Development of Standard Technology for In-service Test

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1. INTRODUCTION

Nuclear power plant has several safety features and each safety feature is based on the operation of pumps and valves. Thus, it is an essential basis for the safety of nuclear power plant to keep operational readiness of pumps and valves. Technology Rule 63.1.2 of Nuclear Facility etc. requires In-service Test (IST) for pumps and valves.

Our domain nuclear power plants can be classified into

1) Westinghouse 2 Loop (PWR600)
2) Westinghouse 3 Loop (PWR900)
3) Framatom 3 Loop
4) Korea Standard Nuclear Power Plant (KSNP)
5) CANDU

Each type of plant has similar design and maintenance features. However, the IST program in each type is slightly different each other in components subjected to IST, test item, test period and so on. These have caused excessive effort for the test itself, the response to regulatory authority, and the response to the change of code and standards.

This study is motivated in order to resolve such problems as a first step. The objectives of this study is

1) Development of standardization methodology of IST for each plant type
2) Development of IST technical backgrounds for each plant type
3) Development of standard IST plan on the base of the technical backgrounds for each plant type

The results of this study will be utilized in

1) Effective response for the regulatory activities using the standard technical backgrounds and plan for IST
2) Exclusion of none-safety functioned components from the definite analysis for each component
3) Foundations for the relief request

Because of practical status in each plant, the concerned plants are limited to: 1) KSNP (YGN3&4, YGN5&6, UCN3&4, UCN5&6), 2) PWR900 (Kori3&4, YGN1&2), 3) CANDU

2. APPROACH TO STANDARD TECHNOLOGY

2.1 Code and Standards

The first code and standard is Ministry of Science and Technology (MOST) Guide 2004-14[1]. This guide identifies the requirement of IST, and endows KEPIC MO 2000 [2] or ASME OM 1995 and its addenda [3] for detailed test requirements. KEPIC MO 2000 is also based on ASME OM 1995 and its addenda. KINS-G-018 (Rev.1) is also used as a code and standards [4]. NUREG-1482 (Rev.1) is referred to as complementary code and standards[5].

2.2 Standardization Methodology

Standardization for each type of plants was carried out according to following procedures

1) List up the components subjected to technical background according to reference format
2) Consolidate the lists for each type of plant
3) Review the function of the components
4) Decide the safety function of each components
5) Review the test items, frequency and so on
6) Comments on the difference between units for each type of plant

3. DEVELOPMENT OF TECHNOLOGY BACKGROUND FOR IST

The references for selecting the components subjected to technical background are current IST plan, FSAR Ch. 3, FSAR Ch. 6, FSAR Ch. 16, Emergency Operation Procedure (EOP), Probabilistic Safety Analysis (PSA) reports, Engineer Safety Feature (ESF) components, Safety Class components, and components of regulatory authority requirement.

Technical background is made in MS-Excel and Hangul word. Samples are shown in Figs. 1 and 2.

As a result the number of components subjected to technical background is

1) KSNP : Pump 43, Valve 886
2) PWR900 : Pump 35, Valve 708
3) CANDU : Pump 34, Valve 475

4. DEVELOPMENT OF STANDARD IST PLAN

IST plan of each plan was reviewed for standardization. At first standard form IST plan was composed regardless of plant type. And then specific features for specific plant type were reflected in the IST plan for each type. There was not significant difference in body of IST plan. The detailed items were attached in appendix.

5. RELIEF REQUEST

MOST Guide 2004-14 allows relief request for the components which are very hard to test or test of which results in reverse effect in overall plant safety. In this study current relief requests of each plant are integrated. Some foreign relief request was also integrated. All these cases were classified according to its request type. Such a classification will helpful in further relief request in each plant to both licensee and regulatory authority. The results are summarized in Table 1. Foreign cases shows variety of relief request comparing with domain case. Thus, more relief request for domain plan may be possible in future.

6. CONCLUSION

From this study following outputs were generated

1) Standard IST plan
2) Standard technical background for each plant type
3) List of components subjected to technical background

These outputs can be used as first reference for further development of IST plan in each plant. And these also can provide the technical background for regulatory authority.

This study is the first attempt for the systematic IST program, and continuous technical meeting among plants is needed for the better IST program. Such activities may produce grand standardization for IST, which means the standardization for all domain nuclear power plant.

REFERENCES

[1] MOST Guide 2004-14, Guide for In-service Test of Safety-related Pumps and Valves, Ministry of Science and Technology (MOST), 2004

[2] KEPIC MO, In-service Test for Nuclear Power Plants, 2000

[3] ASME OM, Code for Operation and Maintenance of Nuclear Power Plants, 1995

[4] D.Y. Cho, et al, Guidelines for In-service Test for Safety Related Pumps and Valves, KINS/G-018 Rev.1

[5] Steven M. Unikewicz, Guidelines for Inservice Testing at Nuclear Power Plants, NUREG-1482 Rev.1

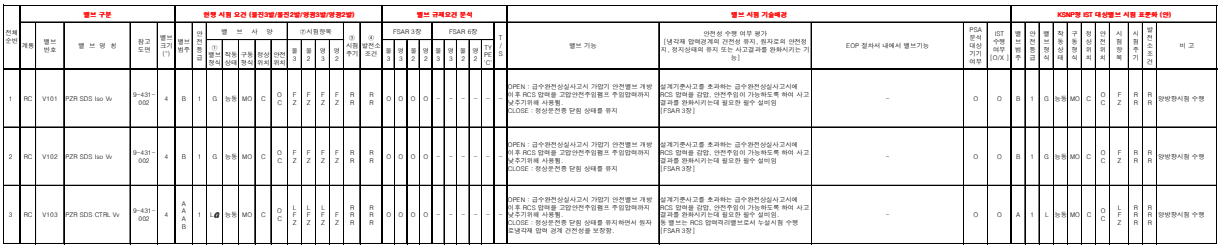

Fig.1 Excel Form of Technical Background

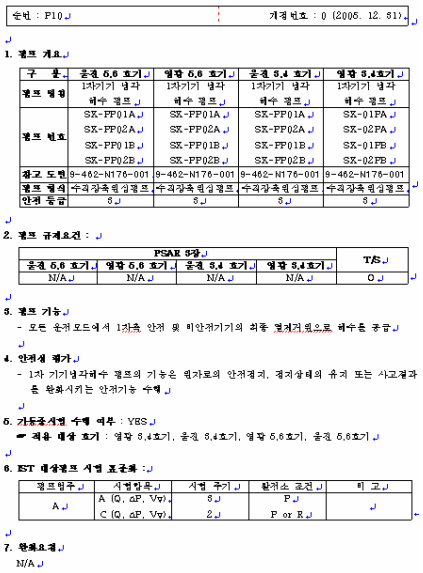

Fig.2 Hangul Form of Technical Background

Table 1 Classification of Relief Request

Pump			
Reference	Relief Request	Basis for Relief Request	Number
Acceptance criteria	Changing alert range	Operability proved by baseline vibration study and monitoring	Foreign :2
Operation point	New operation point or new pump curve	Impossible to operate at reference point	Foreign :3
Measurement	Not measure flow rate, differential pressure, or vibration	Impossible to install the sensor	Foreign :12 Domain : 10
Test accuracy	Full scale change	Provide basis for sufficient safety level	Foreign :2
Check Valve			
Reference	Relief Request	Basis for Relief	Number
Sampling Method	Testing for sampled valves in refueling outage	Operability proved by sampling program	Foreign : 6 Domain : 3
Extension of Test Period	Delay test to cold shutdown or refueling outage	Avoiding retardation of EDG operability, etc.	Foreign : 5 Domain : 1
Non-intrusive Test	Non-intrusive testing for sampled valves	No indicator, differential pressure meter	Foreign : 2
Monitoring Program	Applying the check valve monitoring program	Provide basis for sufficient safety level	Foreign : 1
Non-safety Direction Closure	Relief for close direction full stroke test	Close direction is non-safety position	Domain : 1
Group A&B Valve			
Reference	Relief Request	Basis for Relief	Number
Measurement	Not measure stroke time	Impossible to install the sensor	Foreign : 1 Domain : 5
Other Test Program	Endow to MOV Test Program	Provide basis for sufficient safety level	Foreign : 1
Relief Valve			
Reference	Relief Request	Basis for Relief	Number
Thermal Equilibrium	Not evaluate the thermal equilibrium	Inadequate to evaluate the thermal equilibrium	Foreign : 1
Set Pressure of Valve	Not use the accumulator volume	Accumulator volume is not needed to establish the set pressure	Foreign : 1