A Study on Control Transfer of SMART

Jonghyun KO*, Sangmoon SUH **, Youngrok SIM*, Dukhyun SEONG*, Geunok PARK**, Jungseon KIM*
** Samchang Enterprise Co., Ltd.*
*** Korea Atomic Energy Research Institute*
kjh1350@samchang.com

1. Introduction

At a room, physically and electrically separated locations outside the Main Control Room(MCR), equipment shall be provided with a design capability for prompt hot shutdown and subsequent cold shutdown of the reactor and for maintaining its safe states in accordance with suitable procedures in the case of a failure of the MCR such as a fire in SMART(System integrated Modular Advanced ReacTor). [1][2]

The room is named as Remote Shutdown Room(RSR). Sit-down console which is placed in the RSR is named as Remote Shutdown Panel(RSP). The equipment is composed of Soft Control system(SC)s and Display Device(DD)s mounted on the RSP.

Devices used the operator transfers location of control between MCR and RSR is named as Control Transfer Devices(CTD).

The purpose of this study is to define design requirements of control transfer and present configuration of control and monitoring interface between MCR and RSR in SMART.

2. Requirements and Configuration

A number of design assumptions and requirements are as the following. And configuration of control transfer is described.

2.1 Design Assumptions

Control of the plant shall normally be from the MCR.

The Evacuation Occurrence(EO) is not simultaneous with Design Basis Accident(DBA), nor does it cause fuel damage or result in loss of function of the reactor coolant pressure boundary or reactor building barriers.[3]

The EO is not coincidentally with severe natural phenomena such as earthquakes, floods, typhoons, tsunami and so on. [4]

Plant operates on power in normal plant condition before EO. There are no trouble, testing and repairing devices in the plant.

In the event of EO the operator 1) trips the plant as predefined evacuation procedures, 2) transfers location of control from the MCR to the RSR using the operator interface equipment(i.e., transfer switches) of CTD in electrical equipment room and 3) moves to the RSR.

2.2 Design Requirements

Design requirements of control transfer are derived from a number of requirements required to be performed characteristic function of CTD. [3]

2.2.1 Prevention of simultaneous control The CTD shall be designed to prevent from simultaneous operation both the MCR and the RSR.

2.2.2 Recover control from the RSP The CTD shall be capable of returning control to the MCR following termination of the EO.

2.2.3 Physical position Physical position of operator control interfaces(i.e., transfer switches) for the CTD is electrical equipment room and the RSP except the MCR because the CTD is provided in the event that environment in the MCR do not meet operator's habitability.

2.2.4 Indication of plant status Indication value of plant status shall be designed to indicate same value to DDs which are placed in both MCR and RSP irrespective of location of control even at that time of transfer.

2.2.5 Alarm Operation of the CTD shall cause an alarm to be actuated in the MCR and in the RSR to warn inadvertent transfer to the operator. Actuating alarm shall be designed to perform control function of alarm.

2.2.6 Fire CTD shall be provided with structures and provisions to preclude from malfunction of CTD for fire on the design of CTD. Installed area of CTD shall be provided with fire protection provisions to minimize probability and effect of fire.

2.2.7 Sabotage Installed area of CTD shall be provided with exit to minimize access and isolated from general passage. Operator of MCR shall be capable of identifying information for someone access to CTD. [5]

2.3 Interface between MCR and RSP

Configuration of control and monitoring interface between MCR and RSP which is used fiber optic cable applied to SMART is respectively shown in Figure 1 and Figure 2.

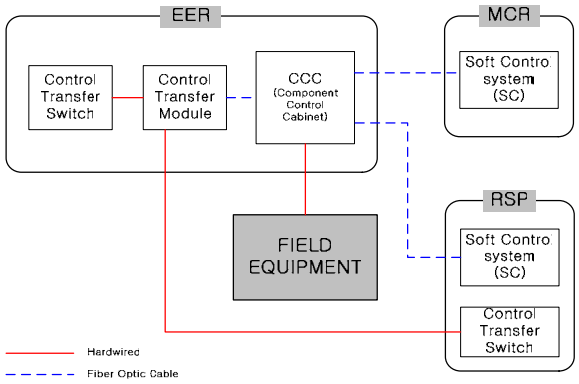

Figure 1. Control interface between MCR and RSP

Logic that MCR-SCs not operate and only RSP-SCs operate is the following.

Control transfer switches in EER are adjusted to 'RSP' and control transfer switches on RSP are adjusted to 'RSP'. And then control transfer module is identified to location of control and order Component Control Cabinet(CCC) to accept only RSP-SC signal for operating field equipment.

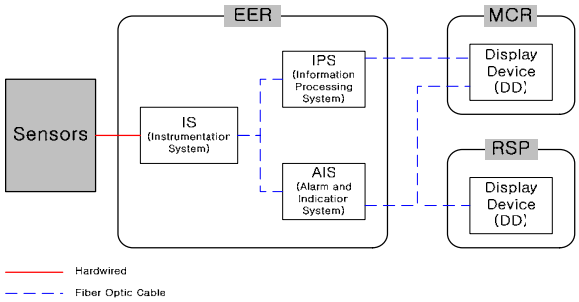

Figure 2. Monitoring interface between MCR and RSP

Monitoring interface between MCR and RSP is always indicated to Display Device(DD)s in both MCR and RSP irrespective of location of control.

3. Conclusion

We described assumptions and requirements for design of CTD and presented configuration of control and monitoring interface between MCR and RSP.

It is necessary to further study for equipment specification of configuration of interface between MCR and RSP.

REFERENCES

[1] Regulations on Technical Standards for Nuclear Reactor Facilities, Etc., Regulation 31 of the Ministry of Science and Technology, 2001.

[2] Title 10, "Energy," Code of Federal Regulations, Part 50, "Domestic Licensing of Production and Utilization Facilities," Appendix A, "General Design Criteria for Nuclear Power Plants," Criterion 19, "Control Room.", U.S. Government Printing Office, 2000.

[3] Criteria for Remote Shutdown of Light Water Reactors, KEPIC ENB 6320, Korea Electric Association, 2000.

[4] Title 10, "Energy," Code of Federal Regulations, Part 50, "Domestic Licensing of Production and Utilization Facilities," Appendix A, "General Design Criteria for Nuclear Power Plants," Criterion 2, "Design Bases for Protection Against Natural Phenomena.", U.S. Government Printing Office, 2000.

[5] Act on Physical Protection and Radiological Emergency, Korea Act 6873, 2003.