Assessment of Evacuation Protective Action Strategies For Emergency Preparedness Plan

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1. Introduction

In radiological emergency, residents nearby nuclear power plant should perform protective action that is suggested by emergency preparedness plan. The objective of emergency preparedness plan is that damages, such as casualties and environmental damages, due to radioactive accident should be minimized.

The recent PAR study includes a number of subjects to improve the quality of protective action strategies. For enhancing protective action strategies, researches that evaluate many factors related with emergency response scenario are essential parts to update emergency preparedness plan.

2. Methods

There are several considerable suggestions in NUREG-0654 that is recent PAR study. These are related with emergency preparedness and helpful to enhance protective action strategies. To assess protective actions evaluation methods like sensitivity analysis and details with depth are necessary.

2.1 Scope analysis

Evacuation is representative response in radiological emergency situation, thus it is important that some remarkable points should be treated to enhance protective action strategies. For example, evacuation formation which includes direction, speed, pathways and so on is variable element according to surrounding situations.

NUREG-0654/FEMA-REP-1, Supplement 3 said that reducing evacuation time could decrease public health consequences and ETEs(Evacuation time estimates) are very important in planning protective action strategies. In this point of view evacuation time has priority to assess emergency response action after nuclear power plant accident.

2.2 Qualitative analysis

To estimate evacuation time, several details with influential factors should be considered so that selection of factors should be performed sincerely. The following suggestions are suitable elements to establish emergency preparedness.

- Survey of facilities, includes school or welfare institutions, should be executed accurately.
- For selection of evacuation pathway, location and capacity of roads should be grasped by authorities.
- Public information should broadcast effectively because of shadow evacuation.
- Emergency drills and educations should be performed in regular in order to not only evacuate quickly but also support vehicles or control traffic conditions without delay.
- Assessing ETEs should be done based on the latest data.

2.3 Methodology

In order to establish updated emergency preparedness plan, suitable assessing methodologies are necessary. Evaluation of evacuation scenarios could contribute to find best protective action strategy that has minimized consequence caused by radiological emergency.

For example, process of determine optimized evacuation pathway could be shown by figure #1. Through this progression the best evacuation pathway which has the least result value could be reflected to emergency preparedness plan. In this point of view setting up methodology is essential part to assess protective actions effectively.

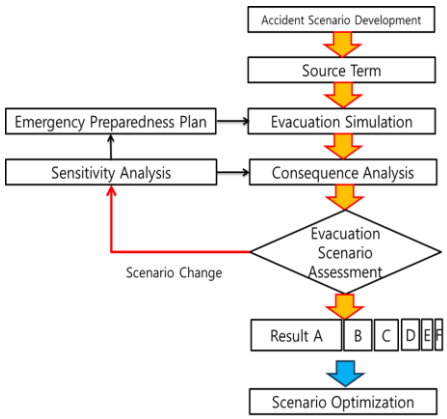

Fig. 1. The process to optimize evacuation pathway

2.4 MACCS2 Code

MACCS2 code (MELCOR Accident Consequence Code System code) is tool to perform Level 3 PSA that includes economic aspect, early and cancer fatality, injuries and population dose with specific conditions. This code considers regions, population, geographical features, weather, release of radioactivity and emergency preparedness. The consequences which are outcomes through MACCS2 code could be used not only as evaluation nuclear power plant accidents but also as development of emergency preparedness plan or update of protective action strategies.

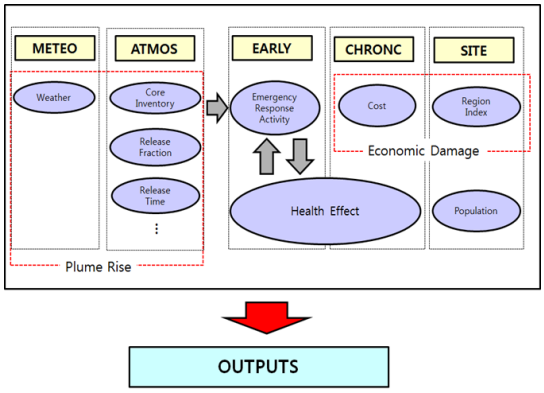

Fig. 2. MACCS2 code mechanism

2.5 Sensitivity analysis

Sensitivity analysis is representative method that decision maker could predict outcome with reliability and effectiveness. Because of comparing with various input data, the result by sensitivity analysis could be optimized consequence in certain situation. Furthermore unpredictable conclusion could be gained in work process of sensitivity analysis.

Figure #3 shows the result of sensitivity analysis of evacuation speed in emergency situation of reference plant of Ulchin 5&6 which is located in Ulchin. The speed of evacuation affects to population dose that is evacuating quickly could be more effective protective action. However this result also shows that the difference of population dose is immaterial above a certain velocity. Hence minimum speed in evacuation could be established as a criterion within specified distance.

Additionally, evacuation delay time, pathway, transportations and special facility could be factors that would affect to accident damage results. Pathway should be considered with road capacity, traffic conditions and location of first-aid stations and so on. Transportation includes that which type of vehicle could be available and it could also provide information to assess evacuation delay time. And special facilities that include school, institutions for elders and disabled people should be treated with concerns. Hence divided suitable emergency plan should be operated by specialists.

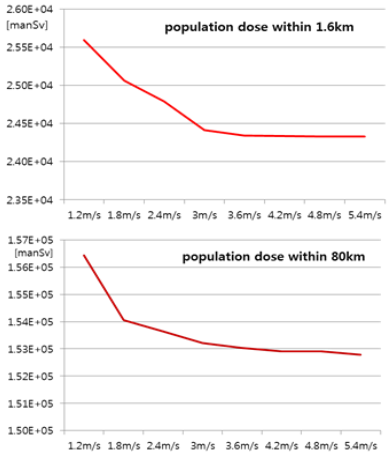

Fig. 3. The consequences of sensitivity analysis

3. Conclusions

Evacuation is very important response action as protective action strategy. This report which studies about evacuation formation suggests some considerable factors to reduce damage of radiological accidents. Additional details would be required to study in depth and more elements should be considered for updating emergency preparedness. However, this methodology with sensitivity analysis could adapt to specific plant which has total information such as geological data, weather data and population data. In this point of view the evacuation study could be contribute to set up emergency preparedness plan and propose the direction to enhance protective action strategies.

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