Improvement of Engineering Work Efficiency through System Integration

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1. Introduction

Engineering processes at Nuclear Power Plant(NPP) in USA have been utilized to enhance plant performance and equipment reliability(ER) from the early 1990s. Korea Hydro & Nuclear Power(KHNP) has introduced ER related engineering processes from USA to improve equipment reliability of plant since 2000s.

But each process including computer system and database was introduced separately by each department at that different time. Each engineering process has a close relation with other engineering processes. The introduction of processes in a different time has caused the several problems such as lack of interrelationship between engineering processes, lack of integration fleet-wide statistical data, lack of the function of data comparison among plants and increase of access time by different access location on internet. These problems have caused inefficiency of engineering system utilization to get proper information and degraded engineering system utilization.

This paper presents the concept of developing an integrated engineering system for ER to improve efficiency and utilization of engineering system.

2. Integrated engineering system development for ER improvement

2.1 Engineering system example for ER in foreign NPP

FENOC(FirstEnergy Nuclear Operating Company) introduced integrated engineering system to utilize the shared database to support all process in ER workbench(IT software) as shown in figure 1.

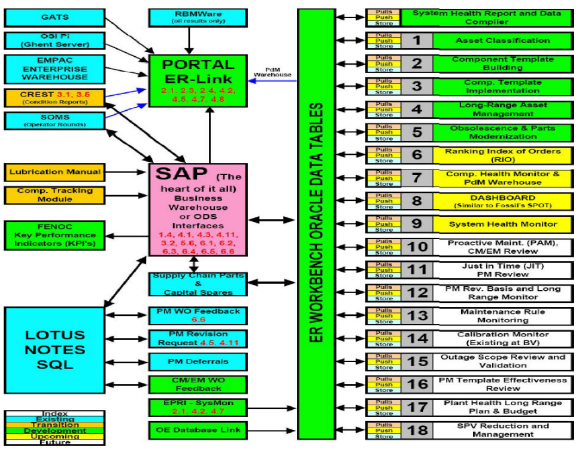

Fig.1. ER Information System Architecture of FENOC

The system brings together all information related to ER into a centralized data warehouse. Materialized views of data are then created and other module's schemas are granted permission to view them. For example, Component Health and Trending(CHT) module has thirteen information views relating functional locations, template associations, work orders, condition reports, failure codes and user information. CHT module was installed in a central data center. The single instance of CHT supports all three nuclear sites and drives the fleet towards standardization of process[1].

2.2 Current engineering process analysis in domestic NPP

Before the development of integrated engineering system, investigation and analysis of engineering processes in NPP need to be preceded as shown in figure 2

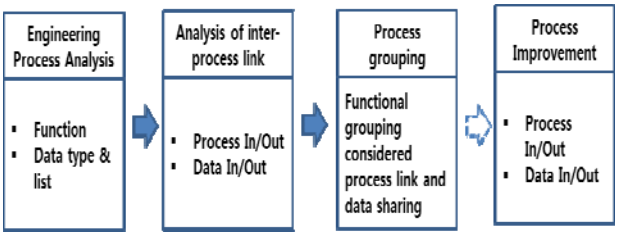

Fig.2. Review process for existing engineering process

The purpose of these steps is to identify functions of each engineering process, linkage with other processes and finding areas for improvement in process. First, roles of engineering process and data types have to be investigated. Second, relationship among processes is analyzed including process flow and data in/out. And third, similar processes are grouped upon consideration of process relationship and data sharing. Through this analysis process, the weakness of each engineering process and data flow can be found out. Finding results of weakness process also have to be reflected to the related procedures[2].

2.3 Application of Integrated Engineering System

To utilize engineering processes and data effectively, Integrated Engineering System(IES) for equipment reliability need to be built based on the result of figure 2 and engineer & management's requests. IES's architecture is based on INPO AP-913 process[3]. INPO AP-913 is the ER process which is verified as an optimized ER process through benchmarking among plants in USA. ER process in AP-913 represents the

integration and coordination of a broad range of equipment reliability activities into one process for plant personnel to evaluate important station equipment, develop and implement long-term equipment health plans, monitor equipment performance and condition, and make continuing adjustments to preventive maintenance tasks and frequencies based on equipment operating experience. This process includes activities normally associated with such programs as Reliability-Centered Maintenance(RCM), preventive maintenance (periodic, predictive, and planned), Maintenance Rule, surveillance and testing, Life Cycle Management (LCM) planning, and equipment performance and condition monitoring[3].

The architecture of IES can be composed as shown in figure 3. Engineering systems in use currently for ER are grouped as five categories such as scoping, performance monitoring, corrective action, preventive maintenance, life cycle management. The example of engineering system for scoping category is Functional Importance Determination(FID), and for performance monitoring category is Maintenance Rule (MR) and for corrective action category is Corrective Action Program(CAP) and for preventive maintenance category is Preventive Maintenance(PM) and for life cycle management category is Long Term Asset Management (LTAM). It would be more effective if IES should provide additional information such as each process explanation, overall process status report and schematic diagram of process. A database for IES has to be updated and shared as real time by on line to ensure data conformity among systems.

Engineering Supporting programs will provide systems for Plant Management Programs dealing with motor operated valve/air operated valve, steam generator management, loss of offsite power monitor program, etc.

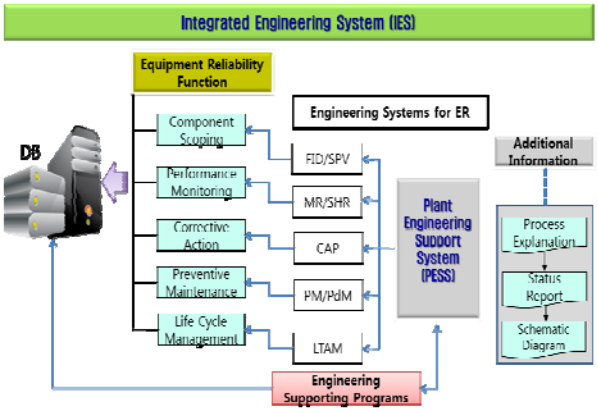

Fig.3. The overall architecture of Integrated Engineering System

IES also provides another function for plant engineer as shown in figure 4. This is called Plant Engineering Support System(PESS). The purpose of this system is to enhance engineer's work efficiency by getting access to useful information easily and playing a role of work navigator to execute works in a timely manner.

PESS can be composed of sub-systems which include three categories such as operation information, equipment management and system management which provide various equipment information and workplaces that engineer can put input data and conduct engineering work.

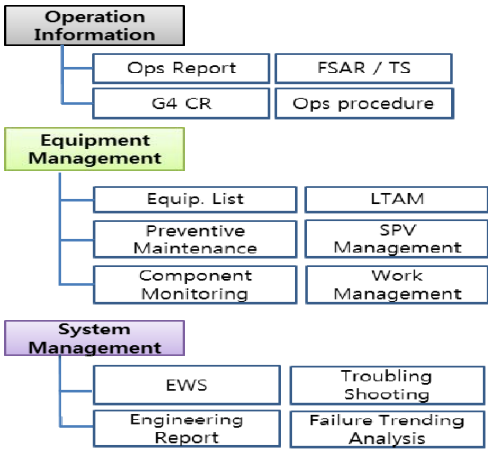

Fig.4. Contents of Plant Engineering Support System

3. Conclusions

KHNP has introduced and conducted advanced engineering processes to maintain equipment effectively in a highly reliable condition since 2000s. But engineering systems for process implementation have been developed in each department at a different time. This has caused the problems of process inefficiency and data discordance.

Integrated Engineering System(IES) to integrate dispersed engineering processes will improve work efficiency and utilization of engineering system because integration system would enable engineer to get total engineering information easily and do engineering work efficiently. And also the additional functions such as process explanation and status report would help managers or engineers understand what each process purpose is and how each process flows.

REFERENCES

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