Investigation of Performance Indicators on Emergency Preparedness for Application to Domestic EPR Framework

Chanki Lee*, Wi-Ho Ha

Nuclear Emergency Preparedness Section, KAERI, 111, Daedeok-daero 989 beon-gil, Yuseong-gu, Daejeon lck@kaeri.re.kr

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1. Introduction

Nuclear power plant operators periodically assess performance indicators for each cornerstone related to safety aspects that are inspected by regulatory agencies. In the case of the US, such safety performance indicator (PI) assessment guidelines for each cornerstone, which are inspected by NRC, can be found in NEI 99-02 [1]. Since these safety PIs have been established based on risk-informed insights, it is helpful to intuitively understand the philosophy concerning appropriate standards required to maintain specific safety performance. Specifically, it is possible for nuclear licensees or regulatory agencies to find areas required for safer operation by analyzing PI assessment methods and their supporting data.

In this study, we focused on reviewing the emergency preparedness (EP) PIs among the seven cornerstones of NRC, and examined points to further improve the current domestic emergency preparedness and response (EPR) framework. Especially, importantly notable points were discussed from the additional descriptions for applying the EP PIs assessment methods.

2. Investigation of EP PIs

In NEI 99-02, EP PIs are divided into three; that is, drill/exercise performance (DEP), emergency response organization drill participation (ERO), and alert and notification system reliability (ANS). Calculation equations for each PI are as follows, respectively:

- Percentage of timely and accurate classifications, notifications, protective action recommendations (PARs) from drill/exercise (DE) and actual events (AE) in the previous 8 quarters;
- (2) Percentage of ERO members assigned to key positions that have participated in DE or AE in the previous 8 quarters;
- (3) Percentage of successful siren-tests in the previous 4 quarters.

Among PIs, especially, quantitative guides for assessment of successful DEP are provided together. Criteria for "timely" means basically "within 15 min" from the initial condition satisfaction. Those for "accurate" are emergency classifications and PARs based on approved plan and implementing procedures, and appropriate completion of initial notification form. Relevant information in the form includes emergency class, emergency action level number, description of emergency, wind direction and speed, necessity of offsite protective measures, potential effects to populations and areas, release status, time of emergency declaration, DE/AE classification, unit as applicable. Here, the situation description should be concise, sometimes like an emergency action level number, and need not include all plant states. Minor discrepancies in wind parameters are not considered failures. PARs based on pre-established emergency plans do not count toward DEP PI.

In case of ERO PI, types of key positions in each facility are listed as in Table 1, where some positions share similar skill sets. Other than key positions, field monitoring teams and damage control teams are described. When calculating PI, if ERO member in key position supports multiple units, it may be granted as credit applied to all facilities. In contrast, assigning a single member to multiple key positions is counted only once. Security-related DE can be credited only once in the 8 quarters for assessment of ERO PI.

Facility	# of key	Descriptions
type	positions	
Control	2	Manager, communicator
room		
Technical	5	Manager, operations
support		support, radiological
center		controls, communicator,
		technical support
Operational	1	Manager
support		
center		
Emergency	3	Manager, protective
operations		measures, communicator
facility		

Table 1. Key positions in ERO.

For ANS PI, failures due to planned maintanence and repair are accepted as non-failure. Even in case of subsequent maintenance and repair after below 6 events, it is accepted; severe weather, vandalism, physical damage, PC hardware and software failure, communication cable damage, and problems identified by routine use. Activation from single signal among all redundant signals can be considered success. However, such ANS PI does not intend to replace FEMA alert and notification requirement.

3. Reflections to EPR framework

3.1 Emergency plans

NRC considers default time objectives for emergency response to be 15 minutes, emphasizing that this is a crierion to ensure minimal impact and does not imply margin for accident mitigation or delay in decisionmaking. Since there is a consensus between the NRC and IAEA time objectives [2, 3], this could be an important compliance requirement for emergency response under the EPR framework. It can also be seen that the initial notification form should emphasize the importance of conciseness of information, not obsessed by minor errors. It is worth discussing the initial notification form to be determined flexibly after negotiation with the state/local government, taking into account the characteristics of the nuclear facility.

3.2 ERO staffing

This report provides clear guidance on the principles of ERO composition and convening, thus important clues can be found by nuclear licensees to establish their ERO in emergency plans. For example, key positions can be used as staffing philosophy to set the minimum required number of emergency workers for launching operation of each facility and entire ERO. Both technical support center and emergency operations facility must have sufficient capacity to collect the data necessary for PARs. Several key positions should be avoided from being combined into single task. Additionally, forming a scalable ERO for the entire site can be justified, provided that an ERO member can be in multiple facilities.

3.3 Training system

Descriptions for detailed DEP PI and ERO PI assessments can provide important guidances for planning and implementing improved training. For example, when developing DE scenarios, confidentiality should be maintained, and capabilities related to DEP PI should be verified. These scenarios may include PARs through the decision-making in situations not predefined in emergency plans. Frequent DE implementation based on security event scenarios should be avoided. If necessary, training may require appropriate role-playing to ensure that it resembles actual response procedures.

4. Conclusion

In this study, we listed regulatory points that should be considered for improving the domestic EPR framework through the investigation and analysis of EP PIs described in NEI 99-02. Specifically, we derived specific objectives and requirements for establishment of emergency planning, ERO staffing, and training system. However, when applied to nuclear facilities other than nuclear power plants, a graded approach will be required, considering the features of each facility.

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