

A Work Management System for Nuclear Power Stations and Future Trends Regarding a Maintenance Support System

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OVERVIEW: From the standpoints of administration of nuclear power plants in line with the deregulation of power utilities and the worldwide appreciation of the crude-oil price and global warming, the social environment surrounding their administration in recent years has been getting ever tougher in terms of the need to reappraise nuclear power generation and improve its capacity utilization. Moreover, as a result of the planned introduction of new inspection systems in 2008, it is predicted that operation information management and inspection-work-information management will have to be further upgraded. On top of this social situation, maintenance and repair work will be required to reach higher levels of efficiency, safety, and upgrading than have so far been attained. Based on the abundant results achieved by the “work management system” (which underwent system renewal last year) spanning the ten years since it started operation at the Shimane Nuclear Power Station of the Chugoku Electric Power Co., Inc., a concept called an “on-site maintenance support solution” for handling advanced maintenance work of next-generation plants is presently under construction and testing. From now onwards, Hitachi intends to propose implementation of this solution at a wide range of power-generation companies.

INTRODUCTION

REGARDING the operation of nuclear power plants, given the importance of global nuclear power

generation, on top of even safer maintenance, improvement of utilization rate is a major challenge. With this background in mind, actively applying the

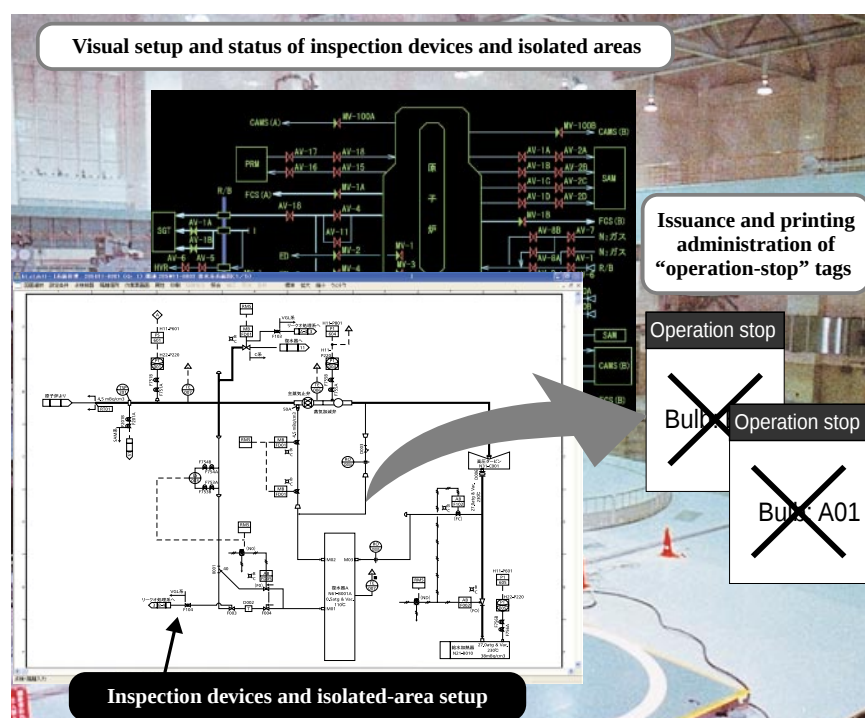


Fig. 1—CAD (computer-aided design) Screen and Operation-stop Tags of the Work Management System for a Nuclear Power Station. Inspection devices and isolated areas are set up on a P&ID (piping and instrumentation diagram/drawing) or a one-line wiring diagram displayed on a PC (personal computer), and maintenance work during regular inspections is supported.

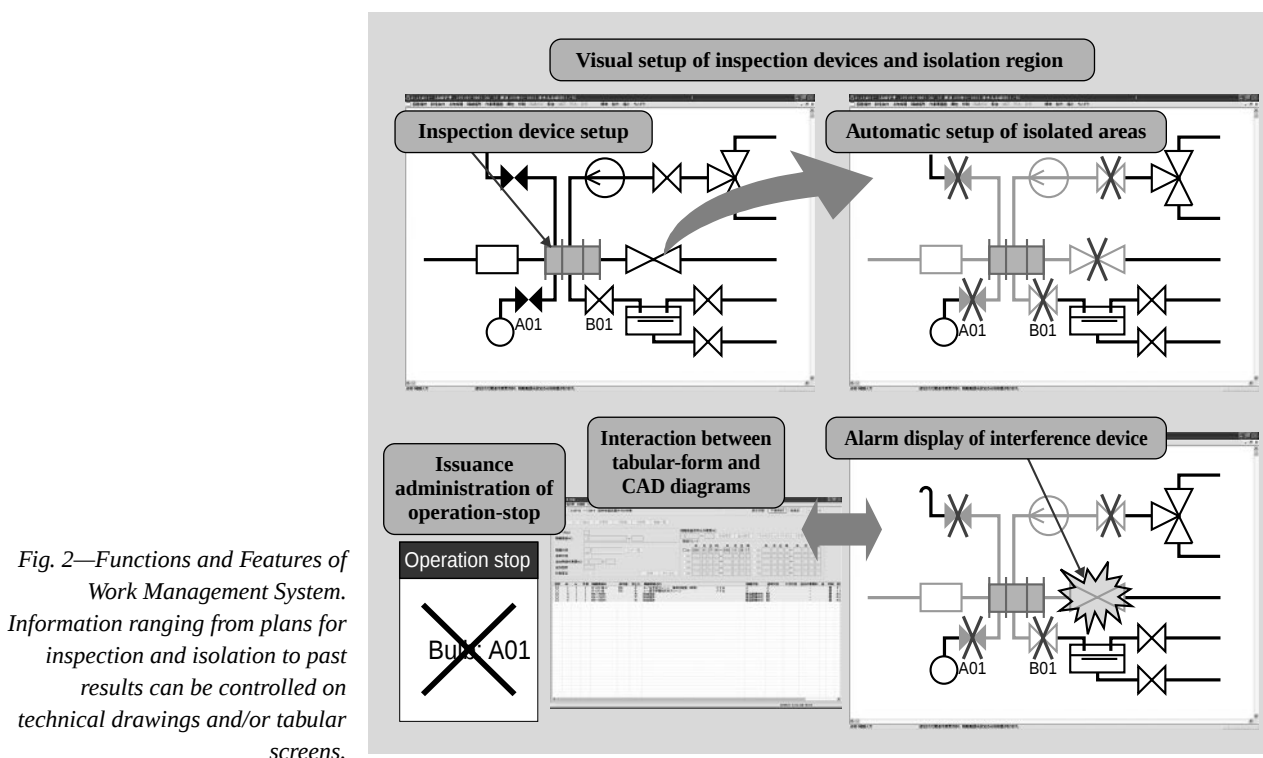


Fig. 2—Functions and Features of Work Management System. Information ranging from plans for inspection and isolation to past results can be controlled on technical drawings and/or tabular screens.

know-how we have acquired in construction and operation of a “work management system” and an “equipment management system” at the Shimane Nuclear Power Station of the Chugoku Electric Power Co., Inc., Hitachi is currently installing and testing an “on-site maintenance support solution” for comprehensively supporting maintenance work to the highest standards in the world.

In this report, the features of the work management system are described, an overview of the on-site maintenance support solutions is presented, and the future prospects concerning on-site maintenance management are discussed (see Fig. 1).

FEATURES OF WORK MANAGEMENT SYSTEM

Having started operation in 1996, the “work management system” at the Shimane Nuclear Power Station of the Chugoku Electric has become a vital system that plays a key role in the periodic inspections at that power plant. A method for setting up isolation areas in line with the guidance from computers and assigning equipment for inspection according to piping instrumentation drawings and one-line wiring diagrams displayed on computer screens was a breakthrough at that time. After that, in 2005, while functionality and performance were maintained, the

architectures of two UNIX* servers were integrated with that of one PC (personal computer) server, thereby lowering running costs.

The features of the work management system are listed below (see Fig. 2).

(1) Setting up equipment for inspection

Equipment targeted for inspection and inspection details can be set up from CAD (computer-aided design)-created P&ID (piping and instrumentation diagram/drawings) and one-line wiring diagrams.

(2) Automatic setup of isolation areas

Once inspection equipment is specified on the CAD screens, isolation areas based on the locations of that equipment automatically spread out by following the piping connections. When the zones reach valves, the system asks users in a conversational manner how the valves should be set: if the valves are set to be open, the spread of the isolation zones will proceed; if they are set to be closed, it will stop.

(3) Automatic recognition and visual display of interference equipment

As regards the isolation-area setup, in the case that a different status is set up when the valves are set to the same time and date, the valve of interest is

* UNIX is a registered trademark of The Open Group in the U.S. and other countries.

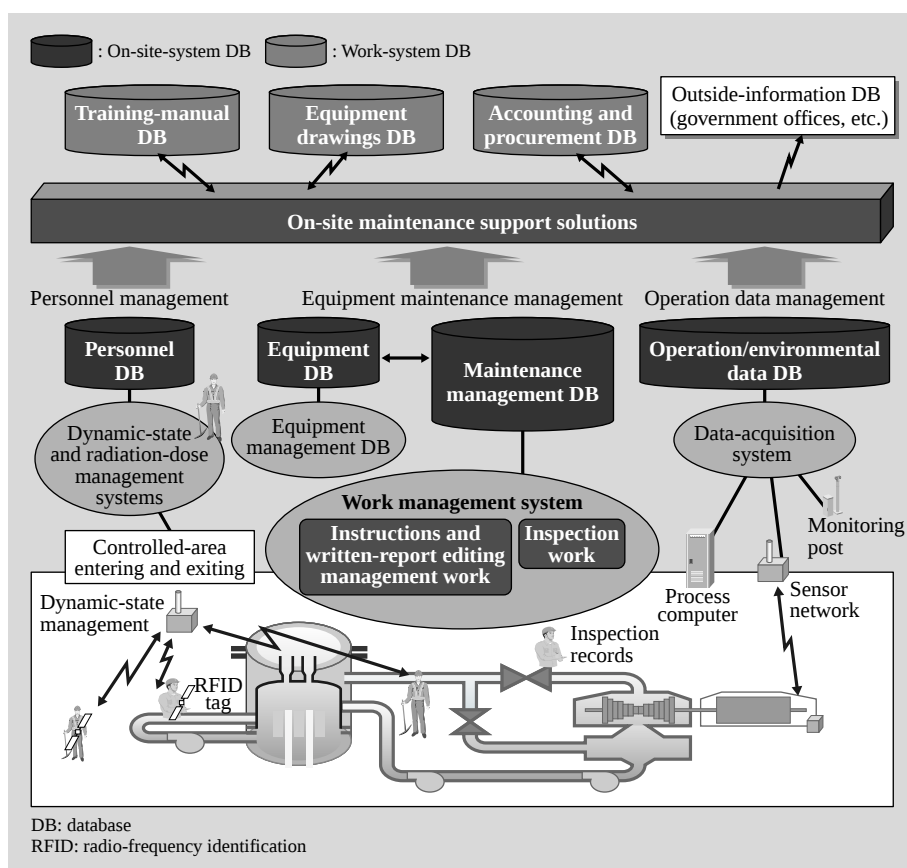


Fig. 3—Overview of On-site Maintenance Support Solutions. Personnel management operations, plant maintenance, and performance-data administrative work are organically joined together and managed as one.

displayed as blinking red on the CAD screen and continues blinking until the interference status is absolved. In this way, operational mistakes can be prevented in advance.

(4) Coordination between tabular-form display and CAD screen

Data from inspection devices and isolated equipment is mutually coordinated on the tabular display and the CAD screen.

(5) Operation-stop-tag issuance control

Data on registered isolated equipment are automatically printed out as “operation stop” tags and administered.

ON-SITE MAINTENANCE SUPPORT SOLUTIONS

Overview

Hitachi is currently constructing and testing on-site maintenance support solutions—for managing the whole body of maintenance work and aimed at improving safety and working efficiency—based on the results from the “work management system.” The key points regarding these solutions are listed as follows (see Fig. 3).

(1) Platform for solutions

Data from each operation (i.e. personnel management, equipment maintenance management, and operation data management) are “organically” linked, and an on-site maintenance support solution is established as a comprehensive management system for administering the interface between the work management system and external systems.

(2) Personnel management

A worker management database centered on dynamic control of workers in controlled areas and a radiation-dose management system are unified as one system.

(3) Equipment maintenance management

In regard to on-site maintenance work, with the work management system at its core, the on-site maintenance support solution comprehensively manages instruction data, maintenance work report data, and maintenance log, and combines the equipment database and maintenance management database. The main feature of this equipment maintenance management is that the equipment database is automatically renewed by means of browsing parts-replacement information created as part

of periodic inspection reports. As a result, maintenance man-hours for the equipment database are significantly reduced, and maintenance errors can be prevented.

(4) Operation data management

Operation data from process computers, status-monitoring data from sensor networks, and environmental data from monitoring posts are gathered, and a comprehensive database is established.

Future Trends Regarding On-site Maintenance Management Work

Revision of inspection systems at nuclear power plants is set for 2008; accordingly, as regards plant operation information and periodic inspection information, more advanced and more detailed management is necessary. The “on-site maintenance support solution” for unified control of personnel management, equipment maintenance management, and operation data management can flexibly respond to advanced maintenance work for next-generation power plants. From now onwards, it is Hitachi’s intention to propose installing the “on-site maintenance support solution” currently under construction and testing at various power-generation companies.

CONCLUSIONS

This report described the main features of a “work management system” installed at Shimane Nuclear Power Station of the Chugoku Electric. It also described the concept of an “on-site maintenance support solution” that will be proposed to various power-generation companies from now onwards. Aiming to make improvements into the future and further improve work efficiency and usability, Hitachi will continue to establish maintenance work management technology for the nuclear power plants of the next generation.

ACKNOWLEDGMENTS

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