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Establishment of a Quality Assurance Scheme for the Development of Excitation Control System for Emergency Diesel Generator

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1. Introduction

The development of excitation control system (ECS) for emergency diesel generator in nuclear power plant is the replacement project of existing control system to resolve the maintenance problems caused by aging and obsolescence.

The excitation control system is classified as a safety-related system. To guarantee the performance of developing excitation control system is equal to or higher than that of other systems, establishing the quality assurance scheme, doing software verification and validation activities, and planning equipment qualification.

In this paper, we'd like to introduce the quality assurance scheme related to the development of excitation control system.

2. Quality Assurance Planning

To meet the quality assurance requirements prescribed in 10CFR50 Appendix B, Korea Hydro & Nuclear Power Quality Assurance Manual and Korea Electric Power Research Institute Quality Assurance Manual, preparing project quality assurance plan, related subordinate quality assurance procedures. Followings are the summary of above mentioned plans and procedures.

- Quality Inspection Plan:
  Contains hold points or witness points must be confirmed by quality assurance department.
- Project Quality Assurance Plan:
  Describes quality assurance organization and guidelines.
- Project Management Procedure:
  Describes preparing, reviewing, approval and management of design products.
- Software Development Plan:
  Define software life cycle, organization, resources, and describes software development plan.
- Software Configuration Management Plan:
  Identifies, controls and manages the changes through whole life cycle.
- Software Verification and Validation Plan:
  Describes a plan to verify and validate task schedule and products through whole life cycle.

3. Equipment Qualification

To meet the requirements of Reg. Guide 1.89, Reg. Guide 1.100 and IEEE 323, preparing seismic and environmental qualification requirements. These requirements can be applied to any nuclear power plant within a country.

Followings are the example of environment requirements.

Requirement		Unit
Elevation	100	Feet
Pressure	14.7	Psig
Temp Max.	122	˚F
Relative Humidity Max.	100	%
Environmental pH Normal	7	
Integrated Dose	Negligible	rad

4. Licensing Strategy

To complete the project with success,

- Review the licensing requirements like the equipment qualification scheme of safety-related grade and the requirements of applicable codes and standards.
- Fix the documents for licensing application, and preparing licensing plan according to the development schedule.
- Manage the documents related to the licensing application as the newest edition.

Followings are the examples of the documents for licensing application.

- Quality Assurance Manual and Procedures
- Project Quality Assurance Plan
- Software Quality Assurance Plan and software related plans
- Design Documents (Concept, Requirements, Detail and Procurement Specification)
- Certificate of Equipment Qualification Test

5. Conclusion

The project introduced above is on-going and the goal of this project is developing excitation control system to have higher performance and reliability. Equipment qualification test will be in Oct. 2006, and installation will be in Jan. 2008. (Kori #3)

A key point to achieve success is the quality assurance scheme and the results from quality assurance activities. Quality assurance scheme established in this project will be helpful to develop other safety-related system or equipment.

REFERENCES

[1] ANSI/IEEE 1993 Application Criteria for Programmable Digital Computer System in Safety Systems of Nuclear Power Generating Stations
[2] IEEE Std 1012 Standard for Software Verification and Validation Plans
[3] IEEE Std 1016 Recommended Practice for Software Design Descriptions
[4] 10CFR50 APPENDIX B Quality Assurance Criteria for Nuclear Power Plants
[5] IEEE Std 830 Standard for Requirements Specification
[6] ASME NQA-1 Quality Assurance Program Requirements