A Development of Web-Based Application Program for Motor-Operated Valve Periodic Verification

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1. Introduction

Safety related Motor-Operated Valves (MOVs) in nuclear power plant are essential elements to isolate or supply various fluids such as reactor coolant. Operational failures of the safety-related MOVs may cause serious consequences. Thus, it is very important to secure the operability of MOVs by performance evaluation and periodic verification. In Korea, design basis performance evaluation of all the safety related MOVs in nuclear power plants were completed and periodic verification is being performed by the regulatory regulations. KHNP (Korea Hydro & Nuclear Power Company) and KEPRI (Korea Electric Power Research Institute) developed web based program to enhance the reliability of design basis performance evaluation and periodic verification and the efficiency of data management.

2. Periodic Verification of MOV

The first step to perform periodic verification of MOV is to determine the test cycle and test method. As shown in table 1, these are decided by operational margin (M) of each valve that is evaluated from the previous test result and safety significance (S) that shows the relative importance of valve for the safety of nuclear power plant.

Table1. Test cycle and test method criteria

M / S	Test Cycle			
	At-the-Valve Test*			MCC Test**
	Low *M<5%*	Medium *5%≦M<10%*	High *10%≦M*	*M≧25%*
High	1	2	3	2
Medium	2	3	3	3
Low	3	3	3	3

* At-the-valve test: Diagnostic test performed at the valve and needs various sensors

** MCC test: Diagnostic test performed at MCC (Motor Control Center) and much more simple than at-the-valve test

When test cycle and test method is determined for each valve, diagnostic test is performed to verify the operability and the condition monitoring. At-the-valve test and MCC test are being used for MOV periodic verification in nuclear power plants. Through valve diagnostic test, various kinds of data for performance evaluation and diagnosis are measured. If the test result does not meet acceptance criteria or trouble is found through signal analysis, corrective action should be taken and test performs again to assure the operability of valve. After completing valve performance analysis, it is compared with the result of design basis performance evaluation and the next test cycle and test method are determined.

3. Web based program

3.1 Program Development Environment

This system (Web based program) was designed with Web/JAVA based 3-tier architecture to be processed rapidly by the separation of web server and client, even though many users access system simultaneously. System specification is described below.

(1) OS: Windows 2003 Standard Edition
(2) DBMS: Oracle 8.1.7
(3) Web Server: Resin 2.1.8
(4) Protocol: TCP/IP, HTTP
(5) Program Language: JAVA/JSP, XML

2.3 system design

2.3.1 Entire system framework

Basic frame of this system is consists of 3 modules such as figure 1 to make system management not only efficient but also convenient. The function of Module 1 is data processing and user could input, update, delete and select various data which are necessary for valve performance analysis with Module 1. Module 2 calculates and analyzes the data from module 1 to evaluate valve performance. The function of Module 3 is to make database of Module 1 and Module 2 at each table.

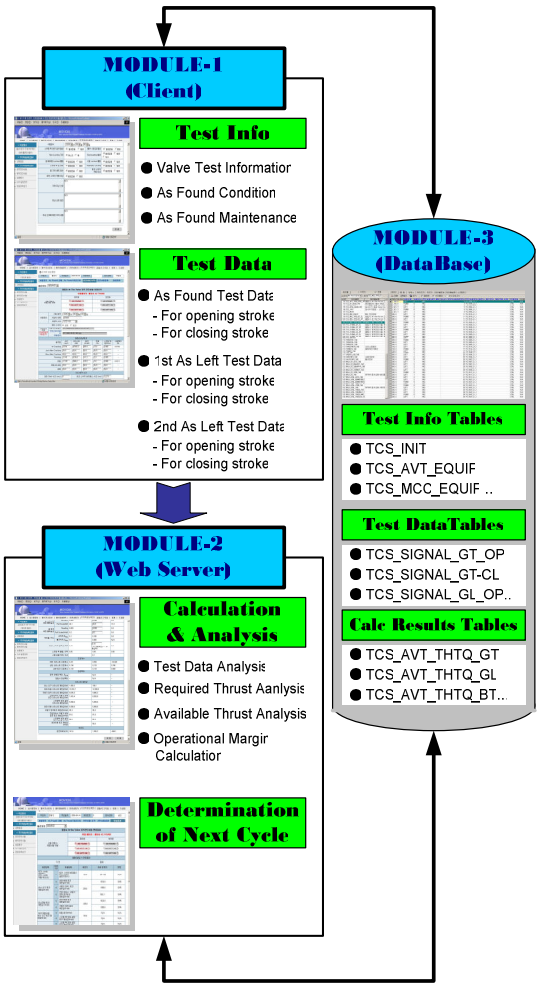

Figure 1. System Design Concept

3.3.2 Key Feature of System

System was designed based on the analysis of MOV periodic verification process as previously stated.

3.3.2.1 User interface

User interface was designed to ensure user convenience. Periodic verification processes and required information, which are valve information search, selection of periodic verification and diagnostic test method, diagnostic test information and results, overall results of periodic verification, consist in order.

3.3.2.2 User input module

Input of valve basic data and diagnostic test results are carried in User input module which is shown in module 1 of figure 1. Valve basic data are used for diagnostic test, which are system operation mode, diagnostic equipment and sensor information, and as found information of valve. Diagnostic test consists of as found test, 1st as left test, 2nd as left test and test results can be input separately.

3.3.2.3 Calculation module

The function of calculation module is to evaluate operational margin and to determine next test cycle of each valve (Module 2 of figure 2). It calculate operational margin for performance evaluation of valve by calculating various data from Module 1 and Module 3. It is convenient for user to identify performance variation of valve by comparing performance evaluation result with previous one. Next test cycle and test method are automatically determined by operational margin calculated in Module 2 and safety significance of each valve according to table 1.

3.3.2.4 Database module

Database module consists of 34 tables, 6 of valve basic data, 6 of diagnostic test data summary, 14 of diagnostic test results and the other tables. Each table was designed to manage data easily by number of periodic verification using primary key, which is combined with plant name, valve name, system name and number of periodic verification. Periodic data backup is executed to prevent data loss by system malfunction or unexpected problems.

4. Conclusion

Web based program for MOV design basis performance evaluation and periodic verification was developed and is being used in all nuclear power plants successfully. With this system, valve engineers in plant are able to analyze valve performance, make reports and share experience conveniently and effectively. Thus, this system contributed to the enhancement of reliability and efficiency of design basis performance evaluation and periodic verification for safety related MOVs in nuclear power plant.

REFERENCES

[1] KHNP, “Periodic Verification Procedures for Motor Operated Valves,” 2005. 5
[2] J.H. Hong, J.K. Kim, K.C. Song, S.P. Lee, H.S. Kim, “Oracle Bible,” 2002. 8