Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 06, June - 2017

Emergency Preparedness and Response Plan for Nuclear Power Plant

Shaaban Abdalla Selouma Mohamed
Department of Nuclear Engineering
KINGS, KEPCO International Nuclear Graduate School
Ulsan, Republic of Korea

Lim, Hak-kyu
Associate Professor
Department of Nuclear Engineering
KINGS, KEPCO International Nuclear Graduate School
Ulsan, Republic of Korea

***Abstract*— In about 50 years of civil nuclear power, there have been two accidents that have caused a great release of radioactive material and have required large-scale evacuation of contaminated areas – Chernobyl in 1986 and Fukushima in 2011. So several international and national organizations conducted a series of activities aimed to identify the lessons to be learned from these accidents and implemented actions in the field of Emergency Preparedness and Response (EPR) based on these lessons. This paper presents how to decrease risk or their consequences for nuclear power plant (NPP), prevent severe direct health damages, and reduce the risk for occurrence probabilities of stochastic influence on health damages in the rate as it is reasonably reachable. Considering the identified importance of the EPR for an NPP that focuses on main parts of On-site and Off-site emergency, including organization, response roles responsibilities, drills and training, and classification of events if it is alert (1st degree) which including actual or potential substantial degradation of the safety level, the shift supervisor would classify the event, Call Emergency Team, Emergency Response Organization (ERO), and Notify Regulatory body, as well as the Technician of radiation safety, would dispatch monitoring team and evaluate the doses. If it is an On-site emergency (2nd degree) which leads to radioactive material release outside of buildings of the nuclear facility or an Off-site emergency (3rd Degree) that leads to serious radioactive material release to the surroundings of the nuclear facility, the shift supervisor would classify the event, call Emergency Team, notify ERO, Regulatory body and local authorities, also the Technician of radiation safety would take Protective measures dispatch monitoring team and evaluation of doses and the Mobile monitoring group would surround the plant for Evaluation of Radiation consequences.**

Keywords: Nuclear power plant, Emergency, Preparedness, Response, emergency classification, On-site, Off-site.

I. INTRODUCTION

Emergency Preparedness and Response is a protocol intended to the response to a nuclear emergency, which is composed of structures, actions, and procedures aimed at controlling and minimizing its effects. EPR is to provide basic information needed for co-operation with relevant local and state authorities and for the development of the emergency response system at the plant in case of emergencies [1].

EPR involves various organizations. The functions of many of these organizations would be the same for a radiological emergency as for a conventional accident. However, the radiological emergency response also involves highly specialized agencies and technical experts. Radiological emergency may be caused by or involves different types of hazards, including natural (e.g. Earthquake), technological (e.g. Radiation), biological, and criminal activity (e.g. Theft, sabotage, terrorist attacks). The response to these hazards involves different response organizations with their own response terminology, cultures and plans. Consequently, the plans and procedures for responding to radiation emergency need to be structured into a coherent and interlocking system. Therefore, in order to be effective, the response must be well coordinated and arrangements must be appropriately integrated with those for a conventional emergency. In addition, many misconceptions exist concerning radiological emergencies and the possible health effects of radiation exposure that could lead to inappropriate actions being taken. Hence, preplanning on the basis of established principles of radiation protection and safety is essential. Such preplanning can be achieved only through a coordinated approach. EPR is the vehicle that establishes requirements for common concepts and expectations; the clear allocation of responsibilities among all response organizations; well-defined agreements between these organizations; and arrangements for coordinating an integrated response.

This paper presents that the deterministic effects can be reduced by minimizing the connection of workers with radionuclides and limiting the doses with immediate consequences on the health of the personnel and emergency workers. The decrease of stochastic effects (tumors, gene mutation, and embryonic malformations) can be fulfilled through long-term protective actions and/ or control of emergency worker doses.

II. METHODOLOGIES

A. Literature Review

This section reviews the situation of EPR related to IAEA and the previous studying. Nuclear accident scenarios taken into consideration to prepare nuclear emergency preparedness and response plans rare based on theoretical studies, power plant technical tests and the study of accidents happened in similar NPP [2]. The nuclear accidents considered in nuclear emergency preparedness and response planning involve from accidents anticipated as design basis (small consequences for the public and the environment) to very severe accidents with a low probability of occurrence (accidents beyond the design basis) [3].

Most of the emergency plans concentrate on off-site further than on-site because they aim to protect the public and their foods and drinks, and also focus on examining the adequacy of current plume exposure pathway Emergency Planning Zone (EPZ) concept and determine the required radius for EPZ

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 06, June - 2017

[4],[5]. Moreover, focus on performance of nuclear emergency exercises [6], discussed Evacuation in case of a nuclear power plant accident [7].

For most emergency types, response takes place over two distinct areas namely: the first is On-site area, with NPP facilities, this is the area surrounding the facility within the security perimeter, fence and possibly other designated property marker. It is the area under the immediate control of the facility or operator. The second is Off-site area, this is the area beyond that under the control of the facility or operator. For facilities of threat categories I [8] that has Facilities, such as NPP, for which on-site events are presumed that could lead to severe deterministic health effects of the site, the level of planning will vary depending on the distance from the facility. For these facilities, planning can be discussed for three emergency planning zones, as shown in Figure 1.

- PAZ: Precautionary action zone,
- UPZ: Urgent protective action planning zone,
- LPZ: Longer term protective action planning zone

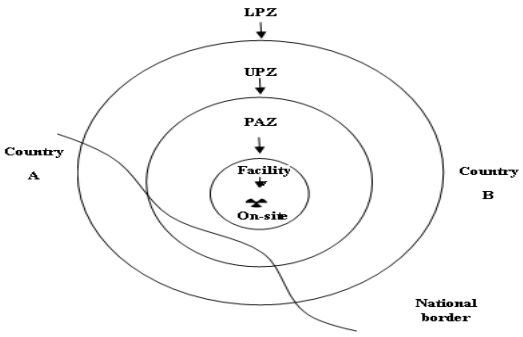


Fig. 1 Concept of emergency planning zones

Table 1 showing the time to take action during accident, where IAEA defines the time required for EPR based on Threat category I that has Facilities such as NPP, which on-site planning for: Mitigatory actions, Protective actions on the site, and formulating recommendations for urgent protective actions within PAZ and UPZ.

TABLE I TIME OBJECTIVES FOR HAZARD CATEGORY I

Element	Time
Classify the emergency	< 15 min
Notify local authorities after classification	< 30 min
Fully activate the emergency organization	< 2 h
Initiate mitigation actions	< 15 min
Activate Technical Support Centre	< 1 h
Recommend urgent protective actions for the public based on emergency classification	< 30 min
Make decisions on urgent protective actions	< 30 min
Conduct environmental monitoring near the facility	< 1 h

About emergency organization, several emergency organizations are assigned different roles and responsibilities for emergency response to an accident at nuclear power plant. These responsibilities are classified into; operator (on-site), off-site, and international level. Once an emergency condition is determined and initial mitigating actions are underway, the Emergency Director has the responsibility to classify the event in accordance with the emergency classification system [9]. Classification of an event is one of the four emergency categories notifications:

- Unusual event: Under this category, events are in process or have occurred which indicate a potential degradation in the level of safety of the plant. No release of radioactive material requiring off-site response or monitoring is expected unless further degradation occurs.
- Alert: If an alert is declared, events are in process or have occurred that involve an actual or potential substantial degradation in the level of safety of the plant. Any releases of radioactive material from the plant are expected to be limited to a small fraction of the Environmental Protection Agency (EPA) protective action guides (PAGs).
- Site area emergency: A site area emergency involves events in the processor or which have occurred that resulted in actual or likely major failures of plant functions needed for protection of the public. Any releases of radioactive material are not expected to exceed the EPA and PAGs except near the site boundary.
- General Emergency: A general emergency involves actual or imminent substantial core damage or melting of reactor fuel with the potential for loss of containment integrity. Radioactive releases during a general emergency can reasonably be expected to exceed EPA and PAGs for more than the immediate site area.

Based on the literature review, we prepare EPR for on and off-site, in order to decrease of risk or their consequences on; nuclear NPP, the equipment at the source, workers, residential surroundings of the NPP area; save the public; prevent severe direct health damages; and reduce the risk for occurrence probabilities of stochastic influence on health damages in the rate as it is reasonably reachable. This depends on the roles; responsibilities; Organizations of the emergency; Facilities and Equipment; Drills and exercise; and Classification of events: 1st degree, 2nd degree, and 3rd Degree. Also, because in case of the on-site EPR fails to secure the employee and the plant, it will be more critical to the public. The study of EPR is nowadays in effervescence. Traditionally, the substantiality of organizations against accidents is based on several pillars: personnel training, equipment and facilities, organization and, especially, planning. All of these dimensions are endeavoring at increasing the preparedness and recovery of facilities against accidents.

Establishing a nuclear EPR plan aims to organize functional coordinating groups that perform emergency response principle and Organizations, define responsibility and documentation, prepare facilities and equipment of emergency response, and do Drills and exercise. This elements will be described in the following sections.

B. Emergency Response Principle and Organizations

Classification of events, Assessment of events on NPP and consequences, warning and notification, organizing of emergency response, monitoring of technological parameters and radiation situation, training and drills, connection to Off-Site (Public) emergency plan, principals of recovery for NPP event, public announcements, facilities and equipment for emergency response, external bodies and organizations

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 06, June - 2017

included in the emergency planning, fire protections, medical plan for emergency planning, and maintaining of emergency plan of nuclear facility are the principles of emergency response.

The phases of Emergency Response Organizations consist of the first phase, which is immediately after event occurs on NPP, the emergency response team managed by Shift supervisor who is the only allowed and responsible person for the first classification of the emergency situation, including the declaration of measures related to such an accident and the activation of the necessary internal emergency response organization which composed by: Shift supervisor, operators and members of shift, Fire brigade of the plant, Security working group, and Control Centre of physical protection.

The shift supervisor would classify the event occurrence on the NPP, alert ERO of the NPP, realize of first protective measures on the NPP to mitigate the consequences of event and initiate the NPP to safety condition, assure of urgent measures in first phase of event, protect the personnel of NPP, Warn and notify the employees inside the NPP and around the NPP, notify the related organizations and authorities, Provide the recommended protective actions for external organizations, and Realize of security measures by physical protection.

After the announcement of the event in the NPP, the fire brigade is on the alert and would perform the following measures: set on fire brigade on intervention inside the NPP; coordination of fire brigade activities with the physical protection; and In case of necessity call the outside fire brigades for helping.

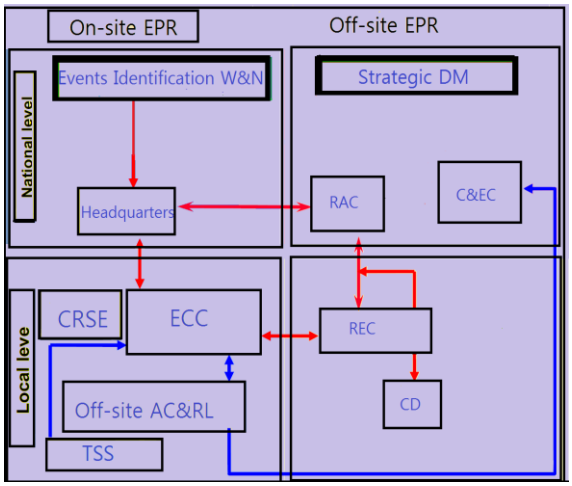
Security working group would perform the physical protection tasks according to the shift supervisor directions and Coordinate the physical protection section activities related to the security of NPP area.

After event occurrence on the NPP, the control centre of physical protection would follow; securing evacuation exits from threat objects; opening of decontamination point; and monitoring of personnel in the NPP area according to sectors.

The second Phase which is after alerting of the Emergency Commission of the NPP at the plant starts with the takeover by the Emergency Commission of the NPP who is responsible for arrangements which are required for the safety of NPP, protection of personnel in NPP area and other urgent measures. This phase managed by Head of Emergency Commission from the Emergency Control Centre (ECC) that takes over the management of the EPR team from the shift supervisor and consists of:

- Technical Support Group (TSG): would fix the first evaluation of the core damage and size of the source term, provide in-depth diagnostic, corrective engineering assistance to shift staff and communicate with the main control room. TSG would continue in the estimation of the core damage and size of the source term on the base of the condition of the barriers after activation of the emergency response team. TSG consists of the safety engineer, technological engineer, TSC coordinator, radiological assessment coordinator and a representative of Instrumentation &Control (I&C).
- Logistic Support Group (LSG): adjusting the on-site, protective actions and send emergency response teams for on- and off-site radiological monitoring, fire brigade, saving operations and maintenance activities. The LSG includes Fire brigade representative, LSG coordinator, and an emergency maintenance coordinator.
- Radiation Monitoring and Dosimeter Group (RMDG): resenting data from radiation and meteorological measurement for assessment of radiation consequences on workers inside the NPP and for personnel in the area of NPP. The RMDG consist of the radiological control coordinator, health physic technician, and dosimeters service.
- Information Group (IG): supporting timely communications and information announcement on plant conditions and emergency operations to the employees, the news, media, and public after permission from the Head of ECC. IG includes I&C coordinator and Communications coordinator.

The emergency response organization is required to interact with appropriate authorities. The purpose of public guidance and information in the sector of emergency preparedness to provide the population in the NPP Emergency Planning Zone with the essential training and information on the steps to be taken in the case of notification of a radiation emergency. As described in Figure 2.



W&N: warning& notification
CRSE: control room shift manager
ECC: emergency control Centre
AC&RL: assessment Centre& radiological laboratory
DM: decision making
RAC: radiological accident commission
C&EC: control& emergency control
REC: regional emergency commission
CD: civil defense
TSS: TeledoSimetric System

Fig. 2 Emergency Response Organizations relations

Warning and Notification (W&N) system of the NPP would be compatible with the Civil defense system. After classification of event on NPP, the following activating signals are prepared: first signal is the alert state (1st degree of emergency classification); second signal is on-site emergency (2nd degree of emergency classification); and third signal is off-site emergency (3rd degree of emergency classification).

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 06, June - 2017

The Emergency Control Centre (ECC) would be located in the shelter of the civil protection of the NPP area. This facility would be activated in cases of the 2nd and 3rd Degree. In case of 1st Degree of event could be ECC activated only if an incident is a radiation case during the daily shift.

Off-site Assessment Centre (OAC) is located Offsite Radiological Control Laboratory. This facility is activated in cases of the 2nd and 3rd Degree. OAC is designed for the assessment to the radiological impact to the environment. It is used for analysis of field monitoring data and the coordination of the off-site radiological activities.

Radiological Accident Commission (RAC) is related to national level and has a direct connection with the on-site through the operator.

Regional Emergency Commission (REC) is related to regional level. This commission connecting with emergency control Centre and OAC.

Control& Emergency control (C&EC) is concerning to the regulatory body and connecting directly to Emergency Control Centre

Teledosimetric system (TSS) includes monitors of basic weather parameters as are direction and speed of wind and weather category. Calculation would be done by dosimeter service.

C. Documentation

The documentation of the emergency planning system covers communication with the authorities, internal communication according to management rules, fire protection, cooperation of the fire brigade with operational staff, radiation protection, civil defence, training of emergency response team, protection of staff and other persons at the NPP area, maintenance of the emergency facilities and equipment, warning and notification in NPP area and in the surrounding emergency zone, sheltering and evacuation, and shifting management in case of nuclear accident.

D. Responsibility

In case of a nuclear accident occurrence, an intervention is managed by the Operator. Management and implementation of intervention focus on activities limiting development of the accident and minimizing its consequences and on gaining control over the source of ionizing radiation, and is conducted in compliance with: Previously prepared intervention procedures, intervention instructions and monitoring programs, and Results of the monitoring, actual situation and its anticipated development during the extraordinary event so that adopted countermeasures bring more benefits than the harm. Therefore it is necessary to keep in operation all instruments and monitoring devices serving for the evaluation of the accident.

E. Facilities and Equipment of Emergency response

Equipment of Emergency Facilities composes of Personnel Protection Equipment (protective aids, protective masks and filters, protective clothing, breathing apparatuses and respirators), Communication Networks, Information and Support Systems, Warning and Notification System, and Nuclear Facility Environment and Surroundings Monitoring.

For Personnel Protection Facilities include Shelters that provide partial protection from radioactive contamination, Gathering Points that use to gather NPP personnel who are not considered to be directly applied to emergency response or accident mitigation, and the Corporate Health Centre that provides medical help in case of injuries or radiological accidents.

The emergency control and support Centers could be provided for communications with Radio Network (portable station and pagers), Public Phone Network, Direct Off-Site Telephone Lines, on - site Broadcast.

Warning and Notification System would use electronic sirens and could stimulate separately sirens of warning signals crossing the affected area and subsequently followed by text messages/instructions.

Nuclear Facility Environment and Surroundings Monitoring system involve Procedures, means, and measures used during monitoring of technological parameters of NPP and through monitoring of radiation and meteorological situation in NPP region and its surroundings.

F. Drills and exercise

Drills include activities such as coordination and management of emergency response, protective action decision-making, plant system repair and corrective actions, and accident assessment.

Drills and exercise scenarios are developed to provide a method to test and evaluate the plant Emergency Program, and shall include, as appropriate:

- Basic objective of each drill and exercise,
- Date(s), time period(s), location(s), and participating organizations;
- Simulated events;
- Description of arrangements for and advance materials to be provided to official observers.

Training and drills would be done for the workers of the NPP and the divisions of the emergency response organization. Workers will be trained in the execution of their responsibilities in an emergency. Each employee would perform the periodical training about EPR and also personnel of organizations related to the NPP (regulatory body, and local authorities). Periodic training from EPR has coordinated the process that the time between finishing the prior training and engaging in a new periodic training is no longer than one year. The essential and periodic course is made at the workplace of the workers. The system of training will involve also information concerning the changes in emergency planning or on-site emergency plan.

Exercise scenarios for the emergency plan should be at least once every six years, an exercise is initiated during off-hours (between 6 pm and 4 am on a weekday or during a weekend).

The emergency response training program is provided to personnel who may be called upon to respond to an emergency. The training program includes practical drills. The instructor/evaluator immediately corrects any erroneous performance noted during these practice drills. Training is also provided to the plant Fire Brigade. This training is coordinated by the Nuclear Training Manager. Training is provided to security personnel based on each person's specific task.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 06, June - 2017

Among prompt nuclear EPR actions, the following would be enhanced: accident classification, leak containment as well as prevention of deterministic and stochastic effects on health. The deterministic effects can be decreased by reducing the contact of personnel with radionuclides and limiting the doses with immediate consequences on the health of the emergency workers and public. The reduction of stochastic effects (tumors, gene mutation, and embryonic malformations) can be obtained through long-term protective actions and/ or control of the public and emergency worker doses [10].

III. RESULTS

By comparing table 1 that showing time objectives for hazard category I and table 2 that showing main activities at events, so depending on NPP state and the radiation case through continuing of the event in case of the classification is 1st Degree or 2nd Degree or 3rd degree, we classify events, Call Emergency Team, Notify Regulatory body and Local Authorities, invite Technician of radiation safety and Mobile monitoring group. Applying EPR in order achieve the purpose of the plan by following these steps:

Classify event, by the shift supervisor during ongoing of the event. If the alert is a 1st degree or 2nd degree or 3rd degree, this classification occurs. Call Emergency team immediately after classification by shift supervisor, Notify Emergency Response Organization during 15 min after classification by the shift supervisor, Notify the regulatory body after classification through the shift supervisor, Call local authorities within 30 min after classification if it is a 2nd degree by the shift supervisor.

Protective measures immediately, if it is 2nd degree or 3rd degree by a technician of radiation safety after classification, Within 30 min after classification, sending monitoring group by the technician of radiation safety, Estimate of doses within 30 min after classification by technician of radiation safety, Surrounding of the plant within one hour for estimating of doses by Mobile monitoring group.

Emergency plan preparedness and response used to secure; personally, technically, and documentary staff preparedness of the NPP and other organizations for the realization of planned measures working in the nuclear power plant with the emphasis to:

- Decrease the risk, or to reduce their consequences on NPP on equipment in the source, employees and citizen surroundings of the NPP area,
- Prevent serious direct health damages (e.g. Death or fatal injury),
- Decrease of risk for occurrence probabilistic of stochastic influence on health damages (e.g. Cancer and serious inherited phenomena) in the rate as it is reasonably reachable.

TABLE II MAIN ACTIVITIES AT EVENTS

No.	Responsibility	Activity	Time	Classification of Events		
1	Shift supervisor	Classify event depending on NPP state and radiation case	Through continuing of event	Alert (1st degree)	On-site emergency (2nd degree)	Off-site emergency (3rd degree)
2		Call Emergency Team	Immediately after classification	√	√	√
3		Call ERO	Within 15 min. after classification	√		
		Notify ERO			√	√
4		Notify Regulatory body	By phone after classification	√	√	√
			Within 45 min. after classification By letter, by e-mail, ...		√	√
5		Notify local authorities	After by classification 30 min		√	√
6		Call parties needed of ERO	Within 60 min after classification		√	√
7	Technician of radiation safety (TRS)	Protective measures	Promptly after classification		√	√
8		Dispatch monitoring team	Within 30 min subsequent classification	√	√	√
9		Evaluation of doses	During 30 min after classification by TRS	√	√	√
	Mobile monitoring group (MMG)		Surrounding of the plant within one hour by MMG		√	√
10		Radiation consequences in the surrounding of NP	Within 120 min after classification		√	√

For Mobile monitoring group, through the IAEA table 1 Conduct environmental monitoring near the facility within less than one hour, but for our result Evaluate the doses during 30 minutes after classification even it is Alert (1st degree), On-site emergency (2nd degree), or Off-site emergency (3rd degree). Also Surrounding of the plant within one hour by MMG even it is On-site emergency (2nd degree), or Off-site emergency (3rd degree). Within 120 minutes sfter clasifcation if it is On-site emergency (2nd degree), or Off-site emergency (3rd degree), the MMG perform prediction Radiation consequences in the surrounding of NPP.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 06, June - 2017

The Emergency work procedures include the following activities:

- Emergency classification of events,
- Specification of source term,
- Assessment of the core damage,
- Activation of the emergency response,
- Administration and cooperation with the off-site participants in the emergency response,
- Recording of activities performed by the Operator during the accident,
- Necessary technical equipment, devices, health protective equipment and other materials required for management and implementation of interferences and a place for their storage.
- Protective aids and a place of their storage,
- Evaluation of emergency impacts on NPP,
- Emergency monitoring of technology area of NPP and around of the NPP,
- Cooperation of teams participating in the emergency response (fire brigade, physical protection, radiation monitoring, health service, communication, etc.),
- Environmental protection plan in case of nuclear accident.

For an On-site EPR, the emergency response includes: Classification of events, Assessment of events at nuclear facilities and their consequences, Warning and notification, Monitoring of technological parameters, equipment for emergency response, Training and drills, Fire protections, Medical plan, Public announcements, Connection to Off-Site (Public) emergency plan, and Maintaining of emergency plan of nuclear facilities.

For off-site EPR, the emergency response include: classified events according to their degrees of severity and possible consequences for the people and the environment, Connection to Public Emergency Plan during normal operation, ionizing radiation and its effects on human health and environmental impact, protection measures during of the events associated with the release of radiation material from nuclear facility, methods of warning and notification of accident and emergency occurred, and monitoring system around of the NPP site.

IV. CONCLUSIONS

Emergency planning is an essential element of overall plant safety because this provides the last level of defense in depth for protecting the public, the environment, and property from a radiation accident.

This paper presents an EPR plan which organizes an emergency response organization, sets specific responsibilities and duties, and specify points of contact between on-site and off-site supporting agencies.

The EPR Plan describes measures to protect the health and safety of the public and NPP employees in the event of an emergency in the NPP. To satisfy this objective, the Plan assures a high order of preparedness and provides for an orderly and timely decision-making process. Emphasis is placed on maintaining preparedness through training, drills, and exercises. The Plan describes response organizations, assessment and protective actions, and equipment, to provide for adequate protection of life and property in the event of a radiological emergency

Emergency preparedness is a complex of activities aimed for the fulfilment of all measures necessary to protect employees and the public if the risk of accident or release of radioactive materials could occur. It includes the establishment of emergency plans, training system, drills and exercises for individuals, authorities, and organizations. These activities have to be fulfilled according to On-site and Off-site emergency plans – Plan for Population protection.

Emergency planning presents an additional protection so that even if there was a release of radioactive material from an accidental, protection could be presented to the public who might be affected. Nuclear emergency arrangements are developing continuously in response to changing events, improved procedures and lessons learned from emergency actions. In realization of this the plans are strong, flexible and under continuous review. This assures that any changes required can be included readily in the relevant emergency plans and emergency arrangements.

When an event will be announced, start to perform protective measures for employees of nuclear facilities and personnel in the area of the NPP. So Urgent protective measures for the personnel are recording and checking the movement of persons on the nuclear facility area, gathering and sheltering of persons, iodine prophylaxis, and personal protection.

The Recovery Plan would provide the general sequence of steps from On-site or Off-site emergency to stabilize and safe condition of NPP. The sequence shall be sufficiently flexible to enable it to be used more in existing or postulated conditions.

ACKNOWLEDGEMENTS

This research was supported by the 2017 research fund of the KEPCO International Nuclear Graduate School (KINGS), Republic of Korea.

REFERENCES

[1] IAEA. TECDOC-953. Method for the development of emergency response preparedness for nuclear or radiological accidents, Vienna, 1997, PP. 9-20

[2] IAEA, International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, Vienna, 1996, PP 71-75.

[3] IAEA, TECDOC-955. Generic Assessment Procedures for Determining Protective Actions during a Reactor Accident, Vienna, 1997.

[4] Collins, H.E., B.K. Grimes, and F. Galpin. “Planning basis for the development of state and local government Radiological Emergency Response Plans in support of light water nuclear power plants”, NUREG-0396, 1978

[5] Bui Hoang Ha, 2013, Examination of the Emergency Planning Zone (EPZ) using Level 3 PSA Approach with MACCS2. Master's degree, KEPCO International Nuclear Graduate School (KINGS), PP. 2-4.

[6] M.V.CastroSilvaa, J.A.C.C. Medeirosb, 2015, Model of Performance Indicators in Nuclear Energy Emergency Plan Assessment applied to Emergency Exercises. 1877-0509 © 2015 Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license. https://doi.org/10.1016/j.procs.2015.07.100

[7] Friedo Zölzer, 2015, Evacuation in case of a nuclear power plant accident – Discussion of some ethical questions. https://doi.org/10.1016/j.kontakt.2015.07.001

[8] IAEA. Requirements No. GS-R-2. Preparedness and Response for a Nuclear or Radiological Emergency.2002, PP 7-12.

[9] Nuclear Power Plant Emergency Preparedness Setting the Standard for Industrial Facilities, NUCLEAR ENERGY INSTITUTE, August 2005, PP 8-10.

[10] IAEA, Generic Procedures for Medical Response during Nuclear or Radiological Emergency, Vienna, 2005, PP 6-20.