

ISOE EG-SAM Interim Report

Radiation Protection Management and Organization

Report on behalf of the Sub expert Group

Willie Harris
Exelon Nuclear

Presented by: David W. Miller
SAM Vice Chair
Cook Nuclear Plant

Chapter Introduction: RP Management & Organization

- Introduction
 - All regulators require nuclear power plants (NPP) to have developed specific emergency plans or emergency response plans (ERP) in response to pre-defined potential emergency scenarios.
 - These plans, which should be subject of regulatory approval, provide the high level strategies to be employed to protect the health and safety of workers and the public.
- Chapter Content
 - Emergency Response Plans
 - Emergency Response Facilities
 - Emergency Response Organization
 - Decision Making
 - Pre-requisites for On-site Radiation Protection Decision Making
 - Public Communication
- Contributors
 - Willie Harris, Exelon Nuclear
 - Ellen Anderson, Nuclear Energy Institute
 - Karin Frithoff, Vattenfall

2.1 Emergency Response Plans

- 2.1.1 Assignment of Emergency Response Responsibilities
 - Organizational structure and assignment of primary responsibilities
 - Includes roles of NPP emergency response personnel, emergency responders, local and national agencies, and support organizations
 - Each position - task-analysed to ensure adequate staffing
- 2.1.2 Emergency Response Procedures
 - Include both on-site and off-site responses to an emergency.
 - Define critical criteria that would necessitate implementation of protective measures.
 - Designate who has authority for allowing emergency workers to receive radiation doses in excess of those permitted during normal plant operation
 - Severe Accident Management (SAM) program, with appropriate implementing procedures, should be established
 - It is recommended that RP instructions in connection to the SAM program are established.
- 2.1.3 NPP On-Shift Emergency Response Staffing
 - On-shift staffing should be unambiguously defined, with adequate numbers of trained and qualified personnel
 - assess and possess personnel to ensure timely augmentation of on-site response capabilities

2.1 Emergency Response Plans (Con't)

2.1.4 Pre-arranged Assistance Resources

- Arrangements for requesting assistance resources should be defined

– 2.1.5 Standard Emergency Classification and Action Level

- A standard emergency classification and action level scheme, the bases of which include facility circuit/system and effluent parameters should be well-understood and used by the NPP and governmental agencies

– 2.1.6 Prompt Communications

- Provisions should exist for prompt communications among principal organizations to emergency responders and to the public.
- Various communications platforms, including social media, should be used

– 2.1.7 Periodic Public Information

- Information should be made available to the public on a periodic basis describing
- Define how they will be notified and what their initial actions

2.1 Emergency Response Plans (Con't)

– 2.1.8 Emergency Facilities and Equipment

- Adequate on-site and off-site emergency facilities and equipment should be provided
- Pre-established arrangements for additional or augmented RP instruments and equipment should also be established

– 2.1.9 Off-site Radiological Consequences

- Methods exist for assessing and monitoring actual or potential off-site radiological
- These methods should include processes to track and estimate exposures from all types of radioactivity releases including noble gases
- methods should be in place to estimate radiological dose from the deposition of radionuclides.

– 2.1.10 Off-site Protective Actions

- Consideration should be made to evacuate, shelter in place, the prophylactic use of potassium iodide (KI), prohibition of eating fresh foods and water, animal housing and temporary or permanent relocation.
- Evacuation time estimates should be developed and reviewed/revised on a periodic basis

2.1 Emergency Response Plans (Con't)

- 2.1.11 Controlling Radiological Exposures
 - Measures should include emergency worker and lifesaving activity protective action guides,
 - Established reference dose levels or emergency dose limits for lifesaving- actions or protection of large populations and equipment-saving actions that could prevent potential significant social and economic consequences.
 - Emergency procedures should also include back-out dose rates for emergency workers.
- 2.1.12 Medical Response to Contaminated Injured Individuals
- 2.1.13 Recovery and Re-entry

2.2 Emergency Command Facilities

- 2.2.1 Main Control Rooms (MCR)
- The MCR is typically the primary command and control centre for emergency response management immediately following an accident. Responsibilities of the operators of the facility are to make the initial diagnosis and mitigation of the abnormal conditions, perform immediate corrective actions and make initial off-site notifications. The facility has the key responsibility for activation of the other emergency response facilities when required
- 2.2.2 On-Site Emergency Control Centre (ECC)
- A key aspect to emergency response is the designation of an on-site Emergency Control Centre. ECC should be considered as a general coordination centre to coordinate activities of Operational Support Centre (OSC), Technical Support Centre (TSC), information centre, monitoring centre, etc. Based upon the severity of the event, key responsibilities are transferred to this facility to remove the burden from the MCR to direct on-site response to the event. There are typically two ECCs. One facility provides management oversight of the event and houses the on-site emergency director. The second facility houses the necessary personnel to respond to the event.
- This second facility houses the key response personnel such as maintenance and RP and can be comprised of multiple smaller locations or one main location.
- 2.2.3 Off-site Emergency Headquarters (EH)
- The Off-site Emergency Headquarters (EH) is established for the reason of prompt availability for action during management of the emergency response organization in case of the occurrence, duration and removal of extraordinary event consequences. Main tasks of the EH, as a managing body, are to manage all activities in the NPP, to transfer information to superior and supervision bodies, to inform the public and to declare the protective measures for NPP employees and other persons present on the NPP premises at the time of the extraordinary event occurrence. The EH secures the deliveries of necessary material, special means, and alternating the personnel as well as its maintenance and supplies.

2.3 Emergency Response Organization (ERO)

- 2.3.1 On Shift Staffing
- 2.3.2 Emergency Facility Staffing
- In the early stages of the event, the on-shift minimum staff should be responding to the event. The staff should be augmented based on the type of issue and emergency classification. The individual responsible for the classification should be a senior on-shift individual. In Canada and the United States, the Shift Manager is responsible for making the initial emergency declaration. In Czech Republic and Slovak Republic, this individual is the shift engineer.
- 2.3.3 Functions of the Emergency Support Staff
 - Operational Support Centres (OSCs) should be equipped with sufficient personal protective equipment and other required supplies and equipment to support personnel working in the area. Typical uses for OSCs include:
 - Areas where plant workers can obtain the status of radiation parameters,
 - Areas to support the shift supervisor during emergency classification from the radiation point of view,
 - Evaluation of the 24 hour on duty personnel emergency doses,
 - Evaluation of the emergency releases to the public, and
 - Monitoring of the weather conditions.
 - The Station Emergency Response Organisation (ERO) consists of station personnel who are involved with emergency response efforts necessary to control the plant during an incident. This organization provide for the following activities during an emergency:
 - Plant systems operations,
 - Radiological survey and monitoring (including environmental monitoring),
 - Firefighting,
 - Rescue operations and First Aid,
 - Decontamination,
 - Security of plant and access control,
 - Repair and damage control, and
 - Personnel protection including assembly, accountability and evacuation.
- 2.3.4 Participants in cases of Radiological Emergencies
- 2.3.5 Intervention Personnel in Radiological Emergency Situations
- 2.3.6 Restrictions

2.3 Emergency Response Organization con't.

2.3.4 Participants in cases of Radiological Emergencies

- The operating experience from the severe accidents at Chernobyl and Fukushima demonstrate the critical (and frequently very hazardous) role played by national emergency services (e.g. fire brigade, military etc.).
- It is important that the emergency arrangements clearly state who can act as an emergency worker, what level of radiation dose they are permitted to receive, under what circumstances and who can authorize such radiation doses. There will be some individuals who will not be suitable for work involving emergency radiation exposures, for example female workers who are pregnant or breast-feeding and young persons under 18 years of age.

- It is vital during severe accidents that emergency responders attending the affected site are properly protected with appropriate radiological controls, notably to identify radiological risks, to assess radiation doses and to ensure suitable personal protective equipment is selected and worn. Emergency workers from external organizations with no experience of working with radiation can be put at significant risk because they may not appreciate the significance of plant conditions unfolding around them. As described in chapter 7, the operating experience from the Chernobyl nuclear accident shows what can happen if emergency responders are not adequately protected by the emergency response organization

2.3.5 Intervention Personnel in Radiological Emergency Situations

- In order to determine their selection, training and medical and radiological monitoring conditions, intervening personnel should be classified into two groups:
- The first group comprises personnel forming the special technical, medical and health intervention teams readied in advance to deal with radiological emergency situations (for example: firemen from public services with specific skills in radiological interventions, workers from the plant, etc.) ;
- The second group comprises persons not belonging to special teams but intervening as part of the tasks within the scope of their competence (for example: firemen from public services, experts in the field of measurements, medical assistance, etc.).

2.3.6 Restrictions

- A process should be in place for the qualification of individuals to perform emergency activities. The qualification process should include assessment of the individuals' physical health and abilities, training, and intended job function. Individuals with conditions precluding their involvement should not be qualified and considered. For instance, pregnant or breast-feeding women and persons less than eighteen years old should not be considered qualified to be included on the teams of intervention personnel. The qualification process should consider prioritization of individuals based on potential health effects from emergency tasks such as the use of respirators
- In addition to qualifying individuals on current health basis, the process should use selective prioritization based on the consideration of the potentiality of health effects after exposure due to respirator usages, protective clothing, heat stress, and other factors relating to potential working conditions.

2.4 Decision Making

- The emergency plan and process should establish decision making authority for the event. With RP perspective, the key decisions should include classification of the event, determination of protective action recommendations for members of the public, protective measures for on-site personnel, and notification of governmental authorities.
- In general, the main control room has the initial responsibility for these decisions. As various on-site and off-site emergency response facilities are staffed and activated, these responsibilities should be transferred from the main control

2.5 Prerequisites for On-site Radiation Protection Decisions

- 2.5.1 Area Classification and Access Control
- In order to quickly activate the required mitigating steps in response to an accident, on-site emergency plans should contain clear concise instructions for workers to move to the appropriate locations to conduct emergency response actions. Of utmost importance is the necessity for workers to be able to understand which areas on-site are dangerous and to be able to safely evacuate those areas to safer on-site areas or to off-site locations. Workers who will be providing emergency response should also understand their roles and know what site areas will be used to perform certain functions. In addition, workers need to know where personnel protective equipment and key response equipment is located so they can perform their jobs.
- In addition to understanding the location of key areas, workers should also be able to predict the hazards that will be encountered in on-site areas after a severe accident. Also, systems should be in place to minimize the entry into dangerous or fatal areas which could be encountered during an accident.
- To effectively communicate the designation of areas, along with their associated dose rates and hazards during an emergency, a classification and access control system should be in place. Several variations of classification systems can be implemented but the goal is to establish a method of delineating zones within the site boundary where different habitability and use conditions exist. To the extent practice, zones, where predicted conditions during an accident could lead to high worker doses, should have access control restrictions which physically prevent the entry of individuals during and after an accident.
- 2.5.2 Establishing Reference Dose Levels in an Emergency
- Reference dose levels, which are established by national regulatory authorities, are country specific and based on the activity to be broadly performed. These tend to be subdivided into two categories: those actions to save a life and those actions necessary to reduce the impact of the event, as discussed in section 5.1. According to the organization described above, it is the Director of the emergency who authorizes the doses to be received by workers. The Director should receive support by personnel who are responsible for the evaluation of the radiological conditions and the prescription of the protective

Table 1: Country Specific Reference Levels

Country	Reference Levels	Life Saving Actions
Belgium	50 - 250 mSv	250 mSv (incl. prevent catastrophic evolution)
Brazil	100 mSv	Consider the thresholds related to the deterministic effects.
Canada	500 mSv	
Czech Republic	100 mSv	200 mSv
Finland	500 mSv	
France	Group 1: 100 mSv during the time of their missions. Group 2: 10 mSv	Group 1: up to 300 mSv for protecting people. Group 2: exceeding reference values can be accepted for saving human lives.
Japan	100 mSv	
Pakistan	100 mSv	500 mSv
Republic of Korea	< 500 mSv	
Slovak Republic	100 mSv	500 mSv
Spain	50 mSv for interventional workers	500 mSv for exposed workers
USA	100 mSv	250 mSv

2.6 Public Communication

- Emergency plans should establish provisions for prompt communications among principal response organizations to emergency personnel and to the public. Each organization should establish reliable and backup means of communications for licensees and response organizations. These must include provisions for 24-hour per day notification.
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- It is recommended that on at least annually, information is made available to the public on how they will be notified and what their initial actions should be in an emergency (e.g. listening to the local broadcast station and remaining indoors), the principle points of contact with the news media for dissemination of information during an emergency, and procedures for coordinated dissemination of information to the public.
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- NPP operators have a responsibility to communicate with the public, media, stakeholders and employees during (potential) nuclear emergencies. To facilitate this, there should be a plan in place and procedure that governs the emergency communications response. They should also be prepared to respond to questions and information (be it true or false) from social media outlets such as Twitter, Facebook, etc. NPPs also participate with the Province and municipalities in a coordinated manner.
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- The main target audience of the NPP's emergency public information program should be the public living or working near the nuclear sites. Another audience is its employees, who need to know about the state of the facility and who may be a conduit for information to external groups. Each site should establish areas around their facility expected to be impacted by both direct exposure and ingestion pathway exposures during and after severe accidents. Citizens should understand by this communication if they reside in critical areas and be ready for response. To reach this audience, the NPPs should rapidly communicate with media outlets, its employees and stakeholders to ensure that they are informed quickly about developing issues.

Chapter Conclusions

- Management of Severe Accident Worker Doses is a complex assignment with a wide variety of radiological challenges which may occur for the ERO to address
- Sharing of different national approaches to ERO management will assist in achieving the goal of continued safe and efficient operation of NPPs globally
- Reference Levels differ among ISOE member countries as shown in Table 1
- Clear communication with the public is an important aspect of severe accident management

Key topics & Discussion points

- List here key issues that need to be addressed during the relevant break-out session
 - *ERO Staffing Levels*
 - *Challenges for nuclear plants sharing borders with other countries within their Ingestion Zone, etc.*
 - *Need to adapt international level for equipment and life saving emergency doses to volunteer workers*
 - *Identify areas for on-going ISOE sharing of experiences with Severe Accident Planning and Management*
 - *What information can be shared with Japanese utilities to support the restart and successful operation of NPPs?*

Key topics & Discussion points

- Best Practices in occupational radiation protection are being requested for the final report including unique:
 - *approaches,*
 - *strategies,*
 - *practices,*
 - *limitations.*
- As more countries complete Post-Fukushima Exercises, it is hoped enhancements to the Management of Accidents and the Emergency Response Organizations will be available and shared

Gaps in Management Chapter

- Handling of contaminated injuries is topic which can be expanded as more drills are completed
- The Darlington Drill actually installed a 8 bed portable hospital for the handling of multiple patients from a severe accident
- The management of environmental surveillance data between the command authority and the technical dose projection group is an important area of additional discussion