In addition, design documents (about 54million pages) of non-standard nuclear power plants will be applied to the content search function until August 2018.

Third, distributed configuration management systems are integrated into a system. It enables to monitor a status of design changes and to increase user convenience and work efficiency.

Fourth, the design change processes were computerized. It is prevented from errors in the design change processes.

Application of Configuration Management Information System for Operation NPP makes it easier to search for large design documents that were difficult to access and Configuration discrepancy was prevented through the computerization of the design change process. It also helped to operate the nuclear power plants safely.

5. Conclusions

By applying this system, it is possible to greatly reduce a search time for design requirements and facility configuration information required for performing a design change work. Integrating configuration management in a single system enables users more convenience and efficiency to find a related document and process a design change.

It will be continuously updated and modified to improve its reliability and effectiveness from an operational experience of the system.

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