Support measures for Information display and accident response for emergency response systems in severe accidents.

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1. Introduction

Nuclear power plants have provided defense in-depth in various aspects for safe operation. After the Fukushima accident, which caused serious damage due to earthquake and tsunami, many improvements and supplements have been made to the existing emergency response system around the world. This is because of the lessons learned that natural disasters beyond the expected range could lead to a fatal blow to existing nuclear protection systems. Various measures have been taken to prevent the development of severe accidents and to ensure safety even in the event of major accidents from the improvement of national regulatory systems and emergency response organizations, to the reinforcement of emergency response equipments in the nuclear power plant against natural disasters.

Supporting decision-making and response measures of accident response personnel, including operators, is one of these measures. It is one of the most important factors to prevent the occurrence of severe accidents that response personnel who would be the first to respond directly to an accident recognize the situation promptly and take appropriate measures. In preparation for an accident in a nuclear power plant, operators must constantly monitor a lot of information and have the task of minimizing the development and damage of the accident by taking appropriate measures when an accident occurs.

This study analyzed the current state of emergency response systems against nuclear accidents and the vulnerabilities of severe accident response systems. Based on this, we have developed measures to support information display and countermeasures for efficient coping of accident response personnel.

2. Review of the emergency response system

After the Fukushima accident in 2011, there has been a lot of change in the preparation for nuclear accident in Japan. Regulatory agencies were integrated, the radiation response system was improved, and improvements were made in terms of personnel training and emergency equipment. In addition, the Offsite Center and the anti-seismic response bases, which played an important role in the Fukushima accident, were strengthened and the aspect of the accident response base was strengthened.

USA has enacted FLEX after the Fukushima accident as a recovery and mitigation strategy against external events beyond design criteria. FLEX is a three-phase strategy that utilizes dedicated accident response facilities. It is a strategy for flexibly responding to incidents by utilizing mobile facilities including various alternative functions.

In Korea, follow-up measures for ensuring the safety of nuclear power plants have been prepared. It is essential to have the ability to maintain and restore safety functions in the simultaneous accidents at multiple units due to natural disasters exceeding design criteria.

It has ameliorated the ambiguity of the responsibility and authority of the emergency response organizations, and reinforced emergency response equipments for severe accidents. In particular, the MACST strategy was established by benchmarking the US FLEX strategy. The MACST strategy consists of three phases, and rapid response to accidents using mobile equipment is the key point.

In addition, improvements have been made in the emergency response bases. On-site emergency response bases have been newly built according to the lessons from the Fukushima power plant. This seismically isolated building will replace the existing off-site center. The new on-site center is durable against natural disasters and will be used as an Emergency Operation Facility (EOF) in the occurrence of the accidents.

3. Development of support measures for information display and accident response

KAERI analyzed human performance in the response of severe accidents, and analyzed the weak point of the surveillance information and response measures assistance system during severe accidents (Lee et al, 2017). In this study, we analyze the some things that need further supplementation in the emergency response system of the nuclear power plant in Korea based on the existing vulnerability keyword.

As a result of applying the improvement items of the emergency response system in the Korea investigated in this study to the vulnerability keyword, it was found that 9 out of 15 items were appropriately supplemented after the Fukushima accident. The remaining six keywords: operator training, communication between workers, ability of operator to respond to unexpected situations, complementing the control room interface, ensuring the reliability of the power plant I&C, and expanding the function of emergency response bases need to be further improved respectively.

In this study, four measures of support for accident information display (interface) and four measures of support accident response (support system and emergency equipment) were derived. First, the support measures for information display are; 1. Updating the interface for use of new mobile equipments and procedure, 2. Developing a safety monitoring system to withstand extreme disasters, 3. Development of alternative interface to support responses by operator competence, and 4. Installation of control functions in emergency response facilities. Four support measures of accident response are; 1. Strengthening the individual capability of the main control room operators, 2. Providing the training system for the workers in the power plant, 3. Securing the high capacity mobile equipments, and 4. Construction of the emergency communication equipment system between the accident response personnel.

4. Conclusions

In this study, we analyzed emergency response systems at domestic and abroad, and applied the keywords obtained from the existing vulnerability analysis report to find the parts that need to be supplemented. Based on this, we developed measures to support accident information display and accident response. The eight measures developed by this study can be used as important considerations in the process of continually strengthening and improving the emergency response system in case of major accidents due to extreme disasters in the future.

REFERENCES

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