

Review of Radiological Emergency Initiation Criteria and Notification Method in Domestic PWR Plants

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1. Introduction

The safety of Nuclear power plant facilities and response of radiological events are important. Nuclear power has one of the longest shares among all power sources in Korea. Emergency Initiation Criteria of the Radiological Emergency Response Plan[1] are maintained insufficient technical guidelines though they have revised and operated for a long time.

Now, The alert event is not a imaginary situation but a real situation because of the case of NPP 3 and the another case of NPP 4's SG tube rupture. Korea Institute of Nuclear Safety(KINS), Atomic Regulation Agency of Korea, concluded that there are insufficient responses and the operating staff's understanding for Emergency Initiation Criteria at the Alert situation. To compensate the insufficient things, KINS published the Emergency Action Level Guidelines for Nuclear Power Plants[2] reflected experience and technological decision of Emergency Initiation. The guideline is reflected the experience and judgement of professional experts and operating staffs. In Korea, The Periodic Safety Review should be performed to improve the safety every 10 years for the operating NPP. We reviewed the PSR of YGN 1,2 and some conclusions were obtained that there is a little difference between the Radiological Emergency Response Plans[1] and the Emergency Action Level Guidelines for Nuclear power plants[2].

2. The comparison of Emergency Initiation Criteria

2.1 Radiological Emergency Response Plans

Radiological Emergency Response Plans are prepared for the each Nuclear Division and they are similar to the level of systems and classification of equipment. In Emergency Response Plan, the background or basis for Emergency are described in three Emergency Action Level and the Emergency Plans are established which replace the classes in chapter 3 of Radiological Emergency Plans. The classes are Alert, Site Area Emergency and General Emergency. Site Area Emergency events are in process or have occurred which involve actual or likely major failures of plant functions needed for protection of the public. General Emergency events are in process or have occurred which involve actual or imminent substantial core degradation or melting with potential for loss of

containment integrity. In this paper, we reviewed the Alert situation for RCS leakage.

2.2 Guideline of Emergency Initiation Criteria for PWR Plants

KINS's Guideline is included the general requirements and regulatory position of Emergency Initiation Criteria for PWR Plants. The criterion bases are Korea Atomic Energy Law and MOST Notice 2003-15. Additionally, the guideline was reviewed by the committee of Nuclear Safety Special Part to attain the authority. The developer wants that the guideline is utilized decision making in various possible accidents and also in technical interpretation. In future, the guideline would be improved by continual study or developing efforts of nuclear engineers. The guideline in content of background comments the lack of clear Emergency Initiation Criteria and the reason operating system

In body contents, The total emergency situation is classified 41 items including the 20 alert items and each Emergency Initiation Criteria are composed of ①Name of emergency situation, ②Specific class, ③Background and Relation description of Criteria, ④Regulatory guideline on Emergency Initiation Criteria ⑤Notification Alarms for Emergency Initiation, ⑥Alarm value of each Initiation.

A typical guide's conclusion is that there are too many input items of logic tree in the Emergency Action Level Guidelines for Nuclear Power Plant. It confuse the senior operator's notification event and delay the decision of appropriate further action. The other guide's conclusion is the notification of event and decision time and should be less take.

2.3 The Alert Initiation Criteria on RCS leakage between Radiological Emergency Guideline and Emergency Plans

There are 20 items in Alert initiating conditions in NUREG-0654 which has been a reference of Radiological Emergency Response Plans and also are 20 items in Emergency Action Level Guidelines. There are 7 items related RCS Leakage among them. The Initiating Conditions of Alerts are ②Rapid gross failure of one SG tube with loss of offsite power, ③Rapid failure of SG tubes(e.g several hundred gpm primary to secondary leak rate, ④Steam line break with significant(e.g greater than

10gpm)primary to secondary leak rate(PWR), ⑤Primary coolant leak rate greater than 50gpm, ⑥Radiation levels or airborne contamination which indicate a severe degradation in the control of radioactive materials , ⑫Fuel damage accident with release of radioactivity to contaminate or fuel handling building, ⑬Radiological effluents greater than 10 times technical specification instantaneous limits .

2.4 Comparison of Radiation Monitory System to Radiological Leak Cognition

The following Table 1 summarizes the effective comparison between Emergency Guideline and Response plans.

Table 1. RMS list related RCS leakage in Documents

Alert	KINS's Guideline	KHNP's Emergency Plans
2, 3,	Main steam monitor, SG BD sampling system monitor, Condenser air ejector	Main steam N-16(gamma), SG BD sample system monitor, Condenser air ejector monitor, Condenser Vacuum pump exhaust gas monitor, SG BD monitor
4	Main steam monitor, SG BD sample system, Condenser air ejector	Main steam N-16(gamma), SG BD sample sys. monitor, Condenser air ejector Cond. vac.p/p exhaust monitor, SG BD monitor CV Air Exhaust monitor
5	-	-
6	Control room monitor SFP monitor, New Fuel monitor, CV Fuel monitor, Cavity of CV or Fuel Bld. monitor, Radwaste Bld. monitor, Drum storage area monitor, Analysis Lab monitor, Primary Chem. Lab monitor	Control room monitor SFP monitor New Fuel storage monitor CV wide range monitor Seal table Incore detector Operation area in CV Refueling area monitor Loading of Radwaste Solicitation of Radwaste Radwaste control room Sampling room monitor Primary Chemical Lab PASS Lab monitor Radwaste Lab monitor Contaminated Equipment Lab
12	CV or Fuel Bld. monitor	refueling area monitor High radiation of CV monitor CV Operation Area monitor CV Vent monitor SFP monitor Exhaust of Fuel Bld monitor
15	Exhaust or Vent of Rad CV Vent monitor Aux. Bld. hvac monitor, Radwaste Bld hvac monitor, SG BD. Monitor,	Exhaust of Aux Bld.(P,I,G), Exhaust of CV(P,I,G) monitor Release of Liquid waste monitor Exhaust of Fuel Bld monitor SG BD. monitor

2.5 Opinion on RMS of primary coolant Leakage

- Alert 2 and 3 on Table 1, Condenser Vacuum pump Radiation monitor and SG BD Radiation monitor are unnecessary
- Alert 4, Condenser Vacuum pump monitor, SG BD monitor and CV Air Exhaust monitor are unnecessary
- Alert 5, When coolant is leaked to sealing or cooling system about 50gpm at Alert 5 monitor of the system doesn't indicate change. Because there is not the selected radiation monitor.
- Alert 5, Many selected area Radiation monitors are confusing the decision and there is little relations between Emergency event and area Radiation monitors like New Fuel storage, Sampling room and Radwaste Lab.
- Alert 12, Though severe loss of fuel cladding is supposed at Alert, most Radiation monitors in CV and Fuel building are selected. When each monitor keeps a close watch the fuel damage, They should be examined whether each Radiation monitor offers the appropriate alarm and refusing the confused decision logic to operating staffs
- Alert 15, Though gas Radiation monitor offers the information releasing radiological effluents, there are iodine and particle monitor unnecessarily and it may be confused the logic of decision for the operating staff.

3. Conclusions

The newly published Guideline by KINS including many technical bases made reference to NUREG-0654. The Guideline has been beneficially used for Radiation Emergency plan during the operation of NPPs. The review result, there are same need to rearrange the alert of Radiological Emergency plans including radiation monitor for decision RCS leakage at alert 2, 3, 4, 5, 6, 12 and 15.

References

[1] Radiological Emergency Response Plans, YGN Division 2004.
 [2] Emergency Action Level Guidelines for Nuclear Power Plants, KINS, 2003
 [3] Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of NPP, NUREG-0654, U.S NRC, 1980