National Nuclear or Radiological Emergency Management Plan (EMP)

Sri Lanka Atomic Energy Regulatory Council

Ministry of Power and Energy

NATIONAL NUCLEAR OR RADIOLOGICAL EMERGENCY MANAGEMENT PLAN (EMP)

Sri Lanka

FOREWORD

The aim of this publication is to provide procedures and practical guidance to Government agencies involved in the mitigation of consequences of nuclear or radiological emergencies and medical management of exposed individuals in order to fulfill the requirement of the Sri Lanka Atomic Energy Act No 40 of 2014 in particular section 58 of the Act and to adhere to the requirements of the Disaster Management Act No 13 of 2005 in so far it is relevant to Nuclear or Radiological emergencies.

This document includes the legal background, hazard assessments, responsibilities, training, notification, preparedness, and response during a nuclear or a radiological emergency. Standard operating procedures, techniques, and equipment to be used in emergency response are also mentioned.

This National Nuclear or Radiological Emergency Management Plan has been prepared taking in to account the requirements of "International Atomic Energy Agency (IAEA) Safety Standards for Preparedness and Response to Nuclear or Radiological Emergency General Safety Requirements GSR Part 7" and other relevant IAEA safety standards, in order to harmonize communications and response in accordance with international standards.

The procedures for notifications of and related communications during a nuclear or a radiological emergency to the IAEA, other international organizations and Member states of the IAEA, described in this document are based on in accordance with those established by two legally binding documents; namely, the IAEA Convention on Early Notification of a Nuclear Accident and the IAEA Convention on Assistance in the case of a Nuclear Accident or Radiological Emergency to which Sri Lanka is a party.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Sri Lanka is a country exposed to different kinds of natural and man-made hazards. Direct or indirect effects of these hazards, disasters and emergencies can lead to much human suffering. Emergencies arising from use of ionizing radiation can be considered as a kind of hazard that needs to be carefully prepared and managed. Ionizing radiation sources are widely used in Sri Lanka in the medical and industrial sectors for socioeconomic development in the country. Loss or misuse of ionizing radiation sources, or nuclear reactor accidents in a neighbouring country could result in unwarranted radiation exposure and some other non-radiological effects to the public and the environment. It also can give rise to contamination of people and the environment and burden their day today life. In extreme cases, the radiation emergencies can result in severe deterministic health effects and severe contamination of environment.

Therefore, Sri Lanka needs to have proper management structure to manage the nuclear or radiological emergencies, according to the International Atomic Energy Agency (IAEA) standards and national requirements.

Sri Lanka Atomic Energy Regulatory Council (SLAERC) as the organization responsible for arranging necessary plans and procedures as per section 58 of the Sri Lanka Atomic Energy Act No 40 of 2014 (hereafter referred to as the Act) to protect the people and the environment in case of nuclear or radiological emergencies, has a leading and a critical role to prepare National Nuclear or Radiological Emergency Management Plan (hereafter referred to as the "Emergency Management Plan" (EMP)) for management of radiation emergencies with the participation of Disaster Management Center (DMC) and other stakeholders.

Emergency preparedness and response activities and involvement of stakeholders are critical components to be implemented under this EMP where guidelines and policies are clearly stated down. In parallel with the Emergency Management Plan the implementation of 'Business Continuity Plan (BCP) of the SLAERC for responding to non-radiological emergencies' is also incorporated in EMP.

As operating organizations, technical support organizations, and response organizations involving in response to the Nuclear or Radiological emergencies at the regional and national level depending on the degree of effect from the emergency to the different part of the country, it is necessary to establish a proper system of coordination among the organizations identified in this EMP.

1.2 PURPOSE

The Purposes of the Emergency Management Plan are;

1.2.1 To provide a basis for institutional, regional or national level response to a nuclear or radiological emergency.

1.2.2 To provide a basis for coordination with international and national organizations to obtain assistance in case of a nuclear or a radiological emergency

1.2.3 To enhance national emergency response capability for timely and well-co-ordinated action of the authorities in a radiological incident or nuclear emergency.

1.2.4 To establish a mechanism for responding to any nuclear or radiological emergency with the assistance of the stakeholders identified in this EMP.

1.2.5 To introduce a backup system for responding to nuclear or radiological emergency in case of inability of SLAERC to provide services due to external influences of its day today functions.

1.3 SCOPE

The EMP covers requirements and arrangements for mitigation of any nuclear or radiological emergency that can be expected to have a significant radiological effect within Sri Lanka and its territorial waters and that could require a response by several government organizations. Emergencies occurring at any type of radiation facility that use ionizing radiation fall within the scope of this EMP. The EMP also includes requirements, arrangements, and coordination with international organizations in the case of nuclear or radiological emergencies occurring outside of Sri Lanka, which will have an impact within Sri Lanka or its territorial waters. This EMP covers preparedness and response necessary for categories of emergencies identified in Table 1 of chapter 2.1

1.4 LEGAL BACKGROUND

The following legal documents provide necessary legal basis for preparation of this EMP and its implementation.

1. Sri Lanka Atomic Energy Act No 40 of 2014 (Ref [1]).
2. Sri Lanka Disaster Management Act No 13 of 2005 (Ref [2]).
3. Convention on Early Notification of a Nuclear Accident (Ref [3]).
4. Convention on Assistance in the case of a Nuclear Accident or Radiological Emergency (Ref [4]).
5. National Disaster Management Plan (Ref [5]).

1.4.1 Conformity to national laws

As per section 58 (1) and (2) of chapter VII of the Act the SLAERC is required to prepare and adopt an Emergency Management Plan in accordance with provisions of the Sri Lanka Disaster Management Act No 13 of 2005.The SLAERC is also required in terms of section 58 (3) of chapter VII of the Act to assist DMC established under section 8 of the Disaster Management Act no 13 of 2005 for implementation of an Emergency Management Plan in the event of any nuclear or radiological emergency. Arrangements for business continuity is described in case of inability of SLAERC to perform its functions to response to a nuclear or a radiological emergency due to an unexpected external influence in EMP in accordance with provisions given in section 8 (a) and 10 in Disaster Management Act no 13 of 2005.

1.4.2 Conformity to international treaties and conventions

The SLAERC is serving as the point of contact (POC) for providing information to IAEA and relevant states in the case of a nuclear accident as per provision of Convention on Early Notification of a Nuclear Accident and for receiving assistance from IAEA or from another state and providing assistance by Sri Lanka to any state in case of nuclear or radiological emergency as per provision of the Convention on Assistance in the case of a Nuclear Accident or Radiological Emergency.

1.5 PLANNING PRE-REQUISITIES

It is the responsibility of the Ministries, Government Departments and other Government agencies listed in the National Emergency Operation Plan (NEOP) of DMC (Ref [6]) to make arrangements to provide their services in an efficient and effective manner for the activities envisage from them for mitigation of consequences of a nuclear or radiological emergency within the responsibility of that particular agencies. In addition to the above, the following assumptions were also made in formulating the EMP.

1.5.1 Management of facility emergencies

The owner or operator of an affected radiology facility has the primary responsibility for actions within the boundaries of the facility for notifying and providing advice to off-site officials as necessary for minimizing the radiological hazard to the public. SLAERC with the assistance of other stakeholders have the primary responsibility for determining and implementing measures required to protect life, property and the environment in affected areas outside the boundaries of a fixed radiation facility.

1.5.2 Management of national emergencies

When a notification is received by the SLAERC of a nuclear or radiological emergency in a public area or an area including territorial waters of Sri Lanka affected by a nuclear emergency occurring in another country the SLAERC should take necessary measures to notify other relevant agencies to coordinate with each other and promptly attend to the mitigation of consequences of the nuclear or radiological emergency.

1.5.3. The basis for activating the EMP

The EMP will be activated in the following situations

a) When government agencies must respond to meet their statutory obligations in a nuclear or radiological emergency.
b) when public protective actions are warranted in case of nuclear or radiological emergency.

1.6 REVIEW AND UPDATING THE EMP

EMP should be reviewed and updated every five years to keep abreast of new technologies and new developments and after each of the following scenarios with the participation of relevant stakeholders,

a) If it is found that the existing plan is inadequate to respond to a major nuclear or radiological emergency that has occurred. The revisions to the EMP should be based on the lessons learnt.
b) After a national exercise, if the findings of the exercise warrant a revision of the EMP.
c) any other situation that demands a revision of the EMP.

1.7 FUNDING FOR MEETING THE COST OF PREPAREDNESS AND RESPONSE TO RADIATION EMERGENCIES

The all organization responsible for responding to nuclear or a radiological emergency should have financial resources to meet their cost of preparation and response to nuclear or radiological emergencies in so far, their involvement is essential for the fulfilment of mandate given to the relevant organizations by the respective Acts, Government orders and this EMP.

1.7.1. Request for government assistance

SLAERC and DMC should coordinate with relevant Ministries and Government Departments to acquire necessary additional funds in the event of a high level nuclear or a radiological emergency that requires enhanced manpower and financial resources for mitigation of its consequences.

CHAPTER 2

PLANNING BASIS

2.1 EMERGENCY PREPAREDNESS CATEGORIES (EPC)

Before planning for radiation emergencies, the situations for which emergency response planning is required must be identified. IAEA in its publication, (IAEA) Safety Standards for Preparedness and Response to Nuclear or Radiological Emergency General Safety Requirements (GSR) Part 7 (Ref [7]) has listed Emergency Preparedness Categories (EPCs) that should be considered for preparedness and planning for a nuclear or a radiological emergency. A hazard assessment is hereby made using IAEA emergency preparedness categories to identify possible situations that requires emergency response and planning in Sri Lanka's context, and accordingly necessary requirement is provided in this EMP.

Table 1: Emergency Preparedness (EP) Categories (Ref [7])

Category	Description	Whether facility/situation relevant to Sri Lanka
I	Facilities such as Nuclear Power Plants (NPP), for which on- site events[a,b] (including those not considered in the design[c]) that could give rise to severe deterministic effects[d] off the site that would warrant precautionary urgent protective actions, urgent protective actions or early protection actions, and other response actions to achieve the goals of emergency response in accordance with international standards , or for which such events have occurred in similar facilities. (NPP)	None
II	Facilities, such as some type of research reactor and nuclear reactor used to provide power for the propulsion of vessels (e.g. ships and submarines), for which on-site events[a,b] that could give rise to doses to people off the site that would warrant urgent protective action or early protective actions and other response actions to achieve the goals of emergency response in accordance with international standards[e], or for which such events have occurred in similar facilities. Category II (as opposed to category I) does not include facilities for which on-site events (including those not considered in the design) are postulated that could give rise to severe deterministic effects off the site, or for which such events have occurred in similar facilities. Warranting urgent protective actions off-site, deterministic health effects on-site. (Research Reactors)	None
III	Facilities, such as industrial irradiation facilities or some hospitals, for which on-site events that could warrant protective actions and other response actions on the site to achieve that goals of emergency response in accordance with international standards, for which such events have occurred in similar facilities. Category III (as opposed to category II) does not include facilities for which events are postulated that could warrant urgent protective actions or early protective actions off the site, or for which such events have occurred in similar facilities. No urgent protective actions off-site are warranted, severe deterministic health effects on-site	Yes

Table 1: Emergency Preparedness (EP) Categories (Ref [7]) (cont.)

Category	Description	Whether facility/situation relevant to Sri Lanka
IV	Activities and acts that could give rise to a nuclear or radiological emergency that could warrant protective actions and other response actions to achieve the goals of emergency response in accordance with international standards in an unforeseen location. These activities and act include: (a) transport of nuclear or radioactive material and other authorized activities involving mobile dangerous source such as industrial radiography sources, nuclear powered satellites or radioisotope thermoelectric generators; and (b) theft of a dangerous source and use of a radiological dispersal device or radiological exposure device[f]. This category also includes: (i) detection of elevated radiation levels of unknown origin or of commodities with contamination; (ii) identification of clinical symptoms due to exposure to radiation; and (iii) a transnational emergency that is not in category V arising from a nuclear or radiological emergency in another State. Category IV represents a level of hazard that applies for all States and jurisdictions with the potential to trigger a radiation emergency that could warrant protective actions and other response actions in an unforeseen location.	Yes
V	Areas within emergency planning zone and emergency planning distances[g] (as given in Appendix 1) in a State for a facility in category I or II located in other State.	Yes

a. That is, on-site events involving an atmospheric or aquatic release of radioactive material, or external exposure (due, for example, to a loss of shielding or a criticality events), that originates from a location on the site.

b. Such events include nuclear security events.

c. This includes events that are beyond the design basis accidents and, as appropriate, conditions that are beyond design extension conditions.

d. See 'deterministic effect' under Definitions.

e. See the goals of emergency response in 3.1 in this EMP

f. A radiological dispersal device is a device to spread radioactive material using conventional explosives or other means. A radiation exposure device is a device with radioactive material designed to intentionally expose members of the public to radiation. They could be fabricated, modified or improvised devices.

g. See Appendix 1 for emergency planning zones and distances

Details of facilities in Sri Lanka which is identified for emergency preparedness and response listed in Annexure 1.

2.2. TYPES OF EMERGENCIES

The emergencies categorized above are defined in three types for easy management with respect to involvement of personnel and institutions.

1. **Low level emergencies-** Consequences only limited to facility and it can be managed by Radiation Protection Officer (RPO) and facility staff.

2. **Medium level Emergencies-** Severe onsite and limited off site consequences which cannot be controlled by the facility staff and can be controlled with the SLAERC assistance.

3. **High level Emergencies-** These are national emergencies that could affect a group of people, the environment and water bodies. Involvement of several stakeholders including the SLAERC are required for mitigation of consequences.

Standard Operation Procedures (SOP's) for nuclear or radiological emergencies identified under above types of emergencies are given in Annexure 6.

2.3 PROTECTION STRATERGY

In Sri Lanka reference level is set to 100 mSv. This represents acute or annual residual dose via all exposure pathways. Generic criteria given in Appendix 2 are based on this value. Protective actions that are planned to be taken during an emergency are based on Operational interventional levels (OILs) and observables described in Appendix 2.

2.4 RESPONSE ORGANIZATIONS

Organizations which could be involved in responding to nuclear or radiological emergency is given below. Degree of involvement of each organization depend on the type of emergency and its complexity. The following figure shows the coordination structure during nuclear or radiological emergency.

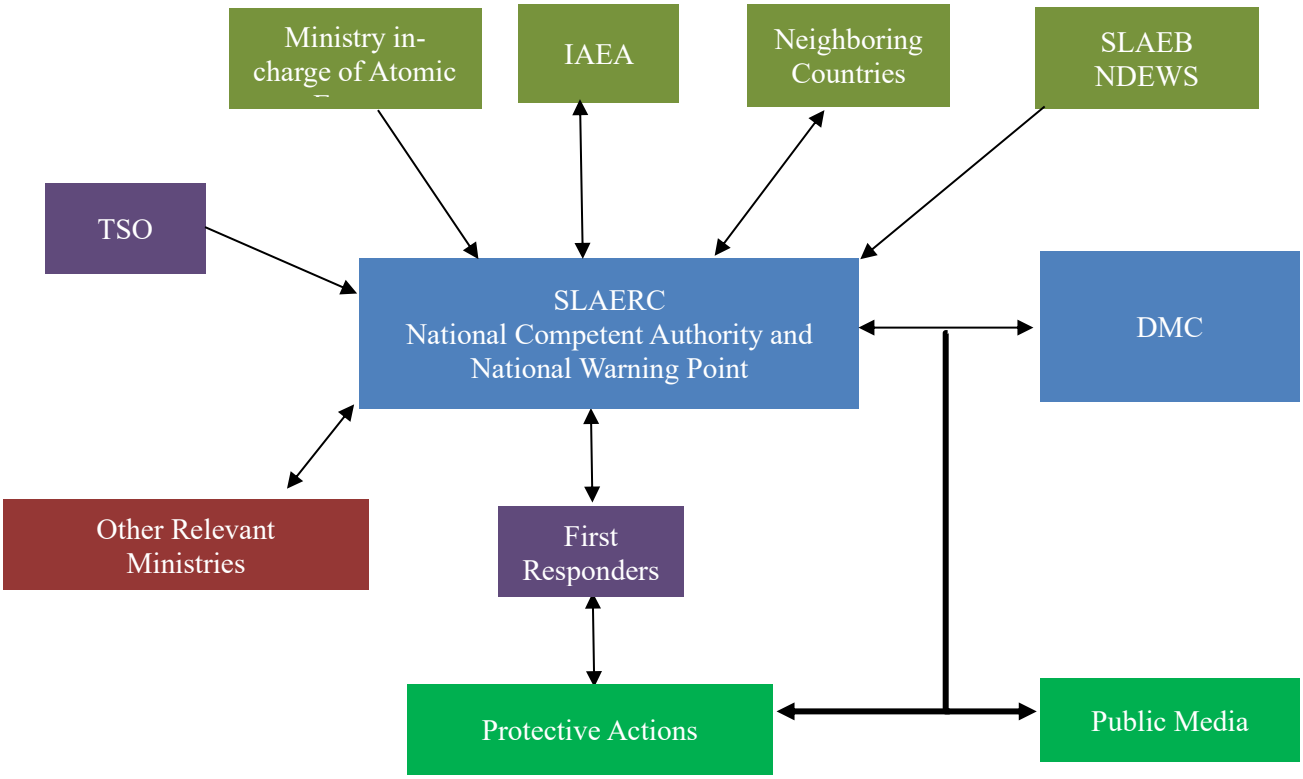


Figure 1: Coordination structure among the organizations

2.4.1 a) Organizations responsible for decision making and coordination

(i) Sri Lanka Atomic Energy Regulatory Council (SLAERC)
(ii) Disaster Management Center (DMC)

b) Technical Support Organizations (TSOs)

(i) Sri Lanka Atomic Energy Board (SLAEB)
(ii) Department of Meteorology
(iii) National Water Supply and Drainage Board (NWSDB)

(iv) Marine Environment Protection Authority (MEPA)
(v) National Aquatic Resource Research and Development Agency (NARA)
(vi) Central Environmental Authority (CEA)
(vii) Government Analyst's Department
(viii) Sri Lanka Transport Board
(ix) Civil Aviation Authority
(x) Sri Lanka Customs
(xi) Sri Lanka Ports Authority (SLPA)
(xii) Airport Aviation Sri Lanka Ltd
(xiii) Sri Lankan Airlines Ltd;
(xiv) Department of Immigration and Emigration

c) First Responders (FR)

(i) Department of Police including Special Task Force (STF)
(ii) Municipal Fire Department (Fire Brigade)
(iii) Sri Lanka Army-CBRN Group
(iv) Sri Lanka Navy -CBRN Group
(v) Sri Lanka Air Force-CBRN Group
(vi) Sri Lanka Coast Guard
(vii) National Ambulance Service

d) Organizations involved in medical management

(i) Ministry of Health
(ii) Provincial Ministries of Health

e) Ministries involved in response planing, decision making and assistance

e.1 Ministry directly responsible for Response planning, decision making and Assistance

(i) Ministry Incharge of the subject of Atomic Energy
(ii) Ministry of Disaster Management (MODM)
(iii) Ministry of Foreign Affairs (MOFA)

e.2 Ministries to be involved in decision making and assistance

(iv) Ministry of Defence (MOD)
(v) Ministry of Environment
(vi) Ministry of Agriculture (MOA)
(vii) Ministry of Provincial Council and Local Governments
(viii) Ministry of Fisheries (MOF)
(ix) Ministry of Mass Media (MOMM)
(x) Ministry of Law and Order
(xi) Ministry of Water Supply
(xii) Ministry of Transportation and Civil Aviation
(xiii) Ministry of Higher education
(xv) Ministry of Education
(xv) Ministry of Finance

2.5 ROLES AND RESPONSIBILITIES OF RESPONSE ORGANIZATIONS

2.5.1 Roles and responsibilities of the organizations responsible for decision making and coordination

2.5.1.1 Sri Lanka Atomic Energy Regulatory Council (SLAERC)

SLAERC is the responsible entity for revising and maintenance of the EMP and constant coordination with relevant stake holders to keep abreast the new developments and lessons learned from emergencies that may occur after this EMP is approved. The SLAERC is also responsible for maintaining coordination among the stakeholders on scientific and technical matters connected with management of a nuclear or radiological emergency.

The National Emergency Coordinator (NEC) who is a senior person with knowledge and competence in managing the national emergency preparedness and response system of the country, appointed by SLAERC is responsible for developing and maintaining the national radiological and nuclear emergency management system.

The Technical Advisory Committee (TAC) appointed by SLAERC is responsible for providing technical advices in the event of a radiological or nuclear emergency, issuing alert and early warning to the public and respond to such emergencies. The TAC leader will be the emergency manager (Described in 3.5.2) during high level emergencies. (TAC representative details given in Annexure 2) During the response SLAERC requests relevant technical support organizations to conduct environmental monitoring, sample collection, testing of samples and report on results of testing and monitoring to the SLAERC, the SLAERC conduct area survey, sample collection and in-situ and laboratory measurement of sample mobilizing team of scientists from SLAERC who were trained in the above areas. The SLAERC also possess resources and laboratory facilities to carryout radiological assessments and to provide protective actions and necessary recommendations.

SLAERC is the national emergency contact point and IAEA POC for information exchange during radiological or nuclear emergency in terms of Assistant and Notification conventions signed by Sri Lanka with IAEA. SLAERC functions as the National Warning Point and National Competent Authority (Abroad)-NCA (A) and National Competent Authority Domestic NCA (D) for coordinating with IAEA on international nuclear or radiological emergency alerts and warnings as per requirements given in IAEA incident emergency centre's (IEC) communication procedures.

IAEA communication system with regard to National Warning Point (NWP), NCA (A) and NCA (D) and involvement of permanent mission of Sri Lanka to the IAEA in an emergency and IAEA website for emergency communication is described in Appendix 4.

As the national regulatory authority, The SLAERC should take every possible step to ensure the availability of emergency plans at each radiation facility with sources in IAEA source categories 1, 2 and 3, which are licenced by the SLAERC (Guidelines of prepare facility Emergency Plans are given in Appendix 5).

Preparedness actions and response actions to be taken by the SLAERC is given in Tables 2 and 3

Table 2: Preparedness actions

Preparedness
▪ Establishment of Nuclear or Radiological Emergency Operation Unit with necessary equipment and 24x7 national and international communication facilities. ▪ Coordination and receiving required data from the nuclear emergency early warning system and base-line data of the environmental radioactivity from SLAEB. ▪ Establishment and maintaining detection system/s that need to provide early warning to public during emergency. ▪ Establishment of SOPs for nuclear or radiological Emergencies (SOP List is given in Appendix 6). ▪ Appointment of National Emergency Coordinator (NEC) ▪ Formation of the Technical Advisory Committee (TAC) of SLAERC ▪ Formation of the National Radiological Emergency Response Committee (NRERC) ▪ Provision of training for the radiological assessors, first responders, and other responding groups.

Table 2: Preparedness actions (cont.)

Preparedness
▪ Establishment of a mechanism for public communication during emergency Conducting awareness programmes for the public ▪ Acquiring and maintaining emergency equipment, detection system/s & assessment laboratory ▪ Coordination with International Atomic Energy Agency by providing all contact details according to EPR Incident and Emergency Communication (IEComm) 2012 Operations Manual for Incident and Emergency Communication (Ref [9]) to NWP, NCA (A) and NCA (D) ▪ Participating in Convex (Convention Exercises) Emergency exercises conducted by IAEA ▪ Appointment of the International Nuclear or radiological Event scale coordinator (INES) ▪ Conducting national drills and exercises on a regular basis. (A plan should be made) ▪ Initialization of bilateral agreements with other neighbouring countries for communication during category V and transnational emergencies. ▪ Creating awareness among disaster management district coordinators, district secretaries, divisional secretaries and local police and other responders as appropriate on measures to be taken in the event of nuclear or radiological emergencies.

Table 3: Response actions

Response
▪ Analysis of the emergency notification and communicate as appropriate. ▪ Take necessary actions as directed by TAC ▪ Coordinate with other stakeholders as necessary for necessary assistance ▪ Activate established SOP's and carry out radiological assessments, issue alerts and warnings to the public if necessary, in collaboration with DMC ▪ Activate the 24x7 Emergency unit during a national emergency with adequate number of persons and communication facilities. ▪ Formulate appropriate protective actions as appropriate and recommend to DMC and Disaster Management Council and relevant district secretaries, divisional secretaries on the measures taken to avert dose to the public and protection of water bodies and food. ▪ Communicate with DMC for activating NRERC ▪ Attend media briefings and arrange press conferences as required. ▪ Obtain assistance from international organisations, when necessary, in coordination with Ministry of Foreign affairs.

2.5.1.2. Disaster Management Centre (DMC)

DMC is the National Coordination Authority for any type of natural and man-made disasters. DMC is responsible for coordinating with SLAERC to implement this EMP.

DMC operates a 24x7 National Emergency Operations Centre (EOC) for natural and man-made disasters and its operational room has all the contact details of stakeholders. They have operated NEOP for all identified hazards. DMC will coordinate with SLAERC during any radiation emergency which is designated as national emergency and it is the main organization responsible for arranging media briefings and for providing nationwide warnings and information to the public in collaboration with the SLAERC.

Preparedness actions and response actions to be taken by the DMC is given in Tables 4 and 5.

Table 4. Preparedness actions

Preparedness
▪ Development and implementing of the NEOP. ▪ Organizing training programmes for first responders, other groups and individuals involve with response activities in collaboration with the SLAERC. ▪ Training DMC staff at District level on radiological or nuclear emergency response. ▪ Coordinating relevant authorities and District Disaster Management Coordinators to obtain / provide information on disasters.

Table 4. Preparedness actions (cont.)

Preparedness
▪ Convening regular meetings of the NRERC in coordination with SLAERC. ▪ Arranging for public awareness programmes in collaboration with relevant authorities. ▪ Providing emergency response equipment to first responders.

Table 5: Response actions

Response
▪ Receiving alerts and warning notices from the SLAERC. ▪ Receiving protective action recommendations from the SLAERC, deciding on them, and implementing the recommendations coordinating with relevant organizations at national and/or local levels. ▪ Disseminating Alerts/ Warnings/ Evacuation notices to Districts/ vulnerable communities / public. ▪ Informing relevant stakeholders regarding a disaster situation. ▪ Monitoring and informing the emergency situation to the Hon. Minister of Disaster Management, any other relevant Ministers, Secretary to HE the President, Secretary to the Treasury, Secretary to Ministry of Defence and Secretary to Ministry of Disaster Management. ▪ Issue regular situation reports to Media, United Nations (UN) Organizations, and NRERC and other relevant stakeholders. ▪ Convening NRERC meetings as required. ▪ Undertake search & rescue operations in affected districts / communities by coordinating resources available with Military, Police, Government, UN organizations and NGOs/INGOs. ▪ Conducting press briefings jointly with the SLAERC. ▪ Responding to requests received from general public on search and rescue, immediate relief and post disaster recovery needs. ▪ Coordinating the clearing of routes / obstacles /debris, cleaning of canals / water wells, establishing relief camps and immediate relief distribution. ▪ Coordinating isolation of the affected people. ▪ Coordinating the provision of food, drinking water, sanitary facilities and medicine requested by affected communities. ▪ Assisting the SLAERC to obtain international assistance in coordination with Ministry of Foreign Affairs.

2.5.2 Roles and Responsibilities of Technical Support Organizations (TSOs)

2.5.2.1 Sri Lanka Atomic Energy Board (SLAEB)

SLAEB is identified as main technical agency responsible for providing support to the SLAERC for measurement of radioactivity during a radiological or a nuclear emergency. SLAEB is the main organization responsible for the provision of technical services for radiation measurements in environmental samples such as soil, air, water and food items through in-situ measurements and laboratory analysis. In order to identify possible contaminated areas, SLAEB is responsible for developing and maintaining their detection capabilities (aerial and terrestrial gamma dose rate measurements and in-situ/laboratory gamma spectroscopy). As a requirement to fulfil the above tasks, the SLAEB has to collect and upgrade the baseline environmental radioactivity database in addition to upgrading the technical capabilities and human resources. The procedures and methods of collecting the environmental measurements should be in accordance with internationally recognized guidelines and standards. A Nuclear Disaster Early Warning System (NDEWS) has been established by SLAEB for early detection of a nuclear disaster. Eleven set of detectors are placed in different locations (Locations of the detectors installed are given in Figure 2.) around the country and the network will be continuously monitored, upgraded and maintained by the SLAEB. All confirmed detections of increase in radiation levels shall be communicated to the SLAERC.

The SLAEB acts as the contact point of the International Radiation Monitoring Information System (IRMIS) of the IAEA and will be responsible for providing environmental and early warning data into the IRMIS database. Likewise, knowledge, technology and experiences shall be shared with the members and measuring teams of the international scientific network to enhance technical competency and accuracy [Analytical Laboratories for the

Measurement of Environmental Radioactivity (ALMERA)]. This enables a pathway to obtain further assistance in an emergency situation.

Existing Detector Stations of the NDEWS ★ Detector Locations to be Established in Future

Figure 2: Locations of the Detectors installed for NDEWS.

Preparedness actions and response actions to be taken by the SLAEB are given in Tables 6 and 7.

Table 6: Preparedness actions

Preparedness
▪ Maintaining of the early warning system to provide alerts in a nuclear or a radiological emergency. ▪ Human resources development for detection and response. ▪ Development of technical capabilities of radiation measurements. ▪ Developing procedures and methods, technical guidelines and SOPs for radiation measurements. ▪ Develop and maintain a preparedness and response plan; conduct rehearsals to validate emergency response procedures. ▪ Acquire and maintain radiation monitoring equipment & standardization of laboratories in conformity with International Organization for Standardization (ISO) 17025. ▪ Nominate an emergency response coordinator as a focal point to communicate with SLAERC. ▪ Preparation of waste acceptance and storing criteria and procedures during a radiation emergency. ▪ Establishments of Environmental monitoring groups. ▪ Participation in EP Trainings conducted by SLAERC.

Table 7: Response actions

Response
▪ Provide data from NDEWS established at the SLAEB to SLAERC during a nuclear or a radiological emergency. ▪ Assign response teams under the above contact person available in 24x7 during a nuclear or a radiological emergency. ▪ Conduct radiation monitoring on radiation contaminated areas people, food and other commodities and provide data to the SLAERC. ▪ Provision of in-situ and laboratory measurement data to SLAERC for decision making. ▪ Provision of personal monitoring services for emergency workers with available resources according to the advice by NEC. ▪ Communicate with SLAERC for radiation measurements during national emergencies Provide assistance and technical support to manage radioactive waste generated as a result of national emergencies and facility emergencies.

2.5.2.2 Department of Meteorology (DOM)

The Department of Meteorology is expected to provide weather conditions in and around the area during nuclear emergency and also to provide weather forecasts including wind speed, wind direction rain fall, etc. and assists the SLAERC to predict plume deposition areas. This information is required to make precautionary actions during nuclear accidents.

Preparedness actions and response actions to be taken by the DOM are given in Tables 8 and 9.

Table 8: Preparedness actions

Preparedness
▪ Assisting the SLAERC on plume modelling and forecasting. ▪ Nominating a contact point to the radiation emergency response. ▪ Participation in EP Trainings conducted by SLAERC. ▪ Develop and maintain a preparedness and response plan; conduct rehearsals to validate emergency response procedures

Table 9: Response actions

Response
▪ Providing weather conditions (Wind speed, wind directions, rainfall etc.). ▪ Assist in providing necessary weather data to SLAERC for forecasting of plume directions and areas of depositions.

2.5.2.3 National Water Supply and Drainage Board (NWSDB)

The National Water Supply and Drainage Board is responsible for protecting public water bodies and assisting in monitoring drinking water during a nuclear or radiological emergency. NWSDB should provide information on additional water resources suitable for human consumption and distribution of non-contaminated water in the affected areas.

Preparedness actions and response actions to be taken by the NWSDB are given in Tables 10 and 11.

Table 10. Preparedness actions

Preparedness
▪ Identifying locations of additional water resources to use in radiological emergency situations. ▪ Nominating a contact point for radiation emergency response. ▪ Acquire relevant personal protective equipment for persons responding to emergency. ▪ Participation in EP training programmes conducted by SLAERC. ▪ Develop and maintain a preparedness and response plan; conduct rehearsals to validate emergency response procedures

Table 11. Response actions

Response
▪ Providing water samples to the SLAERC for analysis. ▪ Deploying the necessary resources and making immediate alternative water supplies, restoration of water supply to affected areas. ▪ Handling water and waste water to avoid distribution of contaminated water to already safe zones.

2.5.2.4 Marine Environment Protection Authority (MEPA)

Marine Environmental Protection Authority is responsible for assisting the SLAERC in marine environment monitoring and assessment if requested by the SLAERC during category V or transnational nuclear accidents. MEPA should provide the resource personnel and equipment to carry out these tasks.

Preparedness actions and response actions to be taken by MEPA are given in Tables 12 and 13.

Table 12: Preparedness actions

Preparedness
▪ Develop and maintain a preparedness and response plan; conduct rehearsals to validate emergency response procedures ▪ Participation in EP training programmes conducted by the SLAERC. ▪ Nominate a contact point for coordination of response with the SLAERC.

Table 13: Response actions

Response
▪ Collect and supply marine samples from the areas recommended by the SLAERC for radioactivity analysis ▪ Provisions of resources to SLAERC officers to carry out radiation surveys in marine environment.

2.5.2.5 National Aquatic Resource Research and Development Agency (NARA)

NARA is responsible for monitoring and assessment of marine samples and developing interventions. Preparedness actions and response actions to be taken by the NARA are given in Tables 14 and 15.

Table 14: Preparedness actions

Preparedness
▪ Develop and maintain a preparedness and response plan; conduct rehearsals to validate emergency response procedures ▪ Participation in EP training programmes conducted by the SLAERC. ▪ Nominate a contact point for coordination of emergency response with the SLAERC.

Table 15: Response actions

Response
▪ Collect and supply of samples of sea-fish and plants for radioactivity analysis. ▪ Provide resources and personnel for SLAERC officers to carry out radiation surveys on marine environment.

2.5.2.6 Central Environmental Authority (CEA)

Central Environmental Authority is expected to assist the SLAERC for managing radioactive wastes during national emergency and in assessment of environmental impact due to a nuclear or a radiological emergency.

Preparedness actions and response actions to be taken by the CEA are given in Tables 16 and 17.

Table 16: Preparedness actions

Preparedness
▪ Development of procedures for management of contaminated household items, buildings and soil with radioactive materials. ▪ Develop and maintain a preparedness and response plan; conduct rehearsals to validate emergency response procedures. ▪ Participation in EP training programmes conducted by the SLAERC. ▪ Nominate a contact point for coordination of emergency response with SLAERC.

Table 17: Response actions

Response
▪ Coordinate with the SLAERC for waste management of contaminated household items, buildings and soil with radioactive material ▪ Coordinate with CEA licence holders to convey decisions of the SLAERC for restriction of use of water bodies and environment.

2.5.2.7 Government Analyst's Department

Government Analyst's Department is assisting the SLAERC and the police for investigation of cause of accident and nuclear forensic activities especially in security event.

Preparedness actions and response actions to be taken by the Government Analyst's Department are given in Tables 18 and 19.

Table 18: Preparedness actions

Preparedness
▪ Identification of the actions to be taken and responsibilities during the event of a radiological emergency resulting from a criminal activity involving a nuclear material or a radiation source. ▪ Develop and maintain a preparedness and response plan; conduct rehearsals to validate emergency response procedures ▪ Nominate a contact point for coordination of response to an emergency, with the SLAERC. ▪ Maintenance of facilities required for forensic analysis after a radiological emergency. ▪ Participation in EP training programmes conducted by the SLAERC.

Table 19: Response actions

Response
▪ Coordinate with the SLAERC or and Police in investigations ▪ Carry out necessary forensic analysis and communicate results to police and the SLAERC.

2.5.2.8 Sri Lanka Transport Board (SLTB)

Sri Lanka Transport Board is expected to assist in making arrangement for public transportation during a national emergency for evacuation of the public from the affected areas and transportation of the emergency workers to the affected sites.

Preparedness actions and response actions to be taken by the SLTB are given in Tables 20 and 21.

Table 20: Preparedness actions

Preparedness
▪ Nominate a contact point for coordination of response, with the SLAERC. ▪ Create awareness among responsible parties about possible national radiological or nuclear emergency situations, personal protection methods in a radiation emergency and situations where assistance from Transport Board is required. ▪ Preparation of a leaflet giving information to Drivers and Assistants on suitable personal protection devices to be used and method of protection from contamination. ▪ Plan on arranging required volume of transportation. ▪ Develop and maintain a preparedness and response plan; conduct rehearsals to validate emergency response procedures ▪ Participation in EP training programmes conducted by the SLAERC.

Table 21: Response actions

Response
▪ Arrange transport facilities as requested by the SLAERC. ▪ Provide contact details of Drivers and Assistants to SLAERC who are mobilized for transport in order for SLAERC to provide them guidance and arranging them suitable protection as emergency workers if necessary.

2.5.2.9 Civil Aviation Authority (CAA)

Civil Aviation Authority is expected to make arrangements for aviation related activities including control of flights during a transnational emergency or a radiological emergency at the airport.

The preparedness actions and response actions of CAA are given in Tables 22 and 23.

Table 22: Preparedness actions

Preparedness
▪ Nominate a contact point for coordination of response, with the SLAERC. ▪ Develop and maintain a preparedness and response plan; conduct rehearsals to validate emergency response procedures ▪ Participation in EP training programmes conducted by the SLAERC.

Table 23: Response actions

Response
▪ Provide assistance for SLAERC survey team to carry out radiation survey of passengers and goods ▪ Facilitate radiological surveys of selected aircrafts (Passengers and cargo) if requested by SLAERC, during Category V or transnational nuclear emergency

2.5.2.10. Sri Lanka Customs

Sri Lanka Customs is expected to assist in import/export control of contaminated food and other commodities. Arrangements should be made with the SLAERC to monitor and assess food and other commodities. Sri Lanka Customs should also assist SLAERC in clearing imported equipment for emergency response during IAEA Response and Assistance Network (RANET) missions to Sri Lanka or equipment going out from Sri Lanka in case Sri Lanka is providing assistance.

Preparedness actions and response actions to be taken by Sri Lanka Customs are given in Tables 24 and 25.

Table 24: Preparedness actions

Preparedness
▪ Developing and implementing a plan for providing samples of imported food and other commodities to the SLAERC for analysis, in case of a radiological or a nuclear emergency giving rise to possible contamination of such commodities. ▪ Ensuring the optimal functioning of the Mega Port Surveillance Unit. (There are 17 Radiation Portal Monitoring Lanes (RPM) and one Sodium Iodide portal monitor (SPM) installed at this unit, 08 Local Alarm Station (LAS) points, 01 Central Alarm Station (CAS) and 02 Secondary inspection Site (SISs) are functions for mega port surveillance unit. ▪ Nominating a contact point for coordinating response in case of an emergency, with the SLAERC. ▪ Train the custom staff for a nuclear or radiological emergency.

Table 25: Response actions

Response
▪ Providing samples of imported food and other commodities to the SLAERC for analysis, in case of a radiological or a nuclear emergency giving rise to possible contamination of such commodities, before releasing for domestic consumption. ▪ Ensuring the referral of commodities to the SLAERC for analysis if radioactive contamination is suspected. ▪ Assisting in clearing emergency response equipment during IAEA/RANET missions for emergency response.

2.5.2.11 Sri Lanka Ports Authority (SLPA)

The SLPA is responsible for implementation of the Port Safety Plan to mitigate effects of potential radiation accidents which may occur within the port and control of vessels carrying hazardous and contaminated shipments.

Preparedness actions and Response actions of SLPA are given in Tables 26 and 27.

Table 26: Preparedness actions

Preparedness
▪ Maintaining Mega port surveillance system with necessary updates ▪ Developing and maintaining a radiological emergency response plan at the Port. ▪ Training personnel at the Port for nuclear or radiological emergency response. ▪ Acquiring necessary radiation monitoring equipment for ports of Hambantota, Trincomalee, Galle and Kankasanthure. ▪ Nominating a contact point to coordinate emergency response with SLAERC.

Table 27: Response actions

Response
▪ Identifying radioactive material or contaminated material with the assistance of SLAERC. ▪ Notify and provide information to the SLAERC. ▪ Obtain advice from SLAERC for remedial action and mitigation of consequences in case of a suspected contamination or an accident involving radiation source ▪ Inform other stakeholders who can be of assistance to mitigate the consequences. ▪ Responding emergencies involving radioactive material with the relevant stakeholders.

2.5.2.12 Airport and Aviation Services (Sri Lanka) Ltd.

Airport and Aviation Services (Sri Lanka) Ltd has the responsibility of providing assistance to detect and isolate contaminated goods and passengers at the Airport and function as the first responders for any radiological accident occurring at the airport. Arrangements should be made with SLAERC for monitoring and assessment of unauthorized material.

Preparedness actions and response actions of Airport and Aviation Services (Sri Lanka) Ltd; are given in Tables 28 and 29.

Table 28: Preparedness actions

Preparedness
▪ Developing and maintaining a plan for detecting goods and persons contaminated with radioactive material. ▪ Maintaining a radiation detector system at Airport ▪ Training the staff for nuclear or radiological emergency response ▪ Nominating a contact point for coordinating Emergency response with the SLAERC.

Table 29: Response actions

Response
▪ Provide necessary space and facilities to establish monitoring points at the airport at the request made by SLAERC ▪ Provide arrival and departure flight details to SLAERC during Category V or transnational nuclear emergencies.

2.5.2.13 Sri Lankan Airlines Ltd;

Sri Lankan Airlines is responsible for handling radioactive material at Cargo terminal on general operations and for providing storage facilities for temporary storage of damaged or leaking sources at the airport until the source transferred to safer location.

Preparedness actions and response actions of Sri Lankan Airlines Ltd are given in Tables 30 and 31.

Table 30: Preparedness actions

Preparedness
▪ Develop and maintain a preparedness and response plan; conduct rehearsals to validate emergency response procedures ▪ Train the Sri Lankan Airline staff for nuclear or radiological emergency response ▪ Nominating a contact point to the Emergency response.

Table 31: Response actions

Response
▪ Detecting and notifying damaged sources and contaminated goods to SLAERC. ▪ Provide assistance for temporary storage of radioactive material found damaged and contaminated. ▪ Take immediate action to demarcate the accident site and inform SLAERC for advice if an explosion with sources or source damage during loading and unloading of goods to aircrafts has occurred. ▪ Facilitate radiological survey of selected Sri Lankan Airlines aircrafts if requested by SLAERC during Category V or transnational or nuclear emergency.

2.5.2.14 Department of Immigration and Emigration

Department of immigration and emigration is expected to assist the SLAERC in identifying and controlling contaminated people entering the country during transnational emergencies and should make arrangements for issuing on line/arrival visas for international experts assisting the SLAERC upon requests made through the IAEA/RANET Network.

Preparedness actions and response actions to be taken by the Department of Immigration and Emigration are given in Tables 32 and 33.

Table 32: Preparedness actions

Preparedness
▪ Nominating a contact point to coordinate emergency response, with the SLAERC. ▪ Develop and maintain a preparedness and response plan; conduct rehearsals to validate emergency response procedures ▪ Participation in EP Training programmes conducted by SLAERC.

Table 33: Response actions

Response
• Assisting the SLAERC to identify contaminated people entering the country during a category V or a transnational nuclear emergency. • Issuing online visas to international experts coming to Sri Lanka on short notice, to assist the emergency response through RANET.

2.5.3. Roles and Responsibilities of the First responders (FR)

2.5.3.1. Department of Police including STF

The Department of Police is responsible for normal Police functions in an emergency, including actions against illegal acts, traffic control and criminal investigations. In general, the Police provides the on-the-scene commander (Incident Commander) and ensures physical protection of the affected area during and after the emergency. The Police also provides support for radiation monitoring in the affected areas and issue public warnings (with basic radiation detection equipment). The STF is responsible for responding to security related incidents and therefore is also responsible for attending to security emergency to handle the situation. The STF, along with the SLAERC staff is also expected to participate in source search operations in the event of lost source accidents.

The preparedness actions and response actions to be taken by the Police are given in Tables 34 and 35.

Table 34: Preparedness actions

Preparedness
▪ Developing and maintaining a radiation emergency preparedness plan for all categories of emergencies identified in this EMP (with the assistance of the SLAERC and DMC). ▪ Conducting awareness programmes on nuclear or radiological emergency preparedness and response to police officers. ▪ Training Police officers as first Responders for radiological emergency response. (This can be done through Police and STF training schools.) ▪ Nominating a contact point for coordinating emergency preparedness, with SLAERC. ▪ Nominating members for the NRERC. ▪ Attending regular meetings of NRERC convened by the DMC. ▪ Acquire necessary Personnel Protective Equipment (PPE) to use in emergency response ▪ Become familiar with the instructions given in IAEA publication; EPR-First Responders 2006; Manual for first responders to a Radiological Emergency (Ref [10]) ▪ Arrange drills for the ICS on radiological emergency response

Table 35: Response actions

Response
▪ Carrying out normal Police functions at the accident scene (On the scene commander, traffic control, criminal investigation, crowd control etc. ▪ Activating the ICS

Table 35: Response actions (cont.)

Response
▪ Supporting SLAERC on radiation monitoring and sampling in the affected areas, if requested by SLAERC. ▪ Providing public information and warnings at the scene of the incident, on the recommendation of the SLAERC. ▪ Assisting Provincial Secretaries /District Secretaries /Divisional Secretaries with food supplies and evacuation operations when necessary. ▪ Assisting SLAERC in source searches in lost source accidents. ▪ Attending regular meetings of the NRERC convened by the DMC.

2.5.3.2. Municipal Fire Department-Colombo (Fire Brigade)

The Fire Brigade has the responsibility of extinguishing fires and protecting life and property damage due to the fire within Municipal Council areas of the Colombo and coordinate with other fire services departments in Municipal and Local Government bodies to prepare for such emergencies and to mitigate consequences if any emergency is occurred in any other areas, If fire services arrive at the scene of a radiological accident before the Police, they will take appropriate actions to save lives and property, restrict access to the accident location, notify the Police and seek advice from the SLAERC and implement the ICS system. The Fire Brigade will also participate in any investigation of a radiological emergency involving fires and will assist in the recovery phase of such an emergency. The Fire Brigade will also assist in decontamination of persons, emergency workers and contaminated areas, equipment and vehicles as directed by the SLAERC.

Preparedness actions and response actions to be taken by Fire Brigade are given in Tables 36 and 37.

Table 36: Preparedness actions

Preparedness
▪ Develop and maintain an emergency preparedness plan; conduct rehearsals for validation of emergency response procedures. ▪ Train first responders of their own and provide basic radiological response training programme for all the Municipal and Local Governments fire and rescue units. ▪ Conduct awareness programmes to the fire officers in other departments to acquire necessary equipment for radiological emergency response. ▪ Establish mechanism to contact all Municipal and Local Governments fire departments in an emergency ▪ Establish coordination and cooperation with Chemical, Biological, Radiological and Nuclear (CBRN) units of SL Army, SL Navy, SL Air force, Police and SL Air force Fire Unit to develop a common mechanism for first responders, ▪ Formulate system to organize capacity development programmes throughout the country in collaboration with Professional Fire Fighters Association of Sri Lanka. Acquire necessary decontamination equipment, PPE, Dosimeters, basic radiation detectors and other fire equipment needed to respond to a radiological emergency involving a fire. ▪ Become familiar with the instructions given in the IAEA publication; EPR-First Responders 2006; Manual for first responders to a Radiological Emergency (Ref [10]) ▪ Arrange firefighting and decontamination drills. ▪ Nominate a contact point for coordination of emergency response with the SLAERC.

Table 37: Response actions

Response
▪ Control fires at radiological facilities and sites ▪ Implement ICS ▪ Respond to the accident scene as first responders

Table 37: Response actions (cont.)

Response
▪ Assist in evacuation, rescue and recovery operations ▪ Coordinate with other fire departments outside the Municipal area of Colombo to use PPE effectively for personal safety. ▪ Assist SLAERC in decontamination of contaminated persons and properties. ▪ Provide ambulance service

2.5.3.3. Sri Lanka Army (SL Army)

SL Army is identified as one of the first responder groups for nuclear or radiological emergencies. The CBRN group of SL Army has the capacity to respond to nuclear or radiological emergencies and will do so when requested by the SLAERC or DMC. SL Army is expected to providing heavy machinery (cranes, loaders, heavy vehicles) when required to control and regain the situation during any national radiological emergency, in operations, in the recovery phase of such an emergency and in radiological monitoring.

Preparedness actions and response actions to be taken by SL Army are given in Tables 38 and 39.

Table 38: Preparedness actions

Preparedness
▪ Developing and maintaining an emergency preparedness plan; conduct rehearsals for validation of procedures for responding to an emergency. ▪ Provide training for SL Army first responders. ▪ Conducting awareness programmes to the SL Army officers. ▪ Acquiring Necessary PPE's, Dosimeters, basic radiation detectors etc, ▪ Nominating a contact point for coordination emergency response with SLAERC.

Table 39: Response actions

Response
▪ Assisting relevant authorities in providing resources such as heavy machinery, cranes, loaders heavy vehicles, manpower for radiological emergency response. ▪ Assist in evacuation, rescue and recovery operations. ▪ Function as first responders at the scene of the accident. ▪ Providing first aid and medical assistance if required. ▪ Assists SLAERC in source search and recovery if additional human resources become necessary.

2.5.3.4 Sri Lanka Navy (SL Navy)

The SL Navy is responsible for maintaining the Remote Detector Stations of NDEWS controlled by the SLAEB. The CBRN group of SL Navy is also expected to assist in the monitoring of marine environment by providing resources such as boats, ships, response personnel etc. during a nuclear emergency. Sri Lanka Navy is also responsible for responding as first responders to radiation emergencies occurring in the sea or in Sri Lankan ports.

Preparedness actions and response actions to be taken by SL Navy are given in Tables 40 and 41.

Table 40: Preparedness actions

Preparedness
▪ Developing and maintaining an emergency preparedness plan; conduct rehearsals for validation of emergency response procedures. ▪ Train the SL Navy first responders. ▪ Conducting awareness programmes to SL Navy officers.

Table 40: Preparedness actions (cont.)

Preparedness
▪ Nominating a contact point to coordinate emergency response with the SLAERC. ▪ Provide the physical security for established early warning systems that are maintained by the SLAEB at the Navy bases.

Table 41: Response actions

Response
▪ Early warning /dissemination of information to the specific communities. ▪ Assisting the SLAERC to collect marine samples; providing resources; boats and manpower. ▪ Assist in evacuation, rescue and recovery operations. ▪ Function as first responders at the scene of the accident for accidents in rivers or the sea or a port. ▪ Providing first aid and medical assistance, if required.

2.5.3.5. Sri Lanka Air Force (SL Air Force)

SL Air Force is expected to assist by providing helicopters for movement of emergency workers and victims, response personnel, fire fighters etc. and supporting aerial monitoring when required.

Preparedness actions and response actions to be taken by SL Air Force are given in Tables 42 and 43.

Table 42: Preparedness actions

Preparedness
▪ Developing and maintaining an emergency preparedness plan; conduct rehearsals for validation of emergency response procedures. ▪ Train the SL Airforce first responders. ▪ Conducting awareness programmes for the SL Air force officers. ▪ Nominating a contact point for coordinating emergency response with the SLAERC.

Table 43: Response actions

Response
▪ Assisting the SLAERC to collect environmental samples, in airborne monitoring; providing resources; helicopters and manpower. ▪ Assisting in evacuation, rescue and recovery operations that require helicopters ▪ Function as first responders at the scene of the accident. ▪ Fire extinguishing if required. ▪ Providing first aid and medical assistance, if required.

2.5.3.6 The Department of Sri Lanka Coast Guard (SLCG)

The Department of Sri Lanka Coast Guard as a Law Enforcement Agency will be for assisting SLAERC for events related to Early Warning, Evidence Collection, Crowd Control and other event related to Law and Order in Sri Lankan Waters or in the Coast line.

Preparedness actions and response actions to be taken by SLCG Coast Guard are given in Table 44 and 45.

Table 44: Preparedness actions

Preparedness
At sea Preparation ▪ Establish and develop the capacity of first responder team/s on board ships and crafts in each region ▪ Train on board Fast Petrol Board (FPB) personal to responds to an emergency situation. ▪ Establish alarm system to alert boats and shore base operations rooms. ▪ Carryout response exercise and rehearsals. ▪ Acquire relevant PPE, Dosimeters, basic radiation detectors for persons attending in an emergency. At coastal line ▪ Establish and develop First Responder Teams in each region. ▪ Train first responders ▪ Conduct Public awareness programme in collaboration with SLAERC. ▪ Conduct emergency drills on crowd control and evacuations plan. ▪ Carry out risk assessment around the coastal belt. Nominating a contact point to the Emergency response. Develop and maintain a preparedness and response plan.

Table 45: Response actions

Response
▪ Assisting the SLAERC to collect marine sampling; providing resources. ▪ Providing support for demobilization process ▪ Attending the accident scene as first responders if accident occurred in sea or coast line.

2.5.3.7 National Ambulance Service

An ambulance service is provided by the government which is available 24x7. This service provides paramedics service during radiological emergency. This service can be obtained calling on 1990.

Preparedness actions and response actions to be taken by national ambulance service are given in Table 46 and 47.

Table 46: Preparedness actions

Preparedness
▪ Nominate contact point to the emergency response ▪ Develop and maintain a preparedness and response plan; conduct rehearsals to validate emergency response procedures ▪ Arrange training and awareness (treatment and transport of contaminated victims) for the staff of ambulance service.

Table 47: Response actions

Response
▪ Dispatching medical teams with ambulance to the affected areas whenever request made by SLAERC or DMC. ▪ Conducting Medical Surveillance and triage at the scene. ▪ Carry out Lifesaving actions at the scene ▪ Transport affected victims to hospitals ▪ Providing medical and health advices to the incident commander.

2.5.4 Roles and reponsibilities of ministries involved in response planning ,decision making and Assistance.

2.5.4.1 Ministries directly responsible for response planning, decision making and assistance

a) Ministry in charge of the subject of Atomic Energy

Ministry in charge of the subject of Atomic Energy is responsible for assisting infrastructure development at the SLAERC required for response preparation and responding to radiation emergencies.

Preparedness actions and response actions to be taken by Ministry In charge of Atomic Energy in this regard are given in Tables 48 and 49.

Table 48: Preparedness actions

Preparedness
▪ Assisting the SLAERC to prepare for responding to nuclear or radiological emergencies by providing necessary funds and other resources required for preparedness for emergencies ▪ Train the responsible staff to conduct media briefings ▪ Nominating a contact point to liaise with SLAERC for coordination with the Ministry to obtain necessary advice.

Table 49: Response actions

Response
▪ Allocate adequate funding for SLAERC to manage the emergency situations at the time of an emergency ▪ Coordinate with other Ministries and national institutes to obtain assistance to implement responsibilities of those Ministries and institutions stated in this EMP. ▪ Participating in media briefing on behalf of the Minister if a requirement arises

b) Ministry of Disaster Management (MDM)

Ministry of Disaster Management is responsible for infrastructure development of the DMC to prepare and respond to nuclear and radiological emergencies.

Preparedness actions and response actions to be taken by Ministry of Disaster Management are given in Tables 50 and 51.

Table 50: Preparedness actions

Preparedness
▪ Assisting the DMC in preparing for nuclear and radiological emergencies by providing necessary resources.

Table 51: Response actions

Response
▪ Coordinate with all stakeholders to assist SLAERC to control consequences of Nuclear or radiological emergency ▪ Coordinate with relevant stakeholders to declare start of emergency and to declare termination of emergency activities as per requirements of this EMP.

c) Ministry of Health (MOH) and provincial ministries of health

The Ministry of Health and the Provincial Ministries of Health are responsible for management of public health in a nuclear or a radiological emergency in the country. The response activities include providing medical advice to the public, treating radiation induced injuries, assessment of public health conditions of the persons living in areas where continuous exposure to radiation is possible and other related activities needed. The MOH is also responsible for developing national guidelines for medical practitioners regarding recognition and treatment of

internal and external radiation exposures. Medical treatment for the affected persons is provided by the curative health institutions while the public health activities are provided by the public health units of the Ministry of Health (Eg. Family Health Bureau, Epidemiology Unit, National Cancer Control Programme, Environmental and Occupational Health unit, etc.). The Disaster Preparedness and Response Division (DPRD) of the MOH is responsible for coordination of the health response in a nuclear or a radiological emergency in the country. The DPRD will be the contact point for the emergency preparedness and response at the national level.

The National Hospital of Sri Lanka (NHSL) and identified General and Base Hospitals provide treatments to radiation injured persons including individuals with combined injuries as a result of a radiological emergency. MOH coordinates field locations where medical triage is performed by providing first-aid and transportation of injured persons to the hospitals. NHSL and some other identified Teaching / General Hospitals will be prepared with facilities for specialized treatment for radiation exposed personnel. Expert advice and technical support related to radiation and radioactivity will be obtained from the experts during these activities.

Information generated at the hospitals would be communicated to relevant public health institutions for the follow up activities of exposed populations for long term health effects.

Preparedness actions and response actions to be taken by MOH and Provincial Health Ministries are given in Tables 52 and 53.

Table 52: Preparedness actions

Preparedness
▪ Inclusion of a nuclear and radiological emergency response plan into the hospital emergency plans and the public health emergency plans. ▪ Conducting risk assessments by the respective health institutions (hospitals and public health institutions) ▪ Conducting capacity assessment by the respective health institutions to identify the gaps in the capacity ▪ Conducting capacity building activities to fill the gaps identified in the capacity assessment. ▪ Preparing hospitals and facilities for radiation treatment, identify special areas to treat radioactive contaminated victims. ▪ Training medical practitioners to recognize and treat radiation injuries and over exposures ▪ Establishing a Medical Response Advisory Group. ▪ Medical emergency awareness (This should be done according to the IAEA publication EPR Medical 2005: Medical preparedness and response (Ref [22]) ▪ Nominating contact points both at national and sub-national levels for the medical emergency response. ▪ Attending regular meetings of NRERC convened by the DMC ▪ Conducting regular capacity assessment activities such as regular drills, exercises and simulations

Table 53: Response actions

Response
▪ Dispatching medical teams to the affected areas whenever request made by SLAERC or DMC. ▪ Conducting Medical Surveillance and triage. ▪ Providing treatment to affected victims ▪ Providing specialized treatment for nuclear or radiological emergencies, including international assistance in coordination with SLAERC. ▪ Provision of health services to the displaced people. ▪ Providing medical and health advices to the affected people. ▪ Monitoring of environmental health activities. ▪ Monitoring the quality of water supply and food safety and advice on suitable and unsuitable food with regard to contamination with micro-organisms. ▪ Monitoring of nutritional aspects. ▪ Rehabilitation of victims. ▪ Providing support in non-radiological consequences (psychological)

d) Ministry of Foreign Affairs (MOFA)

MOFA is expected to assist in obtaining emergency assistance from IAEA and the other international agencies under the Convention on Assistance in the Case of a Nuclear Accident or a Radiological Emergency. Such requests will be transmitted by the SLAERC in collaboration with the Ministry of Foreign Affairs and the Permanent Mission of Sri Lanka in Vienna.

The Ministry of Foreign Affairs is also expected to facilitate the issuance of visas for emergency response personnel arriving in Sri Lanka to assist in managing the emergency and providing entry/exit permits for emergency equipment.

Preparedness actions and response actions to be taken by MOFA are given in Tables 54 and 55.

Table 54: Preparedness action

Preparedness
▪ Coordinating ratification and implementation of international, (i) Convention on Assistance in the Case of a Nuclear or Radiological Emergency (ii) Convention on Early Notification of a Nuclear Accident. ▪ Provision of necessary information to Sri Lankan missions in abroad on Conventions signed by Sri Lanka on Radiological and Nuclear Emergencies and provide them instructions to inform the Foreign Ministry information of any nuclear or radiological emergency that occur in relevant country or territory. ▪ Nominating a contact point to coordinate emergency response with SLAERC.

Table 55 response actions

Response
▪ Facilitate Issuing visas/entry permits for international experts assisting in emergency response, when requested by the SLAERC. ▪ Supporting international assistance upon requests made by SLAERC or DMC. ▪ Gather all information of Sri Lankan community living in affected areas of a foreign country that has affected from a nuclear emergency to provide them with necessary advice and providing information to relatives.

2.5.5.2 Roles and responsibilities of ministries to be involved in decision making and assistance.

The Ministries that was listed in 2.4.1.e.2 should nominate a person to liaise with SLAERC to coordinate emergency response activities and decision making in case of a nuclear or radiological emergency.

The above Ministries should provide information, human resources and other necessary resources for SLAERC to mitigate consequences of a possible emergency in so far activities to be implemented by the SLAERC is under the purview of such Ministries.

CHAPTER 3

EMERGENCY RESPONSE PROCESS

3.1 EMERGENCY RESPONSE

An emergency response is a provision of emergency services and public assistance during nuclear or radiological emergency to reach the goals of emergency response. The goals of the emergency response are,

a) to regain control of the situation and to mitigate consequences,
b) to save lives,
c) to avoid or minimize severe deterministic health effects,
d) to render first aid, to provide critical medical treatment and to manage the treatment of radiation injuries,
e) to reduce the risk of stochastic effects,
f) to keep the public informed and to maintain public trust,
g) to mitigate to extent practicable, non-radiological consequences,
h) to protect to the extent practicable property and the environment,
i) to prepare, to the extent practicable, for resumption of normal social and economic activity.

3.2 IDENTIFICATION OF EMERGENCIES

3.2.1 Establishing radiation monitoring and detection systems in the public domain

A mechanism is in place for continuously monitoring of background radiation levels in the public domain and maintaining of NDEWS. This responsibility was delegated to SLAEB and it is the responsibility of SLAEB to maintain the NDEWS and inform the SLAERC any increase of background radiation level which cannot be considered as known reasons. The SLAERC should establish this national monitoring system taking in to account the location of closest nuclear power plants to Sri Lanka enabling early detection of any emergency in a nuclear power plant.

3.2.2 Enhancing security systems at border controls and facilities with handling radioactive sources

In order to detect unauthorized/illicit trafficking, sensitive portal radiation monitors and other radiation detection devices are installed at boarder points. The responsibility for boarder control is delegated by SLAERC to respective institutes based on the location and nature of control envisaged. The maintenance of detection system at Colombo Port has been undertaken by the Sri Lanka Port Authority and responsibility for detection is delegated to Sri Lanka Custom. Sri Lanka Custom is therefore, responsible for notification of any detection of radiation sources to the SLAERC for initiation of response and regulatory actions.

3.2.3 Enhancing security at radiation facilities

All facilities using source category 1 and 2 sources shall have established detection systems as per guidelines given by the SLAERC and in accordance with site security plans. A method for maintenance of an inventory of radiation sources should also be established to avoid loss and misuse of the sources by unauthorized persons to reduce occurrence of radiological emergencies.

3.3 NOTIFICATION AND ACTIVATION OF AN EMERGENCY

3.3.1 Radiological emergencies

Any Radiological Emergency should be notified to SLAERC within 30 minutes. SLAERC will assess the level of emergency.

Radiological emergencies can be notified to Police at phone number 119 or directly to SLAERC. A 24x7 emergency operational unit is maintained by the SLAERC. Emergency contact numbers should be used to notify the incident or use the web-based system of incident reporting to SLAERC. All details of emergency contacts are given in Annexure 2.

Upon receipt of notification by SLAERC the response initiator at the SLAERC should verify whether it is a radiological emergency based on the information received. If it is a radiological emergency, response initiator should obtain information requested in worksheet 1 of Appendix 7. If a notification received directly to the SLAERC and if a notification received from Police 119 response initiator should contact person who has given a notification to get above information requested in Worksheet 1. The response initiator should contact NEC or alternative designate of SLAERC to provide information gathered from worksheet 1. The NEC upon receipt of the information from response initiator should advice the responsible person in affected site/installations to mitigate the consequences and initial response according to the relevant SOP's (see Annexure 6).

Based on the category of the accident, radioactive sources involved, affected individuals, environmental contamination present and other information received, the NEC should determine the type of emergency. Depending on the type of emergency the following courses of actions should be taken.

3.3.1.1 Low level emergencies

Since this type of emergencies can be managed by the relevant institutions according to facility emergency plans prepared by them there is no need for off-site response. A written report should be submitted to the SLAERC by the RPO within 24 hours indicating actions taken to control the situation and present status with any persons exposed to radiation and persons involved in the control of emergency. The NEC should brief the EM the actions taken to control the situation.

3.3.1.2 Medium level emergencies

NEC should contact relevant first responders as appropriate and request to take actions in line with SOP prepared for the relevant emergency, in parallel the NEC should contact the Emergency Manager (EM) to provide the information of the emergency to obtain his advice and contact emergency response group leaders of SLAERC and request them to take actions according to SOP prepared for such an emergency. As per the observations of the response teams, the NEC communicate with EM for decision making. The EM if necessary, contact members of TAC for further advice and arrangements.

3.3.1.3 High level emergencies

The EM will lead this type of emergency and if necessary, DMC will be contacted to activate national response according to relevant SOP's. The SLAERC/DMC then takes initial actions for mitigation of consequences and response actions by activating first responders, radiological monitoring teams and other relevant response organizations as per the SOP. As per the observations of the response teams, EM should liaise with NRERC for further decision making.

3.3.2 Nuclear emergencies

Any nuclear accident in a neighbouring country which can directly affect radiologically to the people and the environment of Sri Lanka is considered as a high level emergency. The information on this type of an emergency

is received to SLAERC either from the IAEA through Unified System for Information Exchange in Incident and Emergencies (USIE) web-based system or directly from the country in which the nuclear accident occurred. After gathering relevant information NEC of SLAERC activated SOP for this type of emergency, i.e EP Category V.

3.3.3 Transnational emergencies

Information of transnational emergencies may be received either by IAEA or from the country in which the accident occurs or from the mass media. Due to emergency in other countries, the people and environment may affect indirectly either by importation of contaminated food and goods and visiting contaminated people. This type of emergencies is considered in EP category IV and will be dealt in terms of SOP prepared for transnational emergencies.

3.4 EMERGENCY MANAGEMENT FLOWCHARTS

The following figures describes the emergency response structures during radiological or nuclear emergencies.

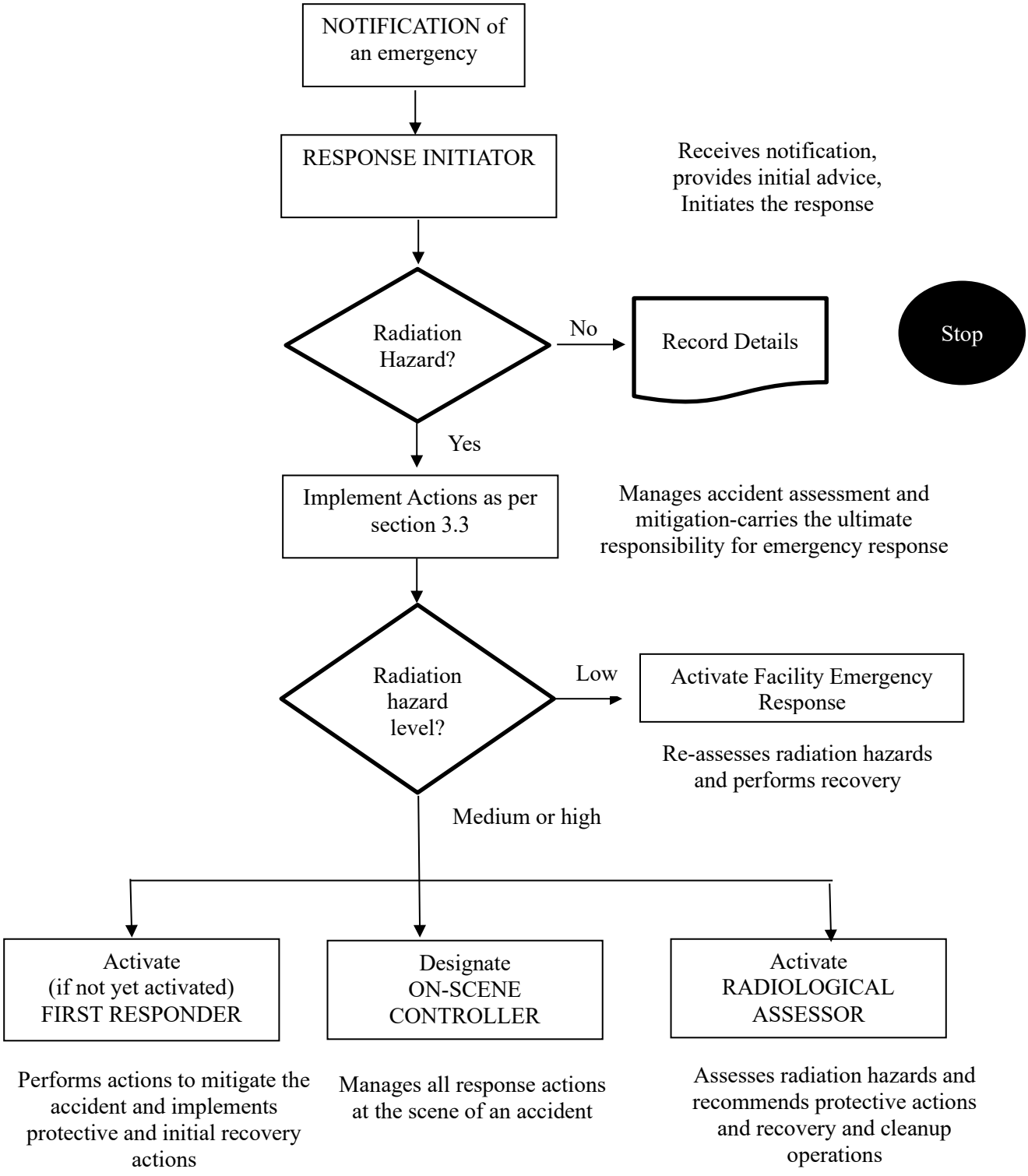


Figure 3: Initial response to a notification of a radiological emergency (Ref [19])

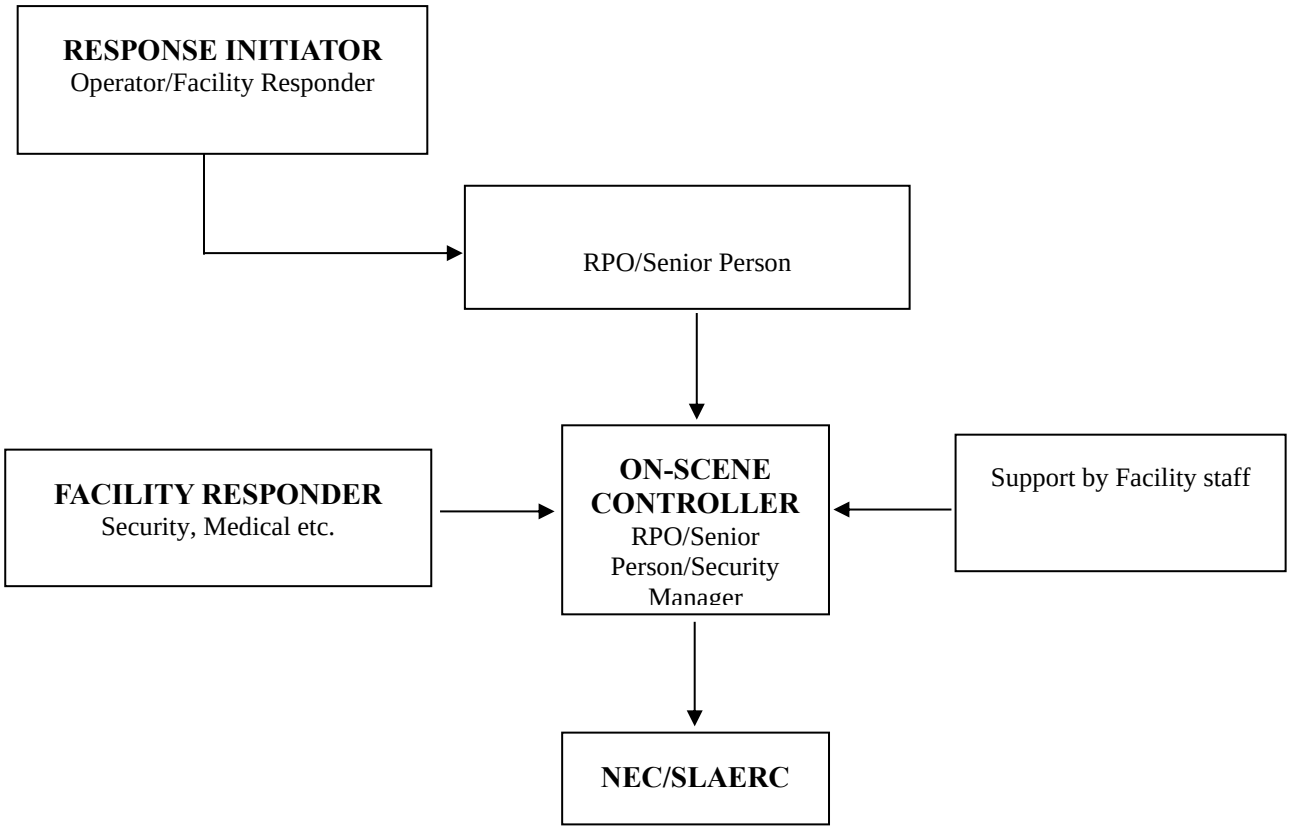


Figure 4: Generic Response structure in lower level emergencies (Ref [19])

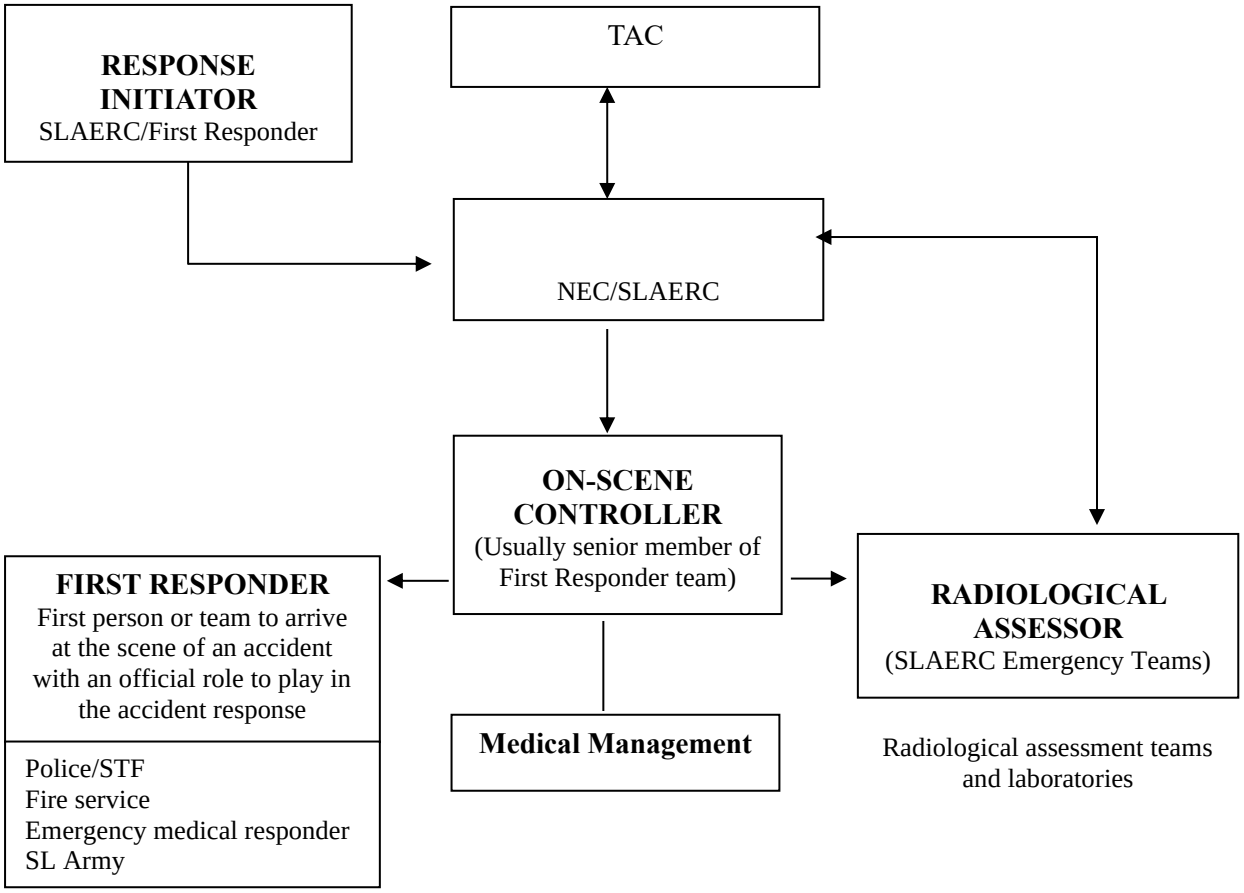


Figure 5: Generic Response structure in medium level emergencies

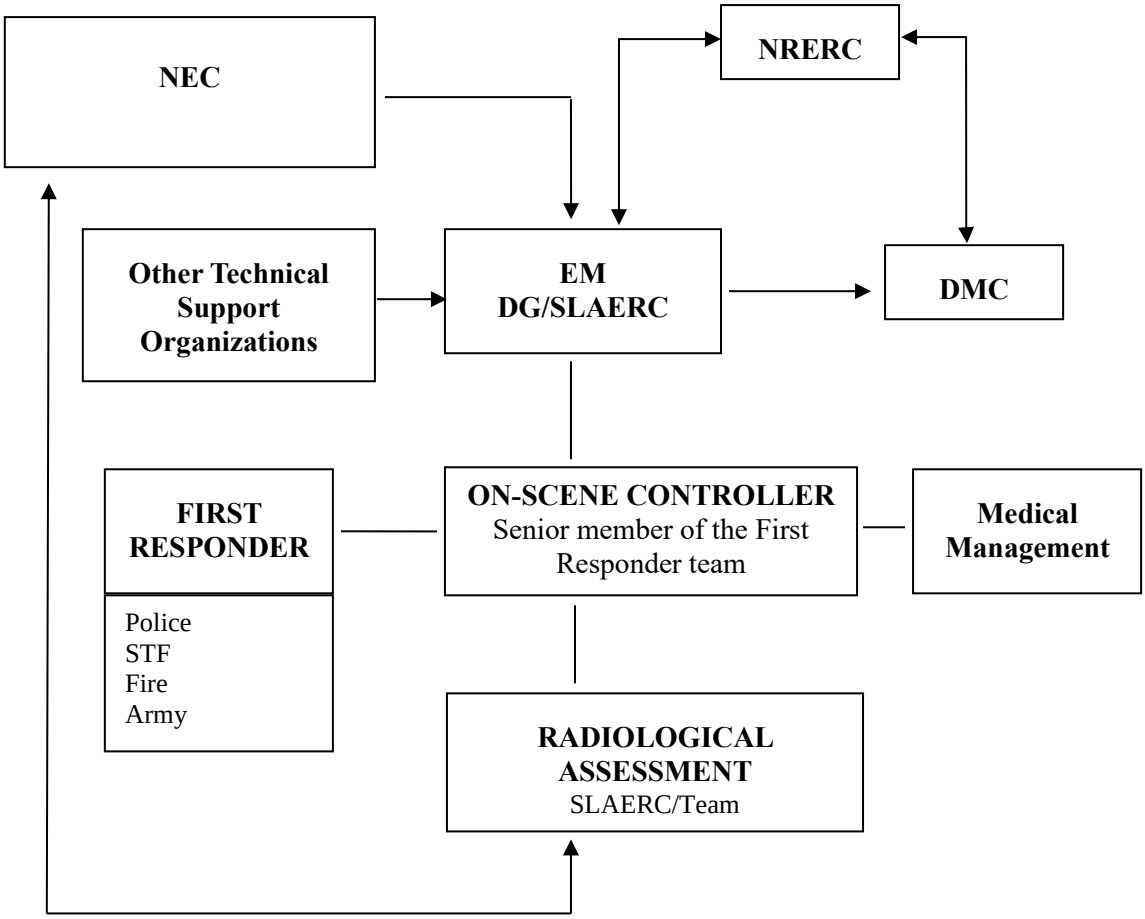


Figure 6: Generic Response structure in high level emergencies

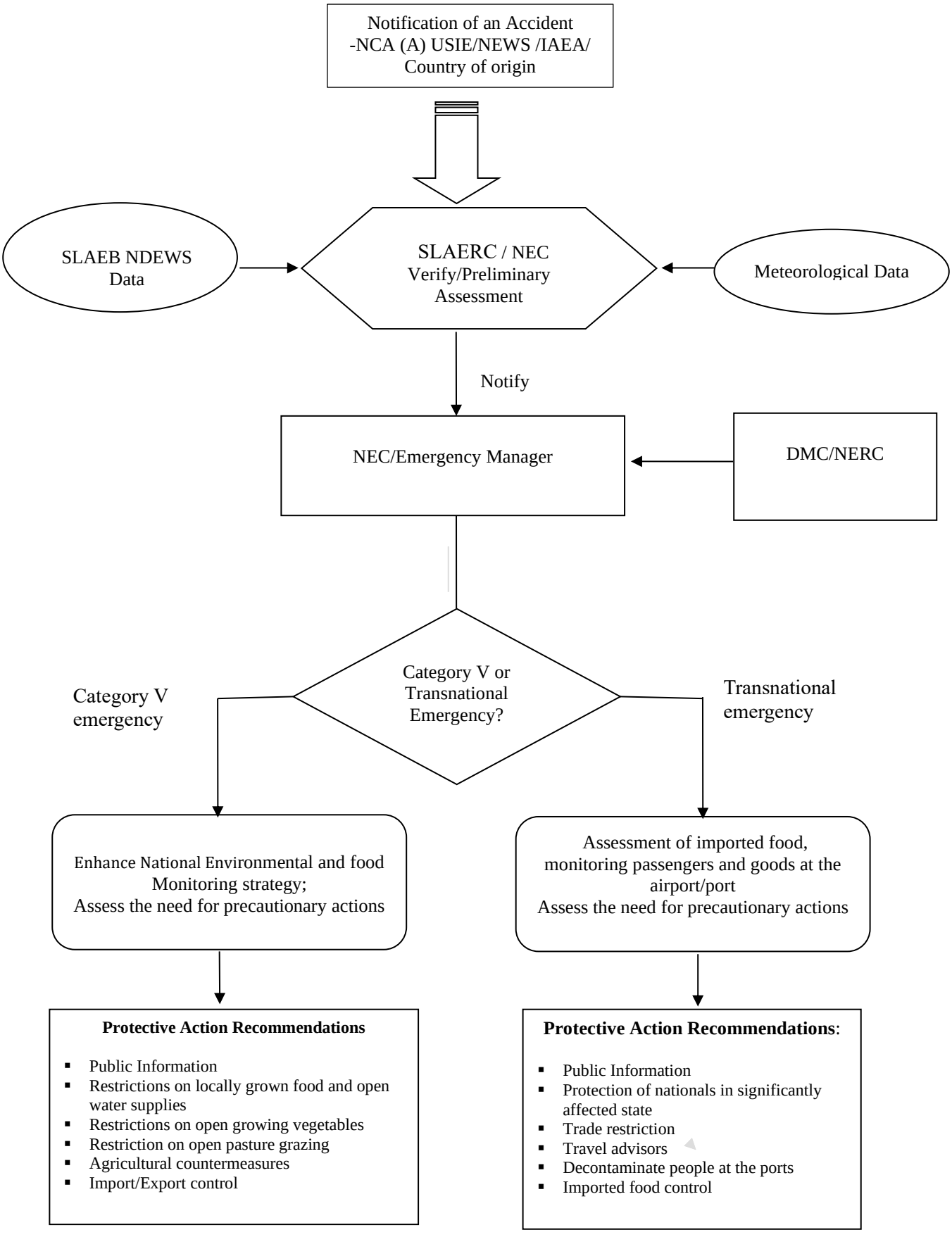


Figure 7: Initial Response to a notification of a nuclear emergency

3.5 OPERATIONAL RESPONSE STRUCTURE

The following definition of response structure, designates responsible "persons", or organizations during emergency. These represent necessary functions to deal with emergencies at all levels, facility, regional or national level as well as at the incident place. However, in small-scale accidents (low level) some of these functions may be combined and carried out by one person. Each of these is described below.

3.5.1 Response Initiator

This is the person who having been notified of an accident, initiates the formal response, and has the authority to do so.

For example, if notification is received by SLAERC directly, then response initiator is one of the staff members of SLAERC, or if emergency happens at a facility where radioactive sources, radioactive material, or radiation generators are used, the response initiator may be the duty officer, the radiation safety officer, or a responsible laboratory supervisor. If an accident occurs while no facility staff is present, the response initiator may be the fire department dispatcher or security personnel. For accidents in a city, the response initiator might be the "on-call" emergency service, such as police or fire department or, in some cases, the NEC, or alternative representative of SLAERC.

In any case, the response initiator is responsible for getting basic information on the emergency, providing initial advice to the caller, and notifying the NEC of the SLAERC.

3.5.2 Emergency Manager

The emergency manager is in charge of the overall strategic management of the emergency response. He/she will manage priorities and protection of the public and emergency workers, will ensure that all appropriate resources have been activated and that communications with emergency personnel at the scene are established.

In high level emergencies (national level), The Emergency Manager (EM) is the Director General (DG) of the SLAERC or alternative designate. He/she will also often be the primary spokesperson with the media in cooperation with DMC representatives, but in a severe emergency he/she may need to appoint someone specifically to deal with the media. The emergency manager will work in close cooperation with the NEC/SLAERC which will coordinate all response actions with the on-scene controller, who is present at the scene. Depending on the nature and severity of the accident, the intervention of EM may not be required. In such situation overall coordination and decision making is taken by the on-scene controller or RPO of the facility.

3.5.3 First Responder (on-scene)

The first responder is the first person or team to arrive at the scene of an accident with an official role to play in the accident response.

For example, at a facility where radioactive sources, radioactive material, or radiation generators are used, the first responder might be the RPO. For an accident in a public place, the first responder would likely to be one of the emergency services, i.e. police, STF, fire service, or emergency medical responders. The first responders are responsible for dealing with all aspects of the emergency at the scene. Their work is supervised and coordinated by the on-scene controller (described below).

The first responders may or may not have available radiation detection equipment and dosimeters. Therefore, suitable generic precautions must be adopted by first responders to protect themselves and other people present at the scene from the radiological hazard, and a qualified radiological assessor from SLAERC or designated alternative should in almost all cases be called to assist with the radiological aspects of the response. First responders should adhere to instructions given in the IAEA first responder manual (Ref [10]).

3.5.4 On-Scene Controller (Incident Commander at the incident)

The on-scene controller is responsible for tactical management of response actions at the scene of an accident. The On-Scene Controller would be most senior official from the first responder group such as Police/ STF or Fire brigade. He/she is responsible to the Emergency Manager for the implementation of mitigating measures, confinement, crowd management, coordination of all response units presents at the scene, initial recovery, and cleanup operations, protection of emergency workers and protective actions. The On-Scene Controller relies on the expertise of the emergency response unit leaders to determine the best ways to implement response actions and to make recommendations to the emergency manager for the management of the emergency. In all cases the On-Scene Controller should coordinate with the NEC of SLAERC.

As stated above, the On-Scene Controller is normally the senior member of the on-scene response teams. When several response units are present (e.g. fire fighters, police, radiological assessment team, etc.), the on-scene controller would be the senior member of Police present at the location and take decision in collaboration with leader of the radiological assessment team

3.5.5 Radiological Assessor

The SLAERC emergency teams and SLAEB emergency teams are considered as radiological professionals (qualified experts) sent to the scene of an accident to assess the radiological hazards, provide radiation protection for the first responders, and make recommendations to the on-scene controller on protective actions. Radiological assessment resources are already identified in this EMP.

The SLAERC has established the emergency response groups described below to respond to nuclear or radiological emergencies who are equipped with the equipment necessary for responding any nuclear or radiological emergency. Each of these four-groups is led by an experienced senior officer.

3.5.5.1 National Emergency Coordinator (NEC)

The NEC is designated by the SLAERC to oversee all preparedness and response activities within Sri Lanka. He/she should be a senior officer of the SLAERC with competence to coordinate all preparedness and response work at all levels. The functions of NEC are as follows

- Emergency preparedness activities at SLAERC
- Coordination of national level preparedness and response actions with all stakeholders
- Provide advice initially to mitigate any radiation accident
- Coordinate with IAEA as the focal point of, NCA (A) and NCA (D)
- For medium level emergencies, plan the course of action during emergency according to EM's instructions and according to SOP.
- Act as the convener to the TAC of SLAERC
- Provide necessary information to Emergency Manager to take necessary protective actions during national level emergencies.
- Arrange training, exercises, and drills at national level
- Participation of Emergency Convex Exercises conducted by IAEA

3.5.5.2 Emergency Coordination Group (ECG)

The Emergency Coordination Group whose functions and names are listed in Annexure 2 is responsible for coordination of all preparedness and response actions at national level. Their main tasks include coordination of response with response personnel during an emergency, provision of necessary facilities to emergency responder's provision of advice at facility level to carry out their tasks. This group is led by the NEC.

3.5.5.3 Radiological assessor groups

There are three radiological assessor groups established in SLAERC as follows,

a) Radiation Monitoring and Survey Team (RST)
b) Decontamination and Contamination Measurement Team (DET)
c) Emergency Sampling and Food Monitoring Team (EST)

All above teams are considered to be radiological assessors. They are led by competent senior officers of the SLAERC. These teams are responsible for carrying out field measurements, surveys, contamination control, radiation protection support to emergency workers and the formulation of protective action recommendations, at the scene of the incident. All activities should be communicated with the NEC and in national emergencies advice and instructions should be obtained from the EM.

The radiological assessors also initiate and, in some cases, carry out source recovery, clean up and decontamination operations. The radiological assessors will also be responsible for setting turn back guidance for emergency workers, for estimating and recording the dose received by emergency workers and/or the public; for requesting additional radiological assessment resources, as required; and health physics expertise to carry out specialized hazard and dose assessment tasks. The identified equipment and details of the teams are described in Annexure 3.

3.5.6 Other emergency workers

The following emergency workers are also engaged in recovery and response work during emergency.

1. Medical responders
2. Technical support organizations
3. Political administrators
4. Helpers (Volunteers)

3.6 EMERGENCY RESPONSE COMMITTEES

3.6.1 Technical Advisory Committee (TAC) and its functions

The TAC is appointed by the SLAERC Board of Management and notified to relevant stakeholders identified in this EMP comprising following persons

- Chairman of the SLAERC– Chairman of the TAC
- Two external experts who are knowledgeable in the field of Atomic Energy
- DG, SLAERC- If NRERC is not activated
- Director/Division of Licensing, import, and export control
- Director/Division of Inspection and Enforcement
- National Emergency Coordinator

In the event of a high or a medium level radiation emergency, the TAC is convened by the NEC to obtain technical advice on the emergency.

The main functions of the TAC are,

(i) Assess the impact and recommend response: These include the radioactive sources involved, individuals affected by over exposure, affected areas, required mitigation actions, radiological monitoring required, recovery operations, medical assistance, types of environmental monitoring to be carried out, analysis of environmental monitoring data received from the field, authorities to be notified, release of early warnings notices to the public, media briefing, international assistance, etc.

(ii) Public Protective Actions (Described in Chapter 3.7): These include advice on evacuation of people, medical advice and medical assistance to be provided, advice on food and water consumption, travel advisors, media briefing, etc.

(iii) Post-accident phase; this includes recovery operations, waste management, further monitoring and assessment, health advices, relocation of people, media briefing etc. The NEC leads managing the situation according to the TAC advice.

3.6.2 National Nuclear or Radiological Emergency Response Committee and its functions (NRERC)

The NRERC consist of the seven members as follows

- DG of SLAERC
- DG of DMC and other senior member nominated by DG of DMC
- National Emergency Coordinator
- A member from Police nominated by the Inspector general of Police
- A member from STF nominated by Inspector General of Police
- A member of MOH nominated by DG of Health services

Co-Chairperson of the Committee will be the DGs of the DMC and SLAERC or designated alternates.

The DG of SLAERC is responsible for obtaining the names of members of the above committee and inform the relevant stakeholders of members of the committee.

In the event of a high level radiation emergency, national & local authorities and first responder organizations need advice on emergency response functions as well as implementation of protective actions recommended by the SLAERC.

The NRERC decisions are made by Co-chairs in consultation with NRERC members.

According to the decisions made by NRERC, other responsible organizations should implement those actions to mitigate and response and recovery actions, such as field monitoring, field sampling, personnel monitoring, decontamination, waste collecting and storage, evacuation, sheltering, relocations, public health advice, providing food and water, medical treatment to the victims, media briefing, etc. at national level.

3.7 URGENT PROTECTIVE ACTIONS AND OTHER RESPONSE ACTIONS IN A RADIATION EMERGENCY (REF [18])

There are two categories of protective actions for the public in response to a nuclear or radiological emergency:

- Urgent protective actions,
- Early protective actions.

These protective actions are usually accompanied by other response actions that aim to provide support to the affected population through undertaking public-information activities, the provision of necessary medical care, psychological support and similar.

Urgent protective actions are primarily intended to prevent deterministic effects. They must be taken promptly (within hours) to be effective and therefore require quick decision-making. They are used over a relatively short period of time (days/weeks).

While early protective actions are intended to reduce the risk of stochastic effects as far as is reasonably possible. They can be implemented within days to weeks and they will still be effective. They can be long lasting.
Major urgent protective actions and some other important response actions are:

- Iodine thyroid blocking (ITB) – for nuclear emergencies,
- Evacuating,
- Sheltering.
- Isolation of a contaminated area or radioactive source (Cordoned off the area) - For radiological emergencies
- Prevention of inadvertent ingestion
- Life saving
- Respiratory protection and protection of skin and eyes;
- Management of the medical response;
- Protection of international trade.
- Public information
- Actions to reduce Non-radiological effects
- Instructions to respective group of people

A major early protective action is relocation. In addition, there are actions that are used as both urgent and early protective actions:

- Closing off the area,
- Actions to prevent inadvertent ingestion,
- Personal decontamination,
- Restrictions on food, milk and drinking water and on commodities,
- Medical treatment
- Monitor vehicles, people or Aircrafts as required
- Collection of samples of areas to be affected
- Decontamination of individuals

Details of Urgent Protective actions to be taken to prevent deterministic health effects and reduce stochastic effects and associated generic criteria for use of urgent protective actions are described in Appendix 2.

3.8 PROVIDING INSTRUCTIONS AND WARNINGS TO AFFECTED PUBLIC

NRERC or TAC formulate instructions for affected public based on decided protective actions. DMC alerts the affected public by common means (same as for other emergencies) and communicate instructions.

3.9 PROTECTING EMERGENCY WORKERS AND HELPERS IN AN EMERGENCY

3.9.1 Description of emergency workers

During nuclear or radiological emergency, several responders from responding organizations can participate in the response at the incident scene. These responders are called emergency workers. Also, some voluntarily persons are attending to help victims and some other responding work even though they are not coming from response organizations. These responders are called emergency helpers. Definition of emergency workers and emergency helpers are given below (Ref [7]). The standard definition of emergency workers and helpers are described below according to IAEA classifications.

a) Emergency Workers
   Person having specified duties in an emergency, who might be exposed while taking actions
   - Includes those employed by registrants and licensees
   - Includes police officers, fire fighters, medical personnel and drivers and crews of evacuation vehicles

b) Emergency Helpers
   - Members of the public who willingly and voluntarily help in response to a nuclear or radiological emergency
   - Helpers in an emergency are aware that they may be exposed to radiation while helping in response to a nuclear or radiological emergency

3.9.2 Critical actions taken by emergency workers

While most of the response actions may be carried out within dose limits for occupational exposure, many of the most critical actions may lead to incurring much higher doses, and as such, they are to be considered as emergency workers on a voluntarily basis. Such actions include:

- Lifesaving actions or actions to prevent serious injury,
- Actions to prevent severe deterministic effects,
- Actions to prevent the development of catastrophic conditions that could significantly affect people and the environment,
- Actions to avert a large collective dose.

3.9.3 Practical arrangements for emergency workers

All emergency workers need to be fit for duty and covered by a health-surveillance programme. They need to recognize their rights and duties with regard to occupational radiation protection. In addition, the operating organization and the response organizations need to ensure practical arrangements so that all the emergency workers and the helpers in an emergency are:

- Appropriately qualified for the intended tasks and trained prior to the emergency. This includes the provision of just-in-time training for emergency workers not designated as such in advance and for helpers in an emergency prior to taking any task in an emergency response,
- Provided with the appropriate, specialized, protective and monitoring equipment,
- Provided with an iodine thyroid blocking agent, when appropriate,
- Informed about the associated health risks and subject to informed consent to perform the specified duties, when appropriate,
- Provided with a medical examination, medical follow-up and psychological counselling, as appropriate.

The emergency workers dose limits and turn back guidance are described in the Appendix 8

3.10 MANAGING THE MEDICAL RESPONSE IN A RADIATION EMERGENCY

Effective medical response is a necessary component of an overall response to radiation emergencies. In general, the medical response to radiation emergencies may represent a difficult challenge to the responders and responding organizations due to the complexity of the situation, often requiring highly qualified specialists and organizational and material resources. Therefore, an adequate planning is needed for this medical response.

In radiation emergency workers near vicinity (eg. workers of the facility, rescuers) are much more likely to be affected than members of the public. However, depending on the scale of the accident, both workers and members of the public may be exposed to ionizing radiation from:

i. unshielded source(s);
ii. radionuclides deposited on the ground or other surfaces;
iii. radionuclides contaminating the body, clothing or possessions, and
iv. inhalation or ingestion of radioactive substances as a result of direct atmospheric or environmental contamination or, subsequently, by radioactive material in water or food.

Medical preparedness should begin from the locations where radiation or radioactive materials are used in Sri Lanka, types and activities of radioactive sources; types of radiation generating devices, information regarding the transportation of radioactive materials through any respective area; spectrum of possible accidents, and estimation of the number of persons to be potentially affected in a severe radiological emergency. This information was assessed in chapter 2 under the section 2.1

The subject of medical response in a radiation emergency should be regularly assessed, discussed, and updated by the National Steering Committee (NSC) for Disaster Management of Ministry of Health. The steering committee is responsible for developing and maintaining a manual consisting the following information and regularly update with the new information associated with the following items

i) a list of medical facilities at the facility level and national levels;
ii) a list of specialized medical facilities in other countries;
iii) a list of medical and support staff with telephone numbers and addresses in each respective location;
iv) a list of specialized medical centers for treating patients with radiation induced skin lesions or immunosuppression;
v) list of equipment and supplies needed for emergency response, and
vi) agreements with ambulance transport services.
vii) Agreements with the relevant expert agencies for technical advice and support
viii) Regular trainings and drills conducted at pre-identified health facilities based on the risk

The basic principles of the medical handling of exposed persons are based, to a large degree, on the methods used for handling other types of accidents, taking into account the specificity of the possible health effects of radiation and problems with contamination.

The Ministry of Health through the relevant health experts specialized in radiation medicine is responsible for providing advice to other Government departments on the health implications of any exposure to radiation. It is also responsible for ensuring that plans exist to provide emergency response, treatment, monitoring and health advice to the public and to persons who may have, or fear that they may have been contaminated or exposed to radiation.

In general, there are four levels of medical response, according to the degree of complexity, with respect to the necessary resources for assistance and the severity of consequences:

1. first aid provided at the scene of the accident;
2. triage and initial medical examination at the scene,
3. detailed investigation and medical treatment in a general hospital; and
4. complete examination and treatment in a specialized medical Centre for treatment of radiation injuries.

At facilities with radioactive sources trained personnel on every shift should normally provide any first aid required. In the case of serious injury medical personnel from suitable off-site medical centers should be available. The purposes of medical handling on-site are to prevent traumatic injuries from threatening life, as well as possible assessment of contamination and performance of limited decontamination. If persons received high doses exceeding threshold for deterministic effects usually it is recommended to transport them directly to a highly specialized medical hospital for complete medical examination, treatment, and assessment of the dose.

3.11. MANAGING RADIOACTIVE WASTE

Radioactive wastes can be generated during any nuclear or radiological emergency. Therefore, Sri Lanka should ensure that radioactive waste is managed safely and effectively in a nuclear or radiological emergency. SLAERC is responsible for advising the management of the waste and SLAEB is responsible for collecting, segregation and storage of the waste during high level emergency. But low and medium level emergencies waste should be managed by facility itself and if they are needed to be handed over to SLAEB the charges may apply. SLAEB is responsible for development and maintaining of details plan on waste handling for emergency cases (Characterization, Storage locations etc.)

3.12 PUBLIC COMMUNICATION IN A RADIATION EMERGENCY

Public communication during an emergency is one of the important activities in an emergency response, and often it can be the major activity, if there is no need for protective actions to be taken such as in case of small incidents, no public communication is needed.

The public is very sensitive to any “nuclear or radiological” news. In general, all radiation emergencies are perceived as dangerous and they receive an immense amount of media, public and political attention. It is not the actual risk that attracts this attention, but the perceived risk. The media will learn of an emergency immediately

and with cellular phones, internet and social media, information will spread quickly, shaping the public perception of what is occurring.

Therefore, SLAERC and DMC need to provide official information about the emergency as soon as possible after the emergency, even though not much information may be known at that time.

In low level emergencies NEC may provide information to general public or media from the information gathered from RPO or any person who notified the emergency. In medium and high-level emergencies, the responsible officer to speak to media is DG of SLAERC (EM) or designated representative.

Messages to the public must be timely, clear and accurate. This requires preparing public information material in advance by SLAERC, so that press releases can be issued in a timely fashion should an emergency occur. SLAERC is responsible for developing templates for press releases and answers to frequently asked questions.

3.13 MITIGATING NON-RADIOLOGICAL CONSEQUENCES

When deciding on protective actions NRERC and TAC taking in to accounts non-radiological consequences. MOH provides Medical and psychological counselling and social support. SLAERC addresses health hazard issues arising in public and provide information to the public about restrictions on international trade (food, vehicles and cargo).

3.14 REQUESTING, PROVIDING AND RECEIVING INTERNATIONAL ASSISTANCE

SLAERC is responsible for obtaining international assistance by communicating with IAEA via RANET, when needed, in coordination with Ministry of Foreign affairs. DMC assists SLAERC by providing logistical support, communications etc. for receiving assistance.

SLAERC responds to international requests and provides assistance if feasible.

3.15 ANALYSING THE EMERGENCY AND EMERGENCY RESPONSE

The following records should be recorded during emergency and reported to NEC at the end of emergency by respective organizations as appropriate.

- Details of accident and accident investigation report and data analyses
- Lifesaving activities
- Protective action recommendations
- Medical records of emergency workers and affected population
- Dosimetry records (received doses, estimated individual and collective doses, Urine samples, bioassays),
- Initial on-scene radiation and contamination survey and monitoring
- Field team (FT) monitoring results/measurements of environmental and marine monitoring
- Epidemiological studies
- Reports on criminal investigation (Security Incidents)
- Results/measurements of contamination of people, foodstuff, water, premises etc.
- Solid radioactive waste
- Packaging and shipment of radioactive materials
- Public communications
- Operational communications

SLAERC in co-operation with DMC and other organizations, which were involved in response, analyses emergency and emergency response.

CHAPTER 4

EMERGENCY PREPREADNESS PROCESS

4.1 AUTHORITIES AND RESPONSIBILITIES

It is the responsibility of every user of radioactive materials in Sri Lanka to be aware of and comply with all the applicable laws, regulations and safety and security procedures related to the utilization of such materials in order to minimize the risk of an accident. All source category I, II, III radiation facilities using radioactive materials are required to prepare facility emergency response plans (guidelines are given in Appendix 5) for the envisaged scenarios resulting in contamination, external exposure and loss of sources etc.

Any unusual event relating to the radiological emergency should be informed to SLAERC and response action should be taken as described in section 3.3 in Chapter 3.

Authority and responsibility for directing and coordination of response rest at the highest positions in responding organizations (Eg: Director General's, Commander's etc.). Decisions on public protective actions during emergency are made by Director General of DMC.

4.2 EQUIPMENT FOR EMERGENCY RESPONSE

Each stake holder shall acquire necessary radiation measuring instruments and protective gears taking in to account the type of actions and precautionary measures to be taken by each stakeholder in responding emergencies.

The SLAERC as the national coordination authority shall acquire and maintain necessary different type of hand-held radiation measuring instruments, laboratory radiation measuring instrument, and personnel protective devices for their own emergency workers and other workers who attend for life saving purposes.

It is the responsibility of the all stakeholders to establish sound maintenance programme to keep the instruments and protective gears in proper working conditions at all times.

4.2.1. Emergency Operation Centers (EOC's)

There is National Emergency Operation Centre (EOC) maintained by the DMC and it is functioned under central command system of DMC. EOC is established to coordinate all response agencies at any type of disaster to minimize the adverse effect of the disasters. This center is working with military and police in 24 hours basis. Their main activities are implemented NEOP, Verify & analyze information receiving from various local/Intl. agencies, Early Warning & Dissemination of Information to Vulnerable Communities, Coordination of immediate relief and medical supports and other stakeholders and mobilize resources with various agencies.

SLAERC has also maintained EOC to respond nuclear or radiological emergencies and this EOC functions under emergency coordination group. NEC is responsible for maintaining this unit at the advice from DG of SLAERC. This also functions 24x7 basis. Their main functions include the maintaining emergency equipment, participating IAEA exercises, all coordination activities and response during emergency. There is no 24x7 personnel available at the office but they respond to all inquiries through e- mails or phones. In any case, the SLAERC team attend to the response and EOC is functioning with full pledge of facilities in 24x7.

4.3 TRAINING ON EMERGENCY RESPONSE

A proper training programme together with emergency exercises should be established to train all emergency workers and keep their training up to date.

The SLAERC is responsible for developing and implementing of the annual and five-year long-term national training programmes. The programmes include trainings such as seminars, drills, table top exercises, partial or full-scale exercises and field exercises.

In addition, individual response organizations are responsible for training of their own responders. All training reports to be submitted to the SLAERC at the end of the year.

4.3.1 Emergency training, exercises, and drills

Emergency training, exercises, and drills play a key role of a good emergency preparedness programme. They can provide unique opportunity for response personnel to acquire confidence in response in a real emergency. The types of exercises given below are described in details in Appendix 9.

- Drills
- Table Top Exercises
- Partial and full-scale exercises
- Field Exercises

4.3.2 IAEA emergency exercises

IAEA has its own emergency exercise system conducted by Incident and Emergency Center under the provisions given in Early Notification and Assistance Conventions. These exercises are called convention (CONVEX) exercises and conducted with member states. These exercises are important for continuous improvement of communication system and dissemination of new technology and methodology to be used for emergency management. More details of these exercises are described in the Appendix 9.

4.4 IAEA AND MEMBER STATES' ASSISTANCE

IAEA in collaboration with other member states has established a RANET to assist member state in case of nuclear or radiological emergency for management of such emergencies. The IAEA carries out regular trainings and exercises with member states and list of member states which have capability for giving assistance is maintained. The following assistance can be obtained from the RANET upon a request made by any IAEA Member State

a) Assess and advise on and assist in the on-site response activities to mitigate impact of emergencies at nuclear facilities;
b) Detect, locate, identify and characterize radioactive material and contamination;
c) Assess and evaluate radiological consequences of an incident or emergency;
d) Provide modelling and prognosis capability;
e) Provide technical advice and recommendations;

SLAERC as the NWP, has the responsibility to request assistance through RANET in case of nuclear or radiological emergency,

The SLAERC is responsible for giving information to INES which is maintained by the IAEA to facilitate member state to obtain levels of INES scale of previous accidents occurred in the world in order to acquire knowledge of accidents and actions taken for mitigation of accidents enabling member states to develop their response capabilities using hand on experience stated in this communication tool. Events in INES scale are classified at seven levels as follows;
Levels 1–3: incidents

Levels 4–7: accidents

Events without safety significance are called "deviations" which may be classified as Level 0.

The above levels are designed so that the severity of an event is about ten times greater for each increase in level on the scale.

INES activities are coordinated with the IAEA by the INES national Officer nominated by the states, Sri Lanka has also nominated an INES national officer who is normally senior officer of SLAERC.

4.5 COORDINATION

Sri Lanka has national coordination mechanism to be functional at the preparedness and response stages among the stakeholders. The roles and responsibilities allocated under Chapter 2 are agreed by all response organizations including SLAERC and DMC. All stakeholders should obey the hierarchy system of the emergency management and be responsible to prepare for their own tasks.

The Coordination Mechanism is assessed on annual meeting participated by all contact points of the stakeholders of this plan convened by SLAERC. The trainings also organized by SLAERC per year basis and all stakeholder agencies are responsible to send their trainees to such trainings. NRERC is convened by DMC and SLAERC and its members also meet in yearly basis.

4.5.1 Coordination of marine samples

The followings organizations responsible for collection of marine samples during an emergency

1. Sri Lanka Navy
2. MEPA
3. Sri Lanka Coast Guard

4.5.2 Coordination of field monitoring

Field monitoring carried out by the SLAERC and all other agencies should corporate with SLAERC for required response

4.5.3. Coordination of public communications

The SLAERC and DMC are responsible for public communication during emergency.

4.6 MAINTAINING RECORDS AND MANAGEMENT OF DATA OF EMERGENCY PREPAREDNESS

The following records should be prepared and maintained by respective organizations as relevant and copies should be sent to NEC at the end of the year.

- Training Records:
- Quality Records
- Instrument records

4.7 ENSURING EQUIPMENT AND SUPPLIES

SLAERC maintains a list of equipment (See Annexure 3) which is tested regular to be operational. DMC maintains EOC which is operation 24x7. SLAERC is responsible for developing regular communication tests with key responding organizations.

CHAPTER 5

BUSINESS CONTINUITY PLAN (BCP) FOR SLAERC

5.1 INTRODUCTION OF BCP

Sri Lanka is vulnerable to different kinds of non-radiological hazards, such as floods, earthquakes, landslides, tsunamis, etc. Sri Lankan population and response organizations have been affected from the above hazards in different scales depending on the location of incident.

Sri Lanka also experienced man-made hazards such as bomb blasts, hostage of people, and the civil war which resulted in injuries and displacement of hundreds of thousands of people.

These natural or man-made disasters may occur in any part of the country and impact to SLAERC in different scales depending on the location and severity of the incident. The consequences may affect to resources such as human resource, equipment and building of the SLAERC. If SLAERC resources is affected from one or more of the above disasters, while radiation emergency situation is occurring in Sri Lanka, the SLAERC should have Business Continuity Plan (BCP) for smooth implementation of EMP during radiation emergency. This chapter describes the BCP of SLAERC.

5.2 PURPOSE OF BCP

This chapter is designed to prepare SLAERC to cope with the effects of a conventional emergencies (the possible emergencies mentioned in section 5.3). It is intended that this chapter provides the basis for a relatively quick and painless return to normal business as usual whilst effect is in progress. The preparations described in this chapter will help SLAERC for smooth implementation of EMP during any such disaster.

5.3. BCP ACTIVATION

The plan will be activated in case of happening one or more of the following scenarios

- Loss of key staff or skills
- This include unavailability of key staff to be involved in decision making or response for mitigation of a radiation emergency.
- Loss of essential utilities
- This include disruption of electricity, water, communication facility etc. affecting normal function of the SLAERC affecting testing and communication.
- Denial of access, or damage to, facilities
- This includes difficulty in accessibility to the vehicles, laboratory premises, and instruments due to flooding of the facility and damage due to explosion, fire or any other natural or man-made causes.

The possible causes which affect above scenarios are given below

a) Fire
b) Flood
c) Earthquake and its after effects
d) Cyber Attack
e) Sabotage or Bombing (insider or external threat)
f) Hurricane or another major storm
g) Power Outage
h) Utility failure of communication
i) Medical emergency such as epidemic
j) Hostage of key staff

5.3.1 Responsibility for activation the BCP

Activation of the BCP will be done by the DG/SLAERC or alternative designee as per the SLAERC organizational structure. The contact details of the key persons are given in Annexure 2

5.4 RECOVERY OF RESOURCES

5.4.1 Loss of key staff or skill

The following table describes the actions during loss of key staff or skill

Table 56: Alternative options to loss of key staff or skill

Category of Loss of key Staff	Alternative
Director General (EM)	• Most senior officer available shall take the functions and responsibility of DG as DG is nominated as Emergency Manager • In collaboration with DMC and other responsible stakeholders' arrangements will be made by the above officer to get the DG recovered from affected area or establish communication with him to get his services. He attends to EM's functions until availability of EM.
NEC	• Senior Alternative designate from the ECG will act as the NEC and he/she will coordinate the work. • The most senior officer available with responsibility for decision making at the time of disaster will in collaboration with DMC make arrangement to get the NEC recovered from affected area or establish communication with him to get his services.
Team leaders of SLAERC Emergency Response Teams	• Absentee's role will be taken by the most senior officer in the group • Explore alternative staff resource options already made available with SLAEB and other stakeholders if needed obtain staff from SLAEB or other stakeholders to whom the training are provided. • The most senior officer available with responsibility for decision making at the time of disaster will in collaboration with DMC make arrangement to get the affected team leaders recovered from affected area or establish communication with them to get his services.
Team members of SLAERC Emergency Response Teams and Emergency Coordination Group	• In collaboration with SLAEB and other stakeholders a list of persons is prepared from trained persons on Emergency response to be summoned in case of emergency to assist SLAERC officers. • The person who is holding emergency manager's role will evaluate immediate and ongoing staff needs and allocate persons to vacant team from the other team if adequate persons are available in other teams if not Emergency manager will contact SLAEB and other stakeholders and request person who have been trained by SLAERC. • The most senior officer available with responsibility for decision making at the time of disaster will in collaboration with DMC make arrangement to get the affected team members recovered from affected area or establish communication with him to get his services.

5.4.2 Loss of essential utilities

Electricity, communication system will be damaged at any instance. SLAERC should maintain the downtime procedures, which specifies the alternative processes that are to be activated to assure continuity of work during radiation emergency. The procedures are to be reviewed and tested, at minimum, on a yearly basis.

Table 57: Alternative options to loss of Essential Utilities

Utility	Alternative
Loss of Power	• Electrical generator is provided as backup and another portable electrical generator is made available for most essential emergency use. • Open curtains and drapes to take advantage of natural or off-site lighting, as applicable • Turn off "unnecessary" electrical equipment to reduce load on generator. Also turn off any equipment that may have been running when the power went out. • Ensure operation and availability of flashlights and batteries for night use. • Adequate number of car charges are made available to charge mobile phones
Loss of Internet facility	• Two numbers of dongles with two different internet connections from different venders are provided to the office. Separate internet connection is made available in addition to the main internet facility • A fax machine is made available as a backup system for communication in case all the possible internet facilities are lost.
Loss of telecommunication system	• Two different types of adequate number of telephones are made available (Wireless and land line phones) • All team leaders of response teams at the SLAERC are provided with communication allowance to maintain their own mobile phones. It is required them to use these phones in case of an emergency.
Loss of water	• A separate tank is made available with sufficient water to cater for 50 persons for three days. • Water bottles are provided in collaboration with DMC and three forces.

5.4.3 Denial of access, or damage to, facilities

In case the SLAERC or its instrument and vehicles cannot be accessed the entire operation will be carried out at the SLAEB as per mutual understanding established with SLAEB, as most of the instruments suitable for emergency operation, trained persons, and vehicles are available with the SLAEB. If persons from SLAERC cannot attend to work at the backup location trained persons at the SLAEB is asked to take the role to be played by the SLAERC persons until SLAERC persons are made available.

While the above work is continued with the assistance of SLAEB the EM will coordinate with other stakeholders to get the essential instruments and vehicles out of the SLAERC premises to safe location using available alternative recovery methods which is used by SL Navy and Air force.

All communication activities are carried out using the available communication facilities at the SLAERC.

APPENDIX 1

EMERGENCY ZONES AND RADIUS SIZES FOR EPR CATEGORY I AND II FACILITIES

This appendix provides the radius sizes for Emergency Zones for EPR category 1 and 2 facilities. The choice of the radii represents a judgment of the distance to which making advanced arrangements is reasonable in order to ensure effective response. In a particular emergency, protective actions may have been warranted only in a small part of the emergency zones. For the worst possible emergencies, protective actions might need to be taken beyond the radii given for emergency zones.

The sizes are shown in terms of a radius of a circle centered at the source of the potential release or criticality. However, the actual boundary of the zones should not be a circle but should be established to conform to geographical features such as roads, rivers, or political boundaries.

Table A.1.1 provides values for approximate radius of the emergency zones and distances for EPR category I and II facilities and Figure A.1 provide the detailed picture of emergency zones and distances.

Table A.1.1. Radius sizes for Emergency Zones and Distances in EPR Category I

Facilities	Precautionary action zone (PAZ) (Km)	Urgent protective action planning zone (UPZ) (Km)	Extended Planning Distance (EPD) (Km)	Ingestion and Commodities Planning Distance (ICPD) (Km)
Reactors > 1000 MW (th)	3-5	15-30	100	300
Reactor > 100-1000 MW (th)	3-5	15-30	50	100

The descriptions of emergency Action zones and distances are as follows;

A.1 Precautionary Action Zone (PAZ)

A precautionary action zone (PAZ), for facilities in this category for which arrangements shall be made for taking urgent protective actions and other response actions, before any significant release of radioactive material occurs, on the basis of conditions at the facility (i.e. conditions leading to the declaration of a general emergency), in order to avoid or to minimize severe deterministic effects. The PAZ only applies to facilities in EP category I. It is the area which arrangements should be made to implement precautionary urgent protective actions before or shortly after a severe release with the aim of preventing or reducing the occurrence of severe deterministic effects.

A.2 Urgent Protective action planning Zone (UPZ)

An urgent protective action planning zone (UPZ), for facilities in category I or II, for which arrangements shall be made to initiate urgent protective actions and other response actions, if possible before any significant release of radioactive material occurs, on the basis of conditions at the facility (i.e. conditions leading to the declaration of a general emergency), and after a release occurs, on the basis of monitoring and assessment of the radiological situation off the site, in order to reduce the risk of stochastic effects.

Any such actions shall be taken in such a way as not to delay the implementation of precautionary urgent protective actions and other response actions within the precautionary action zone.

A.3 Extended Planning Distance (EPD)

An extended planning distance (EPD) from the facility, for facilities in category I or II (beyond the UPZ), for which arrangements shall be made to conduct monitoring and assessment of the radiological situation off the site in order to identify areas, within a period of time that would allow the risk of stochastic effects in the areas to be effectively reduced by taking protective actions and other response actions within a day to a week or to a few

weeks following a significant radioactive release. An EPD from the facility, for facilities in category I or II (beyond the UPZ), for which arrangements shall be made to conduct monitoring and assessment of the radiological situation off the site in order to identify areas, within a period of time that would allow the risk of stochastic effects in the areas to be effectively reduced by taking protective actions and other response actions within a day to a week or to a few weeks following a significant radioactive release.

A.4 An Ingestion and Commodities Planning Distance (ICPD)

An ingestion and commodities planning distance (ICPD) from the facility, for facilities in category I or II (beyond the EPD), for which arrangements shall be made to take response actions

(1) for protecting the food chain and water supply as well as for protecting commodities other than food from contamination following a significant radioactive release and

(2) for protecting the public from the ingestion of food, milk and drinking water and from the use of commodities other than food with possible contamination following a significant radioactive release.

This is the area where preparations for effective implementation of protective actions to reduce the risk of stochastic health effects from the ingestion of locally grown food should be developed in advance. In general, protective actions such as relocation, food restrictions, and agricultural countermeasures will be based on environmental monitoring and food sampling.

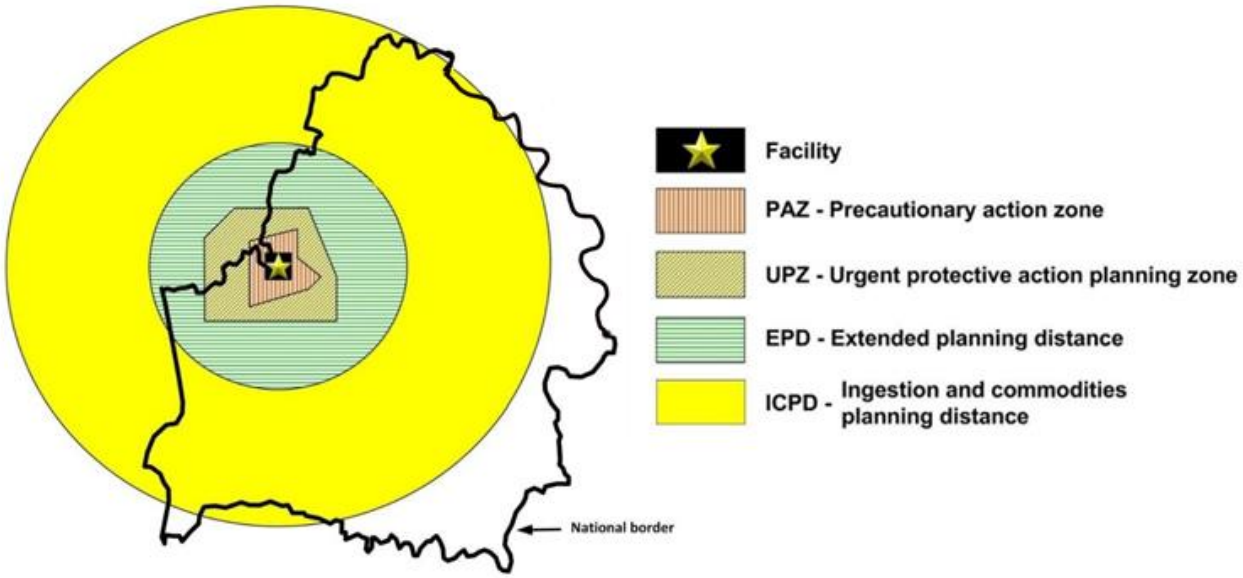


Figure A.1.1. Emergency Planning Zones and Distances

APPENDIX 2

DETAILS OF URGENT PROTECTIVE ACTIONS IN A RADIATION EMERGENCY AND ITS GENERIC CRITERIA FOR USE (REF [7, 17, 18])

Appendix 2 includes examples of associated protective actions and other response actions and protection strategy, including national generic criteria for selection of protective actions. If protective actions in the context of the protection strategy are to be taken when doses are below the generic criteria given in this Appendix, careful consideration is necessary to ensure that such actions are justified (i.e. that they do more good than harm) and that they are optimized.

A.2.1 Protective actions

A.2.1.1 Isolation of a contaminated area or radioactive source

One of the most important aspects of managing a radiological emergency is the ability to promptly and adequately determine and take actions to protect members of the public and emergency workers. In most radiological emergencies involving uncontrolled dangerous sources, individuals can be protected from the radiological hazards by isolating the source and, in case of dispersible radioactive material by preventing inadvertent ingestion. Significant exposure can be avoided by keeping a distance from a dangerous source. Keeping hands and possibly contaminated objects out of the mouth can prevent inadvertent and possibly fatal ingestion. In order to protect the first responders and the public from potential external exposure and contamination, response areas and facilities have to be established immediately after the initial assessment of the emergency.

The two areas to be marked in the field for isolating the source and creating conditions to facilitate response operations are inner cordoned area, delimited by the safety perimeter, and the outer cordoned area, delimited by the security perimeter. These areas have to be established based on type of the scenario (Eg; unknown source, spill fire etc.). The distances of these inner cordoned area are given in the Table A.3.1 of Appendix 3 and Fig A.3.1.

A.2.1.2 Sheltering

Sheltering is relatively easy to implement, but it may not be possible to extend it for long periods of time. Sheltering will provide some protection against exposure via all the major exposure pathways during the early phase of a nuclear or radiological emergency. Sheltering 'in place' can also be used whenever individuals in a potential area of risk are instructed to 'go inside and shut the windows and doors and listen to the radio or television for further instructions' while further assessments of preparations for evacuation are being made. Sheltering can also be used whenever conditions make evacuation dangerous (e.g. in severe weather conditions). The effectiveness of sheltering varies greatly, depending on the characteristics of the radioactive release or the sources of the exposure (e.g. a criticality), the construction of the shelter and the exposure pathway.

External exposure can be reduced by a factor of ten by sheltering in a large structure, while a lightweight building provides little protection from external gamma radiation. Estimating the protection provided against inhalation of radioactive material in the plume by sheltering is very complex. For a short release, most buildings will reduce inhalation doses by a factor of two or three. However, the reductions in the inhalation doses resulting from long releases typically decrease rapidly after a few hours as the concentrations of radioactive material in the structure increase. After passage of the plume, the inhalation doses in most structures could even be greater than those outside if some of the contamination from the plume is trapped in the shelter. Consequently, it should be recommended that normal shelters be ventilated (aired out) after a major release has terminated (Nuclear accident).

Predetermined shelter locations should be provided with a means of determining whether radiation levels are acceptable (e.g. measuring instruments and criteria for judging the results) and arrangements for meeting human needs.

A.2.1.3 Evacuation

A room, facility, or geographic area can be evacuated. Timely evacuation can prevent exposures via all possible exposure pathways and removes individuals from the proximity of the emergency so that they are no longer an immediate concern for response officials. Numerous evacuations have been carried out in response to emergencies involving natural, chemical, and radiological hazards and terrorist activities. Studies of these evacuations show [Ref.15, 16] that the risks of the evacuation itself for the normal population were smaller than those due to normal travel under similar weather conditions. However, evacuation may be more dangerous for special groups in the population, such as hospital patients, if it is not prepared for adequately. The following should be considered in preparing for evacuation.

- Criteria and decision making;
- Established evacuation routes and traffic control;
- Access control and protection of property;
- Arrangements for special population groups and facilities;
- Consideration of farm animals and pets;
- Provisions for meeting the human needs of evacuees.

A.2.1.4 Respiratory protection and protective clothing

The respiratory protection equipment typically used by firefighters provides good protection against the inhalation hazard for most emergencies involving an airborne release of radioactive material. Skin contamination is not a major threat, provided that simple steps are taken to protect the skin and to prevent inadvertent ingestion. However, conditions on the site of a facility in EP category I, II or III may be very severe and may require specialized protective equipment.

For example, the standard protective clothing worn by firefighters during the Chernobyl accident in 1986 did not provide adequate protection for the skin. (In the Chernobyl accident, water contaminated with radioiodine soaked through the protective clothing of the fire-fighters, resulting in beta radiation burns that contributed to several fatalities. In many responses, on-site efforts have been hampered by a lack of protective equipment (e.g. field radiation detection instruments with a high range (e.g 10 Gy/h) or air tanks for self-contained breathing apparatus).

Personnel responding to radiological emergencies should use respiratory protection equipment whenever an inhalation hazard is suspected. Improvised respiratory protection (e.g. a wet cloth over the mouth and nose) has been shown to be effective but it has not been demonstrated that the public will apply it effectively during an emergency. Improvised respiratory protection should not be assumed to provide adequate protection from an inhalation hazard and therefore its implementation should not be allowed to interfere with evacuation or sheltering. All response organizations should prepare their PPS as appropriate to the response.

A.2.1.5 Decontamination of individuals

People have been contaminated by airborne radioactive releases and by handling radioactive material. Significant levels of skin contamination are very rare, and for most emergencies' contamination has not presented a health risk. However, skin contamination can have severe adverse psychological and economic effects as per the lessons learnt from past emergencies. Some cases contaminated people have been shunned and medical professionals have refused to treat them.

Past experiences illustrate the two scenarios for which prompt decontamination may be important in preventing severe deterministic effects:

- Those who may have been heavily contaminated by a major airborne radioactive release should be promptly decontaminated to prevent burns to large areas of the skin. This would probably only be an issue for those on the site during a major release from a facility in EP category I and possibly EP category II or III.

- Those who may have skin contamination that could be hazardous and which could possibly give rise to inadvertent ingestion (e.g. by placing a hand on or in the mouth) should be promptly decontaminated. This hazard would most probably be of concern to someone who handled a dangerous source containing dispersible material or something directly contaminated by such a source.

Contamination by a wide range of radioactive materials is easy to detect; however, criteria are needed to differentiate between significant and insignificant levels in terms of possible health consequences. Lack of criteria has resulted in unnecessary decontamination, diversion of resources, unwarranted anxiety among the public and loss of equipment or facilities such as vehicles. Consequently, operational criteria should be established to assess levels of contamination on people and equipment. (See relevant values given in this Appendix)

Simply changing clothing, showering or washing exposed skin will reduce dangerous levels of contamination and prevent the spread of contamination at significant levels. These simple, cost effective decontamination measures should be used even for contamination at lower levels, provided that they are carried out in such a way as to minimize unwarranted anxiety and do not result in the waste or unjustified diversion of resources. In emergencies, especially when large numbers of people are involved, decontamination measures should be limited to these basic measures and only limited (i.e. easy and simple) efforts should be made to control the wastes arising from the decontamination.

SLAERC has established a team for decontamination in case of nuclear or radiological emergency which involve contamination.

A.2.1.6 Protection of the food and water supply and restriction of significantly contaminated food and water supplies

Following a major release from a facility in EP category I or II, one of the primary sources of exposures may be the ingestion of contaminated food or milk. Ingestion of radioactive material may also be of concern if an explosion or human activity spreads dispersible material from a dangerous source. The past emergencies showed that the contamination of drinking water sources due to an airborne radioactive release might not be a major concern, except if rainwater is being used directly for drinking or cooking. Consequently, for facilities in EP categories I and II (with the potential for an emergency that may result in a major release) arrangements should be made:

- To instruct the public not to eat locally produced food within the UPZ that may have been directly contaminated and not to consume milk from animals that may graze on possibly contaminated ground;
- To instruct the public to protect sources of water (e.g. to disconnect rainwater collection pipes) and to protect important sources of food that may become contaminated;
- Promptly to conduct monitoring and to implement the appropriate restrictions on food and on drinking water from rainwater within the area where food or water may be contaminated to levels warranting restrictions.

These arrangements should be developed in consideration of:

- Arrangements for the distribution and processing of food;
- Instructions for the public and for farmers;
- Availability of replacement foods;
- Operational criteria.

If restrictions could result in severe health effects (e.g. malnutrition), they should not be applied unless ingestion of the food could result in severe deterministic effects.

A.2.1.7 Protection of international trade and commercial interests

Nuclear or radiological emergencies that have occurred in the past have had major adverse economic consequences. This was in part because steps were not taken immediately to reassure people, including national and international customers. It should be noted that threats as reported in the media or as perceived internationally can be as influential as real threats. Consequently, in the event of a nuclear or radiological emergency (or in the event of reports of such an emergency) that may have or that may be perceived to have an impact on trade, there should be provision for taking measures immediately to ensure that all goods in trade meet international standards. The exemption levels and clearance levels in Ref. [23] may be considered as a basis for protecting international trade after an emergency.

A.2.1.8 Medical management

Nuclear or radiological emergencies have occurred that warrant taking immediate action to treat and to identify those who should receive long term medical follow-up. These actions are discussed in the section 3.10 on managing the medical response. This is one of main protective action to reduce stochastic effect and prevent severe deterministic health effects during nuclear or radiological emergency.

A.2.2 Protection strategies

In order to achieve emergency response goals, protection strategies need to be developed to guide the overall development of emergency arrangements at the preparedness stage and to guide the overall emergency response operations. They are basically a justified and optimized set of protective and other response actions that need to be taken in an emergency response that are developed on the basis of the results from the hazard assessment. The protection strategies are implemented during the response through the implementation of emergency arrangements.

Protection strategies are developed by considering two dosimetric concepts: first, using the reference level in terms of residual dose and, second, using generic criteria in terms of the projected dose and the dose that has been received.

A.2.2.1 Reference level

The reference level represents the level of dose or the level of risk above which it is inappropriate to plan to allow exposures to occur and below which optimization takes place. It is expressed in terms of the residual dose, which is the dose expected to be incurred after protective actions have been terminated or a decision has been taken not to implement protective actions.

The reference level for an emergency is set typically for an effective dose in the range 20–100 mSv acute or annually with dose contributions via all the exposure pathways. The actual national value(s) within this band needs to be chosen on the basis of the prevailing conditions of the emergency situation and on national particularities.

A.2.2.2 Generic criteria

The generic criteria represent the dosimetric concept to be used for implementing protective actions and other response actions, either individually or in combination, for use within the process of developing the protection strategy and its implementation during an emergency response. They are expressed in terms of the dose that would be expected if the planned protective actions were not taken, i.e., the projected dose, and the received dose. The generic criteria are given for the RBE-weighted absorbed dose in an organ or tissue, the equivalent dose in an organ and tissue as well as for the effective dose

A.2.2.3 Operational criteria

Generic criteria, which are really generic, as the name suggests. An example of a generic criterion is a projected dose exceeding 100 mSv in the first 7 days at which urgent protective actions, e.g., evacuation, are warranted. But it is impossible for a decision maker and its experts to use this criterion directly, because the projected dose

cannot be measured. And it is nearly impossible to calculate it accurately and timely during an emergency in order to allow for an effective emergency response. Therefore, there is a need for criteria that can be used directly during an emergency without any need for a further assessment. They are called the operational criteria.

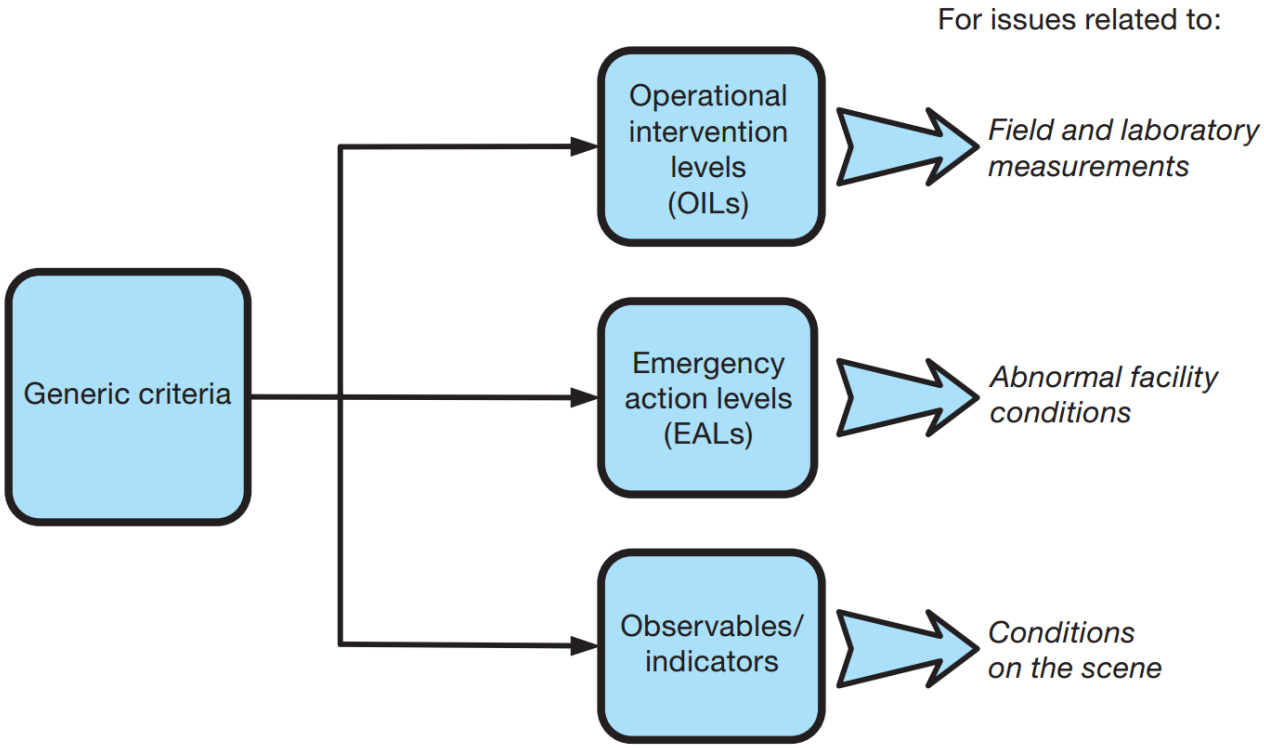


Figure A.2.1: System of generic criteria and operational criteria

In the first stage of a nuclear emergency, i.e., before or shortly after the release, protective and other response actions are decided upon on the basis of the conditions at the facility. The operational criteria associated with the conditions at the plant are called Emergency Action Levels (EALs).

In the later stage of a nuclear emergency, protective and other response actions are decided upon on the basis of monitoring and assessment. For this purpose, Operational Interventional Levels (OILs) are used.

EALs together with OILs and observables at the scene make a system of operational criteria for use within the protection strategy, satisfying the generic criteria and ultimately the reference level.

A.2.2.4 Emergency Action Levels (EALs)

EALs are predetermined, site specific, observable criteria. They can be observed by control room staff and include instrument readings, status indications, observable events, etc. The purpose of EALs is an early detection of the initiating condition of an emergency so that an appropriate level of emergency response is initiated to mitigate its consequences effectively, even before any release occurs.

EALs serve the purpose of triggering protective actions when OILs may not yet be an appropriate indicator for doing so. EALs form the basis of an emergency classification system.

A.2.2.5 Operational Intervention Levels (OILs)

After the release of radioactive material occurs and the monitoring teams can be deployed at the field, OILs can be used to identify and determine when and for whom the protective actions and other response actions are necessary. OILs are measured with instruments in the field or in the laboratory. They can be dose rates, ground

or surface concentrations of radioactive material, or activity concentrations of radionuclides in environmental, food or water samples.

OILs are derived from generic criteria. They are calculated and agreed upon in the preparedness stage as part of the overall protection strategy. They are derived on the basis of certain assumptions with respect to the emergency, the affected population, and the other conditions. This may or may not correspond to the emergency in question. Therefore, arrangements need to be in place to revise OILs if needed as the emergency evolves.

For the previous example of a generic criterion, an operational intervention level for the dose rate of 1000 μSv/h at 1 m above ground level will indicate that a dose projected at 100 mSv in 7 days may be exceeded. Therefore, should the measured dose rates within a certain affected area indicate that this value is exceeded, an evacuation in combination with iodine thyroid blocking (along with other response actions too) may be an appropriate strategy to be considered for those individuals living in this area. So, when a decision maker gets a report from the field indicating these high dose rates being measured, there would be no need for him/her to require further assessments of what would be the projected dose and he/she can decide about implementing the agreed protection strategy in a timely manner.

A.2.3 Generic criteria values (Ref [7, 17])

This Appendix also provides generic criteria:

(a) For doses for which protective actions and other response actions are expected to be undertaken under any circumstances in a nuclear or radiological emergency to avoid or to minimize severe deterministic effects;
(b) For doses for which protective actions and other response actions are expected to be taken, if they can be taken safely, in a nuclear or radiological emergency to reasonably reduce the risk of stochastic effects;
(c) For doses for which restriction of international trade is warranted in a nuclear or radiological emergency, with due consideration of non-radiological consequences;
(d) For doses for use as a target dose for the transition to an existing exposure situation.

Table A.2.1 provides generic criteria for doses received within a short period of time for which protective actions and other response actions are expected to be taken under any circumstances in a nuclear or radiological emergency to avoid or to minimize severe deterministic effects.

Table A.2.1. Generic criteria for doses received within a short period of time for which protective actions and other response actions are expected to be taken under any circumstances in an emergency to avoid or to minimize severe deterministic effects.

Part 1:

Acute external, Local and contact Exposure < 10h		
Organ or Tissue	**Average RBE Weighted Absorb Dose**	**Protective Actions and Other Response Actions**
Red Marrow	1 Gy	If the dose is projected: • Take precautionary urgent protective actions immediately (even under difficult conditions) to keep doses below the generic criteria; • Provide public information and warnings; • Carry out urgent decontamination.
Fetus	0.1Gy	
Soft Tissue	25 Gy at 0.5 cm depth to 100 cm^2 tissue	
Skin Derma	10 Gy to 0.4 mm depth to 100 cm^2 tissue	

Part 2:

Acute Internal Exposure due to an acute intake		
Organ or Tissue	**RBE weighted absorb dose delivered over a period of 30 days**	**Protective Actions and Other Response Actions**
Red Marrow Thyroid Lung Colon Fetus	0.2 Gy for radionuclides with atomic number $Z \geq 90$ 2 Gy for radionuclides with atomic number $Z \leq 89$ 2 Gy 30 Gy 20 Gy 0.1 Gy	If the dose has been received: • Perform immediate medical examination, medical consultation and indicated medical treatment; • Carry out contamination control; • Carry out immediate decorporation (if applicable); • Conduct registration for longer term medical follow-up; • Provide comprehensive psychological counselling.

Table A.2.2. provides generic criteria for taking protective actions and other response actions in a nuclear or radiological emergency to reduce the risk of stochastic effects.

Table A.2.2. Generic criteria for taking protective actions and other response actions in a nuclear or radiological emergency to reduce the risk of stochastic effects.

Part 1

Generic Criteria: Projected dose that exceeds the following Generic criteria		**Urgent protective actions and other actions to be considered**
Dose Quantity	**Projected Dose in the First 7 days**	
Total Effective Dose	100 mSv	Sheltering; evacuation; prevention of inadvertent ingestion; restrictions on food, milk and drinking water and restrictions on the food chain and water supply; restrictions on commodities other than food; contamination control; decontamination; registration; reassurance of the public
Equivalent Dose for Fetus or embryo	100 mSv	
Equivalent dose in thyroid (only for exposure of thyroid to radioiodine)	50 mSv	Iodine thyroid blocking (Nuclear Emergency only)

Part 2:

Generic Criteria: Projected dose that exceeds the following Generic criteria		**Early protective actions and other response actions to be considered**
Dose Quantity	**Projected Dose in the First year**	
Total Effective Dose	100 mSv	Temporary relocation; prevention of inadvertent ingestion; restrictions on food, milk and drinking water and restrictions on the food chain and water in utero development supply; restrictions on commodities other than food; contamination control; decontamination; registration; reassurance of the public
Equivalent Dose for Fetus or embryo (For the full period of in utero development)	100 mSv	

Part 3:

Generic Criteria: Dose that has been received and that exceeds the following Generic criteria		**Longer term Medical actions to be considered to detect and to effectively treat radiation induced health effects**
Dose Quantity	**Received Dose**	
Total Effective Dose	100 mSv in a month	Health screening based on equivalent doses to specific radiosensitive organs (as a basis for longer term medical follow-up), registration, counselling[a]
Equivalent Dose for Fetus or embryo (For full period of in utero development)	100 mSv	Counselling to allow informed decisions to be made in individual circumstances

[a] - When result of the health screening indicated that the criteria in table A.2.1 are exceeded then appropriate medical actions on the basis of table A.2.1 is necessary.

Table A.2.3. provides generic criteria for taking protective actions and other response actions to reduce the risk of stochastic effects from the ingestion of food, milk, and drinking water and from the use of other commodities in a nuclear or radiological emergency.

A value of 1/10 of the generic criteria given in Table A.2.2 for early protective actions and other response actions is established as generic criteria for restrictions on food, milk and drinking water and on other commodities to ensure that the dose via all exposure pathways, including ingestion, will not exceed the generic criteria given in Table A.2.2.for early protective actions and other response actions.

If restrictions on food, milk or drinking water would result in severe malnutrition or dehydration because replacements are not available, food, milk or drinking water with concentration levels of radionuclides that are projected to result in doses above the generic criteria given in Table A.2.3 may be consumed until replacements are available provided that this would not result in doses from all exposure pathways above the generic criteria given in Table A.2.2.; otherwise, the people affected may be relocated.

Table A.2.3. Generic Criteria for Food, Milk and Drinking Water and Other Commodities to Reduce the Risk of Stochastic Effects: Protective actions and other response actions

Generic Criteria: Projected dose from ingestion of food, milk and drinking water, and from the use of other commodities that exceeds following generic criteria		**Protective actions and other response actions to be considered**
Dose Quantity	**Projected dose in the first year**	
Effective Dose	10 mSv in the first year	Restrict consumption, distribution, and sale of non-essential[a] food, milk, and drinking water[b] and restrict the use and distribution of other commodities. Replace essential food, milk and drinking water as soon as possible or relocate the people affected if replacements are not available. Estimate the doses of those who might have consumed food, milk and drinking water or used other commodities to determine whether this may have resulted in doses warranting medical attention in accordance with table A2.2
Equivalent dose to the fetus or embryo	10 mSv for the full period of in utero development	

[a]Restricting essential food, milk or drinking water could result in dehydration, severe malnutrition or other severe health impacts: therefore, essential food, milk and drinking water is to be restricted only if alternatives are available.

[b]These criteria for taking actions on food, milk and drinking water are applied once the sampling and analysis of food, milk and drinking water is carried out. This would also provide a basis for discontinuing restrictions imposed on food, milk, and drinking water as a precaution on the basis of the generic criteria in Table A.2.2.

Table A.2.4 provides generic criteria for taking protective actions and other response actions to reduce the risk of stochastic effects arising from the use of vehicles, equipment, and other items from an area affected by a nuclear or radiological emergency.

A value of 1/10 of the generic criteria given in Table A.2.2 for early protective actions and other response actions is established as generic criteria for vehicles, equipment and other items from an affected area, to ensure that the dose via all exposure pathways, including the use of such vehicles, equipment and other items, would not exceed the generic criteria given in Table A.2.2 for early actions for a member of the public.

Restricting the use of vehicles, equipment and other items from an affected area could interfere with taking urgent protective actions and other response actions or with providing services essential to public health or well-being (e.g. restricting the use of vehicles for transferring individuals requiring critical medical treatment or preventing a ship or an aircraft that has left an affected area from reaching its final destination). Such vehicles, equipment and other items whose use would give rise to a projected dose to their users above the generic criteria given in Table A.2.4 may be used until replacements are available, provided that:

(a) Their use will not result in doses from all exposure pathways that exceed the generic criteria given in Table A.2.2 for members of the public or the guidance values given in Appendix 8 for restricting the exposure of emergency workers, or the restriction for exposures of helpers in an emergency.
(b) Actions are taken to manage and control the exposure of the user as an emergency worker, a helper in an emergency or a member of the public, as appropriate.

Table A.2.4. Generic Criteria for Vehicles, Equipment, and Other Items to Reduce the Risk of Stochastic Effects

Generic Criteria: Projected dose from the use of vehicles, equipment or other items from an affected area that exceed the following generic criteria		**Protective actions and other response actions to be considered**
Dose Quantity	**Projected dose**	
Effective Dose	10 mSv in the first year	Restrict non essential[a] use. Use essential vehicles, equipment and other items from and affected area until replacements are available provided that of vehicles, equipment, and other items from an affected area until Replacements are available provided that i. there use will not result in doses from all exposure pathways exceeding the generic criteria given in Table A.2.2. for a member of the public or the guidance values given in Appendix 8 for restricting the exposure of emergency workers and helpers in an emergency and, ii. actions are taken to control the dose to the user as an emergency worker, helper in an emergency or a member of the public as appropriate. Estimate doses to those emergency workers, helpers in an emergency and members of the public who may have used a vehicle, equipment or other item from an affected area to determine whether this could have resulted in a dose warranting medical attention in accordance with Table A.2.2.
Equivalent dose to the fetus or embryo for the full period of in utero development	10 mSv during the pregnancy	

[a]Restricting the use of vehicles equipment and other items from and affected area could interfere with taking urgent protective actions and other response actions or with providing services essential to public health or well-being (Eg. Restricting the use of vehicles for transferring individuals requiring critical medical treatment)

Table A.2.5. Provides generic criteria aimed at the effective implementation of response actions to reduce the non-radiological consequences of a nuclear or radiological emergency by providing a basis for the continuation or the resumption of international trade. Values that exceed the generic criteria in Table A.2.5 may be acceptable under emergency (temporary) conditions.

The generic criteria for food traded internationally derive from the level used by the Joint FAO/WHO Codex Alimentarius Commission [Ref. 20]. These generic criteria, and generic criteria for other commodities traded internationally that could contain radionuclides following a nuclear or radiological emergency, are established at 1/100 of the generic criteria given in Table A.2.2 for early protective actions and other response actions to ensure that doses to the public would be a small fraction of those for which actions are warranted to reduce the risk of stochastic effects.

For food traded internationally that could contain radionuclides following a nuclear or radiological emergency, the operational criteria (i.e. guideline levels) as published by the Joint FAO/WHO Codex Alimentarius Commission [Ref 20].

If restricting trade in food and other commodities could result in severe health impacts or other detrimental effects in another State, then the food and other commodities that would give rise to a projected dose that exceeds the generic criteria in Table A.2.5 may be traded — if the trade is justified — until replacements are available, provided that:

(a) The trade is approved with the receiving State.
(b) The trade will not result in doses that exceed the generic criteria for the public given in Table A.2.2 and Table A.2.3.
(c) Actions are taken to manage and control exposures during shipping.
(d) Actions are taken to control the consumption of food and use of other commodities and to reduce the exposure of members of the public.

Table A.2.5 Generic Criteria for Food and Other Commodities Traded Internationally

<table>
<tr><th colspan="2">Generic Criteria: Projected dose from food and other commodities that exceed the following generic criteria</th><th rowspan="2">Other response actions to be considered</th></tr>
<tr><th>Dose Quantity</th><th>Projected dose</th></tr>
<tr><td>Effective Dose</td><td>1 mSv per year</td><td rowspan="2">Restrict non essential[a] international trade. Trade essential food and other commodities until replacements are available if :
i. Trade is approved with the receiving state;
ii. Trade will not result in doses to the public that exceed the generic criteria given in Table A.2.2. for all exposure pathways and in Table A.2.3. for the respective pathways.
iii. Actions are taken to manage and control the dose during shipping and,
iv. Actions are taken to control the consumption and use of food and other commodities and to reduce the exposure of members of the public.</td></tr>
<tr><td>Equivalent dose to the fetus or embryo for the full period of Utero development</td><td>1 mSv</td></tr>
</table>

[a]Restricting the trade of essential commodities and food could result in severe health impacts or other detrimental conditions in other State

A.2.3.1 Generic criteria for enabling a transition to an existing exposure situation

Generic criteria shall be established in terms of the projected dose for the implementation of protective actions and other actions aimed at enabling the termination of a nuclear or radiological emergency and the subsequent transition to an existing exposure situation with due consideration of, and verification of the fulfilment of, the conditions given below. These criteria are established as 1/5 of the generic criteria for the early protective actions and other response actions given in Table A.2.2 and are:

(a) An effective dose of 20 mSv per year;
(b) An equivalent dose to a fetus of 20 mSv for the full period of in utero development.

Conditions: The decision to terminate the nuclear or radiological emergency and the subsequent transition to an existing exposure situation is to be taken after:

(a) Justified actions (Take into account the impacts of these actions that are not associated with radiation exposure but on health, economy society and culture) have been taken to reach the generic criteria for enabling the transition to an existing exposure situation and it has been confirmed that any further actions to reach these criteria would do more harm than good;
(b) Confirmation that the source of exposure is fully characterized for all members of the public living as normal in the area;
(c) The situation with regard to exposure has been understood and has remained stable;
(d) Any restrictions on normal living conditions are limited and provisions are in place to confirm compliance with such restrictions;
(e) Confirmation that interested parties, including the public, have been consulted and are being kept informed about the basis for the adjustment of emergency response actions and for the transition, with the associated health hazards put into perspective.

Table A.2.6 provides Overview of the Applicability of reference levels for different exposure situations Further details of transition to an existing or planned exposure situation are given in IAEA safety standard GSG-11 “Arrangements for the Termination of a Nuclear or Radiological Emergency”.

Table A.2.6 Overview of the Applicability of reference levels for different exposure situations

Range of the different level for residual dose	**Applicability**
20-100 mSv[a]	Emergency exposure situation
~20 mSv[b]	Transition from an emergency exposure situation to an existing exposure situation
1-20 mSv[b]	Existing exposure situation
[a] Acute or annual effective dose. [b] annual effective dose.	

A.2.4 Operational Interventional Levels (OILs)

Table A.2.7 contains OILs for assessing the results of field monitoring of contamination of the ground, skin and clothing. Three types of OIL are provided in the units measured by field survey instruments: dose rate (OIL (γ)); beta counts per second (counts/s) for beta radiation (OIL (β)); and alpha counts/s for alpha radiation (OIL (α)). An OIL is exceeded if any of its types are exceeded. These OILs apply for emergencies involving all radionuclides, including fission products released by melting reactor fuel.

The OILs in Table A.2.7 were established for implementing the protective actions and other response actions in a way consistent with the generic criteria in Tables A.2.1 and A.2.2. In the development of these OILs, all members of the population (including children and pregnant women) as well as all usual activities (such as children playing outdoors) were considered. The OILs were calculated to ensure that the protective actions to be

taken to protect against the most radiotoxic radionuclides. As a result, the OILs are overly conservative for many radionuclides and should be revised as soon as it is known which radionuclides are involved.

Table A.2.7 Default OILs for Field Survey Measurements.

OIL	OIL value	Response action (as appropriate) if the OIL is exceeded
Environmental measurements		
OIL1	Gamma (γ) 1000 μSv/h at 1 m from surface or a source. 2000 counts/s direct beta (β) surface contamination measurement[e] 50 counts/s direct alpha (α) surface contamination measurement[f]	• Immediately evacuate or provide substantial shelter[a] • Provide for decontamination of evacuees[b] • Reduce inadvertent ingestion[c] • Stop consumption of local produce[d], rainwater and milk from animals grazing in the area • Register and provide for a medical examination of evacuees • If a person has handled a source with a dose rate equal to or exceeding 1000 μSv/h at 1 m[e] , provide an immediate medical examination
OIL2	Gamma (γ) 100 μSv/h at 1 m from surface or a source. 200 counts/s direct beta (β) surface contamination measurement[f] 10 counts/s direct alpha (α) surface contamination measurement[f]	• Stop consumption of local produce[d], rainwater and milk from animals grazing in the area until they have been screened and contamination levels have been assessed using OIL5 [m] and OIL6[m]. • Temporarily relocate those living in the area; before relocation, reduce inadvertent ingestion[c]; register and estimate the dose to those who were in the area to determine if medical screening is warranted; relocation of people from the areas with the highest potential exposure should begin within days • If a person has handled a source with a dose rate equal to or exceeding 100 μSv/h at 1 m, provide medical examination and evaluation; any pregnant women who have handled such a source should receive immediate medical evaluation and dose assessment
OIL3	Gamma (γ) 1 μSv/h at 1 m from surface. 20 counts/s direct beta (β) surface contamination measurement[f,i] 2 counts/s direct alpha (α) surface contamination measurement[f,i]	• Stop consumption of non-essential[g] local produce[d], rainwater and milk from animals[h] grazing in the area until it has been screened and contamination levels have been assessed using OIL5 [m] and OIL6 [m] • Screen local produce, rainwater and milk from animals[h] grazing in the area out to at least 10 times the distance to which OIL3 is exceeded and assess samples using OIL5 [m] and OIL6 [m] • Consider providing iodine thyroid blocking[j] for fresh fission products[k] and for iodine contamination if replacement for essential[g] local produce or milk is not immediately available

Table A.2.7 Default OILs for Field Survey Measurements (cont.)

OIL	OIL value	Response action (as appropriate) if the OIL is exceeded
Environmental measurements		
		• Estimate the dose of those who may have consumed food, milk or rainwater from the area where restrictions were implemented to determine if medical screening is warranted
OIL4	Gamma (γ) 1 μSv/h at 10 cm from the skin. 1000 counts/s direct beta (β) skin contamination measurement[f] 50 counts/s direct alpha (α) skin contamination measurement[f]	• Provide for skin decontamination[b] and reduce inadvertent ingestion[c] • Register and provide for a medical examination

Note: The OILs should be revised as soon as it is known which radionuclides are actually involved. The OILs should also be revised, if necessary, as part of the preparedness process, to be more consistent with the instruments to be used during the response. However, the default OILs in this table can be used without revision to make a conservative assessment immediately.

[a] Inside closed halls of large multi-storey buildings or large masonry structures and away from walls or windows.
[b] If immediate decontamination is not practicable, advise evacuees to change their clothing and to shower as soon as possible. Guidance on performing decontamination can be found in Ref [10, 22].
[c] Advise evacuees not to drink, eat or smoke and to keep hands away from the mouth until hands are washed.
[d] Local produce is food that is grown in open spaces that may be directly contaminated by the release and that is consumed within weeks (e.g. vegetables).
[e] This external dose rate criterion applies only to sealed dangerous sources and does not need to be revised in an emergency.
[f] Performed using good contamination monitoring practice.
[g] Restricting essential foods could result in severe health effects (e.g. severe malnutrition), and therefore essential foods should be restricted only if replacement food is available.
[h] Use 10% of OIL3 for milk from small animals (e.g. goats) grazing in the area.
[i] Deposition by rain of short lived naturally occurring radon progeny can result in count rates of four or more times the background count rate. These rates should not be confused with the deposition rates due to the emergency. Count rates due to radon progeny will decrease rapidly after the rain stops and should be back to typical background levels within a few hours.
[j] Only for several days and only if replacement food is not available.
[k] Fission products that were produced within the last month, thus containing large amounts of iodine.
[m] Oil 5 and Oil 6 can be found in Annexure 5

APPENDIX 3

RADIUS OF INNER CORDONED AREA (SAFETY PERIMETERS) FOR RADIOLOGICAL EMERGENIES (REF [10])

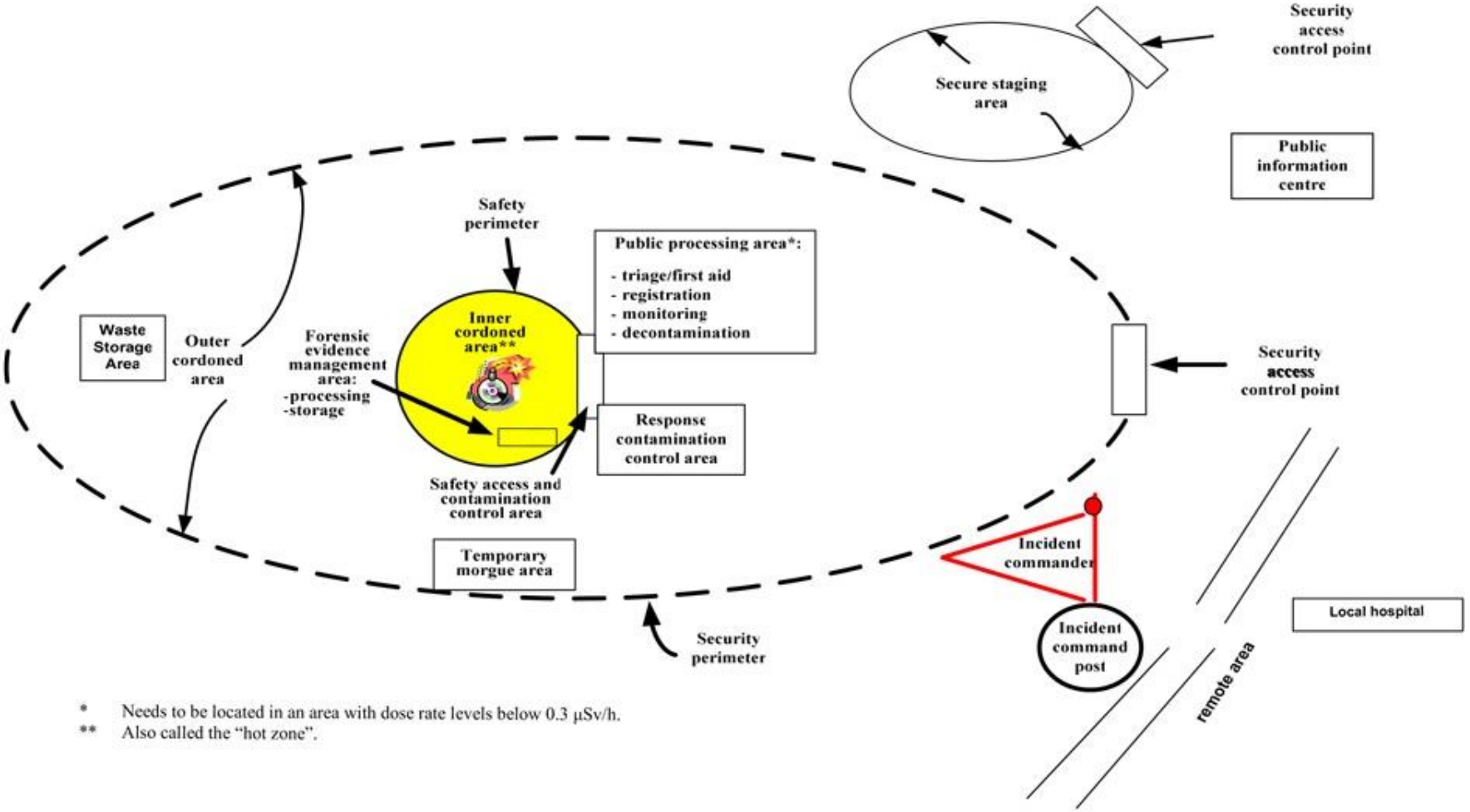
The radius of safety perimeters for various cases of radiological emergency are as indicated in Table A.3.1

Table A.3.1. Radius of Inner Cordoned Area (Safety Perimeter) For Radiological Emergency.

Situation	Initial inner cordoned area (Safety perimeter)
Initial determination – outside	
Unshielded or damaged potentially dangerous source	30 m around
Major spill from a potentially dangerous source	100 m around
Fire, explosion or fumes involving a potentially dangerous source	300 m radius
Suspected bomb (potential RDD), exploded or unexploded	400 m radius or more to protect against an explosion
Initial determination – inside a building	
Damage, loss of shielding or spill involving a potentially dangerous source	Affected and adjacent areas (including floors above and below)
Fire or other event involving a potentially dangerous source that can spread materials throughout the building (e.g. through the ventilation system)	Entire building and appropriate outside distance as indicated above
Expansion based on radiological monitoring	
Ambient dose rate of 100 μSv/h	Whenever these levels are measured

The actual boundaries of the safety and security perimeters should be defined in the way that they are easily recognizable (e.g. roads) and secured. However, the safety perimeter should be established at least as far from the source as indicated in above Table, until the radiological assessor has assessed the situation.

The figure A.3.1 shows the response areas established by incident command system during response to radiological emergency.



* Needs to be located in an area with dose rate levels below 0.3 µSv/h.
** Also called the "hot zone".

Figure A.3.1: Layout of the Establishment of Response Areas by first responder.

APPENDIX 4

COMMUNICATION WITH IAEA

A.4.1 IEC communication system with member states

Every member state should nominate National Warning point, National competant authority (Abroad)- NCA (A) and National competant Authority (domestic)- NCA (D) for easy response communications with IAEA according to the two conventions. IEC published the document to use in communication with IAEA during nuclear or radiological emergencies called EPR-IECOMM 2012: Operations Manual for Incident and Emergency Communication. The following passage describe the definition of NWP, NCA (A) and NCA (D) and the contact points in Sri Lanka for NWP, NCA (A) and NCA (D).

A.4.1.1 National warning point — NWP

The NWP role is assigned to a single institution in a country, which has been designated by its government to receive an initial notification, advisory, follow-up message and/or request for assistance, information or verification and immediately to act upon it on a 24/7 basis. The NWP's functions are independent of those of the NCA. Nevertheless, an NCA could also have the functions of an NWP.

The NWP is expected to be part of a national emergency response system and possesses both the authority and the means to activate it. The service is obligated, under the terms of the Early Notification and Assistance Conventions, to be available continuously, i.e. staffed and able to be alerted 24 hours per day, seven days per week. If requested to consider providing assistance, it needs to be able to rapidly forward any request received to the relevant NCA.

Sri Lanka NWP is the SLAERC and it has persons on duty or have speedy access to persons who can understand and speak English. SLAERC provided all communication details to IAEA and maintain 24x7 contact point to receive notifications. SLAERC counterparts also can access USIE website to emergency communication with IEC.

A.4.1.2 National Competent Authority — NCA (D) — for a domestic emergency

The NCA (D) role is assigned to one or more institutions within a country authorized by its government to issue an initial notification, advisory, follow-up message, as appropriate, or to reply to a request for verification of information regarding a nuclear or radiological emergency originating at a facility or location on the territory or under jurisdiction of the country. Each assigned NCA (D) needs to be competent to verify relevant information provided during a nuclear or radiological emergency at a facility or in a location under the institution's authority. The NCA (D) is authorized by its government in such a way that, in the event of a nuclear or radiological emergency, it may direct a request for assistance to the IAEA. The NCA (D) coordinates the request for assistance with all other NCAs in the State.

SLAERC is designated as NCA (D) and SLAERC has maintained relevant requirement needed to the NCA (D) communication. Emergency Coordinator is the focal point for NCA (D).

A.4.1.3 National Competent Authority — NCA (A) — for an emergency abroad

The NCA (A) role is assigned to the single institution within a state that is expected to verify or arrange for the verification of any relevant information provided during a nuclear or radiological emergency originating in another State, as well as being in a position to receive notifications, advisory messages, follow up information and requests for assistance. In the event of a nuclear or radiological incident or emergency, the NCA (A) is authorized by its government to direct requests for assistance to the IAEA. The NCA (A) coordinates the request for assistance with all other NCA's
SLAERC is also designated as NCA (A).

A.4.2 Permanent missions to the IAEA

The Permanent Mission to the IAEA will receive copies of relevant communications sent out from the IEC to its State's Contact Points while the IEC is activated, and have read-only access to the USIE web site. It is highly desirable that the Permanent Mission has internet capability to be able to send and receive electronic mail and access the USIE web site. The mission will also be requested to assist in the event of communication problems between the IEC and the State concerned, and if the State has not nominated a NWP or NCA's. The mission of a State requesting assistance may itself be requested to assist with matters such as obtaining visas for personnel entering their State and with customs clearance for equipment being brought into the State as part of providing assistance. SL mission in Vienna, Austria has this capability.

A.4.3 USIE website and communication

The Unified System for Information Exchange in Incidents and Emergencies (USIE) is a single unified protected IAEA website for national contact points under the Convention on Early Notification of a Nuclear Accident (Early Notification Convention) and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Assistance Convention), and for International Nuclear and Radiological Event Scale (INES) national officers, to report and exchange information on nuclear and radiological incidents and emergencies.

USIE also provides a means for Member States to request, through their Competent Authorities, international assistance under the Assistance Convention, and displays the national assistance

USIE features:

- Reporting on nuclear and radiological incidents and emergencies;
- Requesting assistance in case of nuclear and radiological incidents and emergencies;
- Notifications, in case of nuclear and radiological incidents and emergencies, via email, fax and SMS;
- Information feeds for the public ('NEWS') in case of nuclear and radiological incidents and emergencies.

While USIE is not accessible to the public, information tailored for use by the media and the public, which is submitted by Member States on USIE and includes descriptions of events and their classification on INES, is also made available on the public NEWS website: http://www-news.iaea.org. NEWS is open to everyone and provides a feature for subscribing to new information posted on the site. Information posted on the NEWS site remains available there for a limited period of twelve months.

APPENDIX 5

GUIDELINES OF EMERGENCY PLANS AND PROCEDURES (REF [8])

This Appendix provides the guidelines and outline for making own emergency plans for facilities which use ionizing radiation, mobile source users and stakeholders in EMP. The composition and size of a response may vary considerably from one emergency to another, involving elements from the high medium and low levels and conventional response organizations such as law enforcement. Emergency preparations should allow for the response procedures from all these levels and organizations to be quickly integrated, expanded, or contracted to meet the requirements of the particular emergency. Consequently, plans at all these levels must have compatible:

(1) terminology;
(2) notification, activating and response;
(3) emergency operations management;
(4) organization and functional descriptions;
(5) co-ordination;
(6) facilities, communications;
(7) procedures, methods and equipment used for performing common or integrated tasks;
(8) training and exercises; and
(9) maintenance and quality assurance.

The following are outlines of proposed plans and implementing procedures. The plan outlines presented here take essentially a "process" approach for developing an emergency plan, to respond to an emergency (Chapter 3 of the EMP) and to develop and maintain a response capability (Chapter 4 of the EMP).

A.5.1 Emergency Plan Outline of the Participating Organizations

This outline is for the plans of the governmental organizations and ministries that will respond under the EMP.

TITLE (COVER) PAGE

On the title (cover) page write the title of the plan, approval date, version number and signatures. The title should clearly indicate the organization addressed by the plan. The signatures should include those of the heads of any participating organizations, such as the local fire brigade.

CONTENTS

1. INTRODUCTION
   - 1.1 Background: Describe the importance of having emergency plan to respond radiation emergencies as an off- site response organization.
   - 1.2 Purpose: Describe the purpose of the plan, See the purpose of EMP
   - 1.3 Scope: Describe the scope of the plan, for example; "The plan addresses the response by (name of participating organization) whereby it performs (list major functions) under the EMP in the event of an actual or perceived radiation emergency" in order to co-ordinate the response and protect public health and safety."
   - 1.4 Legal basis: See the outline of section 1.4 of the EMP for guidance.
   - 1.5 Review, Updating of the plan: Activation methods, update time line, funding etc.

2. PLANNING BASIS

2.1 Types of hazards: Give a brief description of the characteristics of radiation hazards that are important to respond by respective organization to comply with EMP roles and responsibilities. See the outline for the EMP.

2.2 Response roles and responsibilities: Describe the roles and responsibilities of organizations that participate in this plan. This should discuss responsibility for authorizing/activating the plan and directing the total emergency response. It should show how responsibilities could differ under different conditions. Describe how responsibilities are delegated or transferred. See the outline of section 2.5 of the EMP for guidance.

3. EMERGENCY RESPONSE PROCESS

Describe the arrangements for the organization to perform its functions assigned under the EMP for low, medium or high-level emergencies to carry out their respective functions described in EMP where appropriate, to co-ordinate them under the EMP. Identify the response organization component responsible for performing the functions. Refer to the appropriate implementing procedures that will be used during an emergency to carry out each function.

3.1 Notification, activation and Deployment of the response

Describe the tasks and responsibilities for notification, activation, and deployment of the response. Describe how decisions will be made to activate or deploy the response upon notification of activation under the EMP and include an emergency classification system to be used for prompt activation of response consistent with that in the EMP. Describe the level of activation and immediate action to be taken by various components of the response organization for each possible emergency low, medium and high levels or for an event not addressed in the plan. Describe how national organizations will be notified of an emergency. The call lists used for activation and notifications should be part of the procedures. Describe the arrangements to have a notification point available continuously to receive and react to a notification from a facility or SLAERC.

3.2 Operational Response structure

Describe the command and control system used to manage the response and the relationship to the EMP command and control system and, if appropriate, how it will function in the event of simultaneous response at the national level by other organizations to conventional emergencies or criminal activity. Describe the incident command system used at the scene who will direct the response under a unified command system (ICS) as described in EMP. Include an overall management procedure for the incident commander that describes the immediate actions for each type of emergency (medium or high).

3.3 Protecting emergency workers and helpers in an emergency
See the outline of section 3.9 of the EMP for related information and provide guideline to follow the workers during emergency.

3.4 Emergency communication: describe the procedure for emergency communications, list of contact, public information etc.

3.6 Maintaining records and management of data: See the outline of section 3.15 of the EMP for guidance.

4. EMERGENCY PREPAREDNESS PROCESS

Identify the position responsible and describe the arrangements to perform the functions, listed in the subsections below, which are needed to develop and maintain the capability to respond to an emergency described in the plan. See the outline of chapter 4 of the EMP for guidance.

Authorities and responsibilities, Co-ordination, Plans and procedures, Logistical support and facilities, Training and Exercises, Quality assurance and programme maintenance.

REFERENCES LIST OF ABBREVIATIONS DISTRIBUTION LIST

List (and distribute to) all individuals/organizations that are parties to this plan or that will be developing response arrangements that should be consistent with this plan.

APPENDICES: Use relevant information to the chapters in Appendices as required, Memorandum of Understanding (MOU), contact list etc.

A.5.2 Facility (on-site) emergency plan outline

The outline given below can be used to prepare plans for EP category III facilities. Detailed information or information that may change frequently should be provided by reference to other documents available to planners.

TITLE (COVER) PAGE

On the title (cover) page write the title of the plan, approval date, version number, and signatures. The signatures should include those of the heads of all the participating departments in the facility and authority responsible for the local off-site response and any organization providing emergency services support to on-site response such as local emergency services or supporting medical institutions.

CONTENTS

1. INTRODUCTION

1.1 Background: Describe the importance of having facility emergency plan to respond radiation emergencies occurred at the facility.
1.2 Purpose: Describe the purpose of the plan, for example: “The plan provides the basis for (name of the facility) response to a radiation emergency that is effectively integrated with an accompanying international, national and facility response.”
1.3 Scope: Describe the scope of the plan, for example: “The plan addresses the response by (name of facility) to an actual or perceived radiation hazard in order to co-ordinate the response to protect public health and safety.”
1.4 Legal basis: See the outline of section 1.4 of the EMP for guidance.

2. PLANNING BASIS

2.1 Types of Hazards: Give a brief description of the characteristics of facility emergencies that were considered in development of the plan. This should include the results of a comprehensive safety analysis and low probability events. (see Chapter 2.1 in EMP for guidance)

2.2 Response roles and responsibilities

Describe the roles and responsibilities of the on-site departments, off-site organizations and corporate management in this plan. Discuss responsibility for authorizing/activating the response (e.g. Operator, RPO etc) and directing the total on-site response in relation to time. Show how responsibilities would differ as the on-site staff is augmented or in other circumstances (e.g. simultaneous execution of the security plan). Describe how responsibilities are delegated or transferred.

2.3 Response organization/Structure

Provide a block diagram of the on-site response organization components (sections, groups, teams or positions) with a brief description of responsibilities of each “block” and the emergency facility or location where these organizational elements will probably perform. Show how the organization integrates into the off-site organization structure, and describe participation in the off-site response command group and other appropriate organizational components, such as the public information or radiological assessment groups as discussed in EMP. Describe the ICS system at the facility.

3. EMERGENCY RESPONSE PROCESS

Describe the arrangements for the facility to perform their functions assigned under the EMP to carry out the functions in the following subsection and, where appropriate, to co-ordinate them under the EMP. Identify the response organization component responsible for performing the functions. Refer to the appropriate implementing procedures that will be used during an emergency to carry out each function. See the outline of chapter 3 of the EMP for guidance.

3.1 Notification, activation and request for assistance

Describe the arrangements, including those for the emergency organization responsible, for declaration of an emergency off-site notification activation of the response organization and transition to the on-site response organizations. The classification system and the emergency action levels (EALs) used to decide on the level of emergency to declare should be consistent with the EMP and described in an appendix to the facility emergency plan.

3.2 Emergency Process

Describe the command and control system used to manage the onsite response and the relationship to the national command and control system and, if appropriate, how it will function in the event of simultaneous response under other on-site plans (e.g. security plan). This should include a single on-site emergency manager and integration, as soon as practical, into the off-site ICS command group. Refer to the appropriate implementing procedures that will be used during an emergency to carry out these functions.

3.4 Response communications: Describe systems used for communication with off-site officials, SLAERC and first responders, emergency services, in-plant personnel and facility emergency teams. Describe how continued compatibility of communications will be maintained.

3.5 Taking urgent protective action

Describe the arrangements to promptly recommend off-site protective actions to off-site officials, including criteria based on facility conditions and environmental measurements. Describe the arrangements for protection of on-site personnel. Maps of the on-site area, showing assembly points, sheltered areas, and evacuation routes should be provided in an appendix to the facility emergency plan.

3.6 Providing information, warnings and instructions to the public

Describe the provisions for the on-site organization to support the national response arrangements to perform this function.

3.7 Protecting emergency workers

Describe the arrangements to protect on-site responders against all anticipated hazards.

3.8 Providing medical assistance and mitigating the non-radiological consequences

Describe the on-site arrangements for treatment/first aid, dose reconstruction, decontamination, and transport of injured people and for initial off-site treatment.

3.9 Assessing the initial phase

Describe the on-site system to assess plant conditions and environmental releases used to assess the course of the emergency and determine the event classification and potential off-site consequences. Describe the arrangements for conducting environmental monitoring on and near the site in co-ordination with off-site response, and include the default OILs to be used. Describe the teams available and other organization elements involved and provisions for expert assistance for radiological monitoring.

3.10 Conducting recovery operations

Describe how the transition to recovery operations will be coordinated with off-site officials.

3.11 Maintaining records and management of data: See the outline for the EMP for related guidance.

4. EMERGENCY PREPAREDNESS PROCESS

Describe the arrangements, and the responsible person, to perform the functions listed in the subsections below which are needed to develop and maintain the capability to respond to an emergency as described in the plan. Refer to the appropriate implementing procedures that will be used routinely to ensure these preparedness functions are adequately performed. See the outline of chapter 4 of the EMP for guidance.

Authorities and responsibilities, Equipment and resources, Co-ordination, Plans and procedures, Logistical support and facilities, Training, drills and exercises, Quality, assurance and programme maintenance

REFERENCES LIST OF ABBREVIATIONS DISTRIBUTION LIST

List (and distribute to) all individuals/organizations that are parties to this plan or that will be developing response arrangements that should be consistent with this plan.

APPENDICES: SOP for relevant low level emergencies should be included and use Appendices as required

A.5.3. Mobile source operator's contingency plan/ procedure outline

This outline is for the plan for the operator of a practice involving a dangerous mobile source (e.g. industrial radiography, soil moisture, brachytherapy, or transport). Unlike other plans, the contingency plan for operators of mobile sources should contain the detailed procedures needed for implementation. Include information that should be updated regularly (e.g. phone numbers) as attachments. The procedures should be tested with typical users to ensure that they work under emergency conditions.

1. EMERGENCY RESPONSE

On the title (cover) page write title of the plan, version No., and validation date. Other information such as: author(s) and preparation date, reviewer and review date, responsible manager and approval date, and signatures you may wish to put on the inner (second) page.

1.1 Emergency Conditions

Prominently display the emergencies covered by the plan, e.g. 1) operator injury, 2) suspected overexposure, 3) lost or stolen sources, 4) stuck, damaged, or unshielded source, 5) fire, 6) suspected contamination, and 7) unanticipated or another identified hazard.

1.2 Responsibility

Prominently display who is responsible for implementation and maintenance of this plan. This should include the operator/RPO.

1.3 Cautions

Prominently display the safety steps performed before use of the plan, potential hazards, and protective equipment/measures to be used.

1.4 Immediate Response Actions

Immediate Actions should be listed for specific emergency and separate procedures for each emergency that consists of actions to be taken by the operator should be included. The procedures should follow the outline in SOP's given in EMP Annexure 6.

2. NORMAL STANDING INSTRUCTIONS

2.1 Operator Daily Checks

List the checks that the operator should complete before starting and finishing work. This should list equipment, procedures etc. to be taken to the job site.

2.2 Training and Exercises

Describe the employee training requirements and process, frequency of drills, exercises etc.

2.3 Plan and Equipment Maintenance

Describe arrangements to maintain the contingency plan and equipment, naming the person responsible. This should include calibration and other equipment checks.

DISTRIBUTION LIST

List all individuals and organizations that are to receive the plan. This must include operators, their supervisors and the radiological assessors or radiation protection officers.

APPENDICES: Use appendices as required, Contact list, Information for radiological assessor or radiation protection officer, Notification system to local off-site officials.

APPENDIX 6

LIST OF STANDARD OPERATION PROCEDURES

This Appendix provides lists of "Standard Operation Procedures" for each of the radiological or nuclear emergencies covered under this EMP. These procedures delineate the major response actions to be taken by selected response organizations. Possible radiation emergencies identified in Sri Lanka under the EP categories III, IV and V are categorized to low, medium and high-level emergencies as described in section 3.3. The SOP for each of the medium or high-level emergencies are given in Annexure 6. All low-level emergencies should be managed by facility itself, therefore the SOP for low level emergencies are not described in this Appendix. However, Appendix 5 provides guidelines for their developments.

A.6.1 Radiation accidents within licensed radiation facilities,

A.6.1.1 Medium level emergencies

SOP 1 : Disconnected or damaged source use for industrial radiography

SOP 2: Radioactive releases from unshielded radioactive materials at the Facility: Contamination of person or object

SOP 3: Dangerous source in a Fire

SOP 4: Accidental medical overexposure

A.6.1.2 High level emergencies

SOP 5 : Loss or damage of a source above D-value given in Annexure 4

SOP 6 : Theft or sabotage of radioactive sources

SOP 7 : Serious overexposure non-medical person

A.6.2 Radiation accidents due to uncontrolled sources & activities in unexpected location Which all are considered as high-level emergencies

SOP 8: Detection of medical symptoms due to radiation exposure

SOP 9: Public contamination or exposure due to orphaned radioactive source found in a public place or any other places

SOP 10: Accidents during transport of radioactive material or sources,

SOP 11: Detonation of a Radiological Dispersal Device (RDD)

SOP 12: Credible or confirmed terrorist threats

SOP 13: Non- credible terrorist threats

SOP 14: Intentional contamination of water supply

SOP 15: Intentional contamination of food and commodities

SOP 16: Radioactive satellite re-entry

SOP 17: Recovery of an uncontrolled dangerous source

SOP 18: Detection of elevated radiation levels

SOP 19: Nuclear Weapon Accident

A.6.3 Wide spread radioactive contamination due to nuclear accident in neighbouring countries is also a high level emergency

SOP 20: Category V or Transnational Emergency

APPENDIX 7

ACCIDENT REGISTRY FORM (REF [19])

Completed by: Response Initiator	WORKSHEET 1 ACCIDENT REGISTRY FORM PART 1	No. _____ 1 of 2

Full Name: _____ Date: _____
(response initiator)

Provide copy to: □ Emergency coordinator/ Manager Time: _____

Name of caller: _____
(Full name)

Member of: □ Public □ Facility staff □ Emergency Services

Organization or address of caller: _____

Telephone no. of caller: _____ Time of call: _____

Accident location: _____
(Facility address or site location)

Accident description:

_____
_____
_____

Public involved: □ YES □ NO
Does the situation require urgent attention? □ YES □ NO

What assistance is required?

_____

What advice was given (by phone):

_____

Call verified: □ YES □ NO

ACCIDENT REGISTRY FORM - PART 2

Source details Radionuclide(s)/Activity: Sealed: □ capsule □ foil □ pencil □ other Unsealed: □ liquid □ gas □ solid □ powder Generators: kV mA	Type of location Factory: making Laboratory: type Office: function Public place:
Type of equipment □ Diagnostic X ray □ Veterinary X ray □ Teletherapy □ Brachytherapy □ Nuclear medicine □ Baggage inspection □ Gamma radiography □ X-radiography □ Irradiator □ Thickness gauge □ Level gauge □ Density/moisture gauge □ X ray optics □ Unsealed source □ Smoke detectors □ Static eliminators □ Lab sealed sources □ Radioactive waste □ Tracers □ Processing of ore □ Scrap metal recycling □ Other (specify) □ Unknown	Nature of emergency □ Found source □ Found contamination □ Unshielded source □ Damaged source □ Missing source □ Laboratory spill □ Transport □ Dispersion of activity □ Illicit trafficking □ Other (specify) □ Unknown
How discovered	Current status Is access being controlled? □ YES □ NO Actions to prevent exposure:
Backtrack Last time source known to be safe: Where did it come from: Source owner:	Radiological hazards (M-Maybe) □ Significant radiation dose □ Inhalation hazards M □ Contaminated restricted areas M □ Release to the environment M □ Potential for dispersion M
Conventional hazards (M-Maybe) □ Fire M □ Explosives M □ Chemicals M □ Vapour, fumes M □ Other (specify)	Medical effects (N- Number ,M-Maybe) □ Injured persons N:_____ M □ Death N:_____ M □ Exposed individuals N:_____ M □ Contaminated individuals N:_____ M
Challenges to monitoring (M-Maybe) □ Explosive atmosphere M □ Static M □ RF M □ Water M □ Other (specify)	Other data (e.g. transport label details, dose rate measurement, contamination levels, weather details)

Alerting by: _____ Signature: _____

Provide copy to: □ NEC/Emergency Manager Date: _____

APPENDIX 8

GUIDANCE VALUES FOR RESTRICTING EXPOSURE OF EMERGENCY WORKERS (REF [7])

This Appendix provides guidance values as a basis for operational guidance for restricting the exposure of emergency workers.

Table A.8.1 provides guidance values for restricting the exposure of emergency workers in an emergency response in terms of personal dose equivalent $H_p(10)$ from external exposure to strongly penetrating radiation. The values for $H_p(10)$ in Table A.8.1 assume that every effort has been made for protection against external exposure to weakly penetrating radiation and against exposure due to intakes or skin contamination (see para. 5.53 of Ref 7).

The total effective dose and the relative biological effectiveness (RBE) weighted absorbed dose to a tissue or organ via all exposure pathways (i.e. both dose from external exposure and committed dose from intakes) need to be estimated as early as possible in a nuclear or radiological emergency. Table A.8.1 also provides guidance on the effective dose and the RBE weighted absorbed dose to a tissue or organ for consideration in restricting further exposure in the response to a nuclear or radiological emergency once these doses have been estimated.

Severe deterministic effects to a fetus could possibly occur following an equivalent dose to the fetus of greater than 100 mSv. Consequently, in the response to a nuclear or radiological emergency, female workers who are aware that they are pregnant or who might be pregnant need to be informed of this risk and excluded from taking actions that might result in an equivalent dose to the embryo and fetus exceeding 50 mSv for the full period of in utero development of the embryo and fetus.

Table A.8.1. Guidance Values for Restricting Exposure of Emergency Workers

Tasks	Guidance Value [a]		
	H_p (10) [b]	E[c]	AD $_T$[d]
	< 500 mSv	<500 mSv	< AD_T [d,e]
Lifesaving actions	This value may be exceeded — with due consideration of the generic criteria in Table A.2.1 of Appendix 2 — under circumstances in which the expected benefits to others clearly outweigh the emergency worker's own health risks, and the emergency worker volunteers to take the action and understands and accepts these health risks		
Actions to prevent severe deterministic effects and actions to prevent the development of catastrophic conditions that could significantly affect people and the environment	<500 mSv	<500 mSv	$<\frac{1}{2}AD_T$[d,e]
Actions to avert a large collective dose	<100 mSv	E < 100 mSv	$<\frac{1}{10}AD_T$[d,e]

a

These values are set to be two to ten times lower than the generic criteria in Table A.2.1 of Appendix 2 and they apply for:

1. The dose from external exposure to strongly penetrating radiation for $H_p(10)$. Doses from external exposure to weakly penetrating radiation and from intake or skin contamination need to be prevented by all possible means. If this is not feasible, the effective dose and the RBE weighted absorbed dose to a tissue or organ have to be limited to minimize the health risk to the individual in line with the risk associated with the guidance values given here.
2. The total effective dose E and the RBE weighted absorbed dose to a tissue or organ AD_T via all exposure pathways (i.e. both dose from external exposure and committed dose from intakes) which are to be estimated as early as possible in order to enable any further exposure to be restricted as appropriate.

b

Personal dose equivalent $H_p(d)$ where d = 10 mm.

c

Effective dose.

d

RBE weighted absorbed dose to a tissue or organ.

e

Values of RBE weighted absorbed dose to a tissue or organ is given in Table A.2.1 of Appendix 2.

All reasonable steps shall be taken to provide appropriate protection and to record the doses received by emergency workers. When an emergency is over, the doses received and consequent health risks must be communicated to the workers involved.

Workers should not normally be prevented from incurring further occupational exposure because of doses received in an emergency situation. However, qualified medical advice should be obtained before any further exposure is incurred if a worker has undergone emergency exposure ten times the maximum single year dose limit (500 mSv) or at a worker's request.

APPENDIX 9

THE TYPES OF EXCERCISES USED TO TEST EMERGENCY PROCEDURES (REF 11)

A.9.1. Types of exercises

The exercises can be categorized in to several parts and this includes drills, tabletop exercises, partial and full-scale exercises as well as field exercises. The preparation and conduct of each varies in complexity, scope, and objectives.

A.9.1.1 Drills

The drill is small directed exercise and the purpose is learning or testing a small portion of the plan or procedures. Drills normally involve small groups of persons in a learning process designed to ensure that essential skills and knowledge are available for the accomplishment of non-routine tasks such as emergency radiation measurements or the use of emergency communication procedures. A drill is conducted primarily as a training tool to develop and maintain skills in certain basic operations or tasks, or to reinforce a skill or practice or review a procedure. A drill can also be used to assess the adequacy of personnel training and is usually supervised and evaluated by qualified instructors. It normally covers a particular one component, or a group of related components, associated with the implementation of the EMP or facility or stakeholder emergency plans. It may also be a subcomponent of an integrated exercise, for example, fire and first aid drills.

Several types of drills can be conducted. The type of drill to be used depends on the function being practiced and the group being trained. Drills are primarily used for training and should be conducted several times per year. According to exercise plan of Sri Lanka drills can be included to test the training material.

The use of live radioactive sources in drills can also be included if the training is organized by SLAERC or SLAEB or facility under the supervision of Radiation Protection Officer (RPO). In this case, safety is paramount and close supervision is required. Some of the examples of the drills are Activation drill, Survey drill, Medical drill, Decision-making drill, source recovery drill, communication drill etc

A.9.1.2 Table top exercises

A tabletop exercise is a discussion-type exercise conducted around a table. All the participants are in the same room or building (players, controllers, evaluators, and observers). Therefore, no communication link with any outside body is necessary. Tabletop exercises are not usually conducted in real time. Their main focus is on decision-making, assessment, public and media communication policy definition, and implementation.

Therefore, a tabletop exercise may also be the most appropriate exercise for:

- identifying, understanding and evaluating new response issues;
- developing new response concepts;
- trying new response concepts or new response areas;
- formalizing new concepts, plans, procedures, arrangements and systems;
- improving the mutual understanding between stakeholders in emergency situations, particularly when those stakeholders typically don't interact routinely (e.g. international response).

Key points in the preparation and conduct of a tabletop exercise include the following:

- define the objectives of the tabletop exercise;
- prepare a clear scenario, including all associated data, that meet the objectives of the table-top;

- clearly identify and prepare all logistics requirements, i.e. data presentation, communications, tools required by the players, etc.;
- organize the room so that it is clearly perceived by the players to be the setting of an exercise and NOT a meeting;
- ensure all the players are introduced and that their roles and responsibilities are clearly understood by all;
- clearly explain that the goal of the table-top is to assess and try to make decisions and that these decisions will be used for improving the overall emergency preparedness; avoid never-ending discussions.
- explain that the players are accountable for their contribution;
- explain that the discussions will be recorded.

These rules make tabletop exercises very different from trainings and workshops. In a workshop or training, participants tend to be in a receiving and discussing mode. In a tabletop, they need to be proactive and concrete. The table top has given the players a hands-on experience of the onsite or off-site decision making during an emergency at a selected incident, and how the guidance provided in the emergency preparedness plan or procedures and associated training material can be used to achieve an effective decision to protect the people and environment. This is done without deployment of resources and used mainly for decision-makers.

A.9.1.3 Partial and full-scale exercises

Partial and full-scale exercises are simulations used to allow a number of groups and organizations to act and interact in a coordinated fashion. The focus of partial and full-scale exercises is on coordination and cooperation.

Exercises can be partially or fully integrated. In a partial exercise, only selected stakeholder response organizations and interfaces are activated. The rest can be simulated. For example, a partial exercise may involve only the on-site or the immediate response components of the emergency organization, with the off-site organizations being simulated. Another partial exercise may involve only the off-site component of the emergency organization, with the on-site response being simulated.

The most demanding and exhaustive test of emergency response capability is an integrated full-scale exercise involving the full participation by all on-site and off-site response organizations. Its major objective is to verify that the overall coordination, control, interaction, and performance of the response organizations are effective and that they make the best use of available resources.

Exercises can vary in magnitude and scope. In the case of a fixed radiation facility, on-site exercises test the ability of the facility staff to deal with facility problems. An on-site exercise can also test on-site and off-site interaction mechanisms and media relations, but unless off-site organizations are actually involved, they must be simulated and the value of the interface portion of the exercise remains low.

Off-site exercises similarly test the off-site portions of the response and unless the facility participates, it must be simulated, and the interface aspects of the response are not truly tested.

A combined on-site and off-site exercise is effective in testing both the individual on-site and offsite responses and the interface mechanisms in place, which are so important to a proper overall response. In fact, the interface aspects, where successes are usually critical for protecting the population, are often the weak link in the emergency response system.

In the case of an EPR category IV practice (e.g. transportation, large-scale contamination, and lost or stolen sources), there is no fixed facility, and exercises will always take place “off-site.” Only EPR III and especially category V should be tested off site response.

A.9.1.4 Field exercise

Field exercises focus on the tasks and coordination of "field resources". Field resources are defined as those people and teams that must operate at or around the site of an emergency. For example, a field exercise could be conducted to evaluate the integrated performance of survey teams, police, medical first aid and firefighting teams.

A field exercise can be conducted on its own or combined with a partial or full-scale exercise. In the first case, the emphasis is on team procedures and coordination between several teams with a common task. In the second case, the focus is on communications and coordination between the field resources and the decision-making components of the emergency organization. However, field and table-top exercises are often conducted in different time modes, and the exercise organizers need to take this into consideration in the exercise schedule.

A.9.2 Details of IAEA exercise system [Ref 9]

As a member state Sri Lanka should participate to IAEA convex exercises and NEC of SLAERC is responsible to register and arrange of the participation of the IAEA convex exercises according to the relevancy to the country. The exercises are categorized as below and IAEA has informed to member states in advance.

ConvEx-1: this type of exercise uses to test that NWP's are continuously available, whether fax contacts and USIE alert channels are accurate and that Contact Points can access USIE properly.

ConvEx-1a: to test that National Warning Points for receiving notifications are available continuously. The IEC informs all Contact Points in advance of a ConvEx-1a that it plans to conduct this exercise at least 14 days before the exercise will be conducted. It is expected that Contact Points activate their alert channels on the USIE Exercise web site so they can practice using these. The exact date and time of this exercise are not announced; however, the month in which this exercise is conducted is indicated in the exercise schedule published on USIE.

Once per year, the IEC sends an exercise message by fax to all NWPs and NCA (A) s. A corresponding event is published on the USIE Exercise web site and USIE Exercise notifications are sent over the USIE Exercise alert channels to all National Warning Points and National Competent Authorities. It is expected that:

- NWPs send an acknowledgement of receipt by fax or email within 30 minutes to the IEC; and
- NCA (A) s, no later than their next working day, access the USIE Exercise web site and acknowledge the exercise message on the USIE Exercise web site.

ConvEx-1b: to test that National Warning Points are available continuously and that National Competent Authorities can promptly respond to received notifications.
The IEC informs all Contact Points in advance of a ConvEx-1b that it plans to conduct this exercise within the next 14 days. Contact Points activate their alert channels on the USIE Exercise web site so they can practice using these channels. The exact date and time of the exercise is not announced; however, the month in which this exercise is conducted is indicated in the exercise schedule published on the USIE web site.

Once per year, the IEC sends an exercise message to all Contact Points by fax, publishes an event on the USIE Exercise web site and requests acknowledgments on the USIE Exercise web site. It is expected that:

1. NWPs send an acknowledgement of receipt by fax within 30 minutes to the IAEA's IEC;
2. NWPs promptly alert the relevant NCA(A)s;

3. As soon as possible, the relevant NCA(A)s access the USIE Exercise web site, read and acknowledge the message on this site. The target time for acknowledgement of the message on the USIE Exercise web site is 2 hours.

ConvEx-1c: to validate the USIE Administrators' access to USIE

USIE Administrators have the right to change their organization's alert channels on the USIE and USIE Exercise web sites. This is an important function and therefore, the IEC contacts all USIE Administrators once per year by email and ask them to confirm their ability to access USIE and change the settings.

Each USIE Administrator needs to send a confirmation email to the USIE Contact Point.
Unsuccessful email deliveries are followed up with the relevant organization to identify a new administrator, if needed.

ConvEx-1d: to test the IAEA's emergency communication channels

Any Contact Point may send a test message by fax to the IEC not more frequently than once per quarter without prior arrangement, and the IEC returns a simple acknowledgement of receipt on or before the next working day. No other States are involved in this action.

ConvEx-2: to test whether National Competent Authorities can appropriately fill out reporting forms and to drill the appropriate procedures for information exchange and requesting and providing assistance.

ConvEx-2a: to test the ability of National Competent Authorities to complete the appropriate reporting forms

This exercise is conducted once per year on an announced date. Prior to the exercise, the IEC invites all NCAs to participate. In the registration process, the IEC asks for the participants' communication details, so that the IEC can send the exercise messages by fax or email to registered Contact Points, as the IEC does not need to use the primary communication channels for sending the exercise messages. On the day of the exercise, the IEC sends out the exercise messages, which are parts of a scenario in descriptive form, starting at three different times of day: 04:00 UTC for the Asian region, 10:00 UTC for the European/African region and 16:00 UTC for the American region. The exercise requires the NCAs to complete the appropriate forms based on the exercise messages on the USIE Exercise web site.

The NCAs are to complete the forms during their normal working hours and submit them to the USIE Exercise web site.

ConvEx-2b: to test the arrangements for a request and the provision of assistance

This exercise is conducted once per year on an announced date. The IEC invites NCAs to participate and to coordinate the participation of relevant national capabilities in the exercise. This exercise specifically addresses Contact Points with registered RANET capabilities, but also encourages the participation of other Contact Points who plan to join the RANET network. This exercise is conducted over a maximum of three days. However, the exercise is not run in real time and all counterparts and the IEC can perform their exercise activities during their normal working hours. The ConvEx-2b is conducted jointly with relevant international organizations.

The IEC invites the NCAs of IAEA Member States to coordinate the communication of information and requests for advice and assistance for a hypothetical situation in their State. The IEC provides input messages in advance if needed.

The IEC forwards messages from the Accident State to participating Contact Points. It is expected that other participating NCAs review the information and decide whether they are in a condition to render the requested assistance, taking all technical and administrative constraints and capabilities into account. The completion of an Assistance

Action Plan is tested. The IEC and participating NCA(A)s use appropriate communication means to exchange information and to simulate the provision and coordination of international assistance to the requesting State.

ConvEx-2c: to test arrangements for a transnational radiological emergency

This exercise is conducted once every two years on a specified announced date and lasts no more than 8 hours (elapsed time). In advance of this exercise, the IEC invites all Contact Points to participate in this exercise, which is not conducted in the same year as a ConvEx-3 exercise.
The IEC invites the NCAs of an IAEA Member State – 'the Accident State' – to communicate messages for a hypothetical radiological emergency in their State. The IEC provides input messages in advance if needed. The scope of the exercise may include testing bilateral or other multilateral arrangements through the use of the USIE Exercise web site.
The IEC forwards messages from the Accident State to participating Contact Points, and publishes the information submitted on USIE Exercise. It is expected that other participating NCAs access information on the USIE Exercise web site and confirm that they have read and understood messages and respond appropriately to any requests for advice or information.

ConvEx-2d: to test arrangements for a transnational nuclear emergency

This exercise is conducted once every four years on a specified announced date and lasts no more than 8 hours (elapsed time). In advance of this exercise, the IEC invites all Contact Points to participate. This exercise is conducted jointly with the WMO and is expected to involve national meteorological services. A ConvEx-2d is not conducted in the same year as a ConvEx-3 exercise.

The IEC invites the NCAs of an IAEA Member State – 'the Accident State' – to communicate messages for a hypothetical nuclear emergency in their State. The Secretariat provides exercise input messages in advance, if needed. The scope of the exercise does not include testing bilateral or other multilateral arrangements.

The IEC forwards messages from the Accident State to participating Contact Points, and publishes the submitted information on USIE Exercise. It is expected that other participating NCAs access information on the USIE Exercise web site, confirm they have read and understood messages and respond appropriately to any requests for advice or information.

ConvEx-2e: To test the IAEA's assessment and prognosis process

Conducted at the request of a Member State. The scope of the IEC play is agreed in advanced interact through emergency communication channels; request additional technical information as required; share the IAEA's assessment and prognosis of the situation, when relevant; work with counterparts to produce harmonized messages for other Member States, IOs, the media and the public. Provides an opportunity to practice interacting with the IAEA to produce harmonized assessment and prognosis messages

Convex 3: to test the full operation of the information exchange mechanisms and requesting and providing assistance

A large-scale exercise is conducted once every three to five years. Details are announced to States in advance. All States Parties to the Early Notification Convention are strongly encouraged to participate. Such an exercise is coordinated with exercise plans of other

international organizations through the IACRNE[1]. Member States that have adopted the arrangements of this manual are encouraged to volunteer as host for a ConvEx-3 exercise. The exercise scenario needs to simulate a nuclear or radiological emergency involving a significant release of radioactive material into the environment requiring off-site protective actions and having transnational impact or a nuclear or radiological emergency triggered by a criminal act and involving significant radiological consequences requiring protective actions. The scenario may involve requesting assistance and the provision of assistance. States do not need to set up a specific exercise to host a ConvEx-3 exercise, but are encouraged to review their plans to conduct national exercises and may decide on offering such a national exercise as the basis for a ConvEx-3 exercise. Experience has shown that the arrangements for international communication exchange were improved significantly after such exercises. The host country will be involved at the international level in the preparations for the exercise.

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DEFINITIONS

The following definitions apply for the purposes of this EMP.

Accident: Any unintended event, including operating errors, equipment failures or other mishaps, the consequences or potential consequences of which are not negligible from the point of view of protection or safety.

Action level: The level of dose rate or activity concentration above which remedial actions or protective actions should be carried out in chronic exposure or emergency exposure situations. An action level can also be expressed in terms of any other measurable quantity as a level above which intervention should be undertaken.

Arrangements (for emergency response): The integrated set of infrastructural elements necessary to provide the capability for performing a specified function or task required in response to a nuclear or radiological emergency. These elements may include authorities and responsibilities, organization, co-ordination, personnel, plans, procedures, facilities, equipment or training.

Credible Threat-This includes bomb threats, bombings, Sabotage, attacks, kidnapping, hostages taking, theft of radioactive or fissionable material, or suspicious acts potentially resulting in an actual or perceived radiation emergency.

Non-Credible Threat- Not considered as credible threat includes information supplied by an informant or undercover-agent, confession of an accomplice or associate, the sale or offer of sale, of radioactive or fissile materials or radiological expertise, Discovery of missing or stolen radioactive fissile materials, Discovery of radioactive materials being stored or transported illegally, Interception of communication between criminal parties, Intelligence from another state.

Dangerous source: A source that could, if not under control, give rise to exposure sufficient to cause severe deterministic health effects. Activity of amount of radioactive material equal to or above the D-values given in the Annexure 4.

Decorporation: is the action of the biological processes, facilitated by chemical or biological agents, by means of which incorporated radionuclides are removed from the human body. The generic criterion for decorporation is based on the projected dose without decorporation.

Deterministic effect: Radiation induced health effects which are demonstrated by severity of health effect which is certain to happen.

Emergency: A non-routine situation or event that necessitates prompt action, primarily to mitigate a hazard or adverse consequences for human life, health, property or the environment.

- This includes nuclear and radiological emergencies and conventional emergencies such as fires, releases of hazardous chemicals, storms or earthquakes.
- This includes situations for which prompt action is warranted to mitigate the effects of a perceived hazard.

Emergency Action Level (EAL): A specific, predetermined, observable criterion used to detect, recognize and determine the emergency type.

Emergency Planning Distance. The extended planning distance (EPD) and the ingestion and commodities planning distance (ICPD).

Emergency Planning Zone. The precautionary action zone (PAZ) and the urgent protective action planning zone (UPZ).

Emergency Preparedness. The capability to take actions that will effectively mitigate the consequences of an emergency for human life, health, property and the environment.

Emergency Response. The performance of actions to mitigate the consequences of an emergency for human life, health, property and the environment. The emergency response also provides a basis for the resumption of normal social and economic activity.

Emergency Services: The local off-site response organizations that are generally available and that perform emergency response functions. These may include police, fire and rescue brigades, ambulance services, and control teams for hazardous materials.

Emergency Type: A set of conditions that warrant a similar immediate emergency response. The term used for communicating to the response organizations and the public the level of response needed. The events that belong to a given emergency class are defined by criteria specific to the installation, source or practice, which if, exceeded indicate classification at the prescribed level. For each emergency type, the initial actions of the response organizations are predefined.

Emergency Worker: A worker who may be exposed in excess of occupational dose limits while performing actions to mitigate the consequences of an emergency for human health and safety, quality of life, property and the environment.

Epidemic: a widespread occurrence of an infectious disease in a community at a particular time

Facility Emergency: Emergency Occurred at the radiation facility and consequences only limited to on site

First Responders: The first members of an emergency service to respond at the scene of an emergency.

Graded Approach- (1) For a system of control, such as a regulatory system or a safety system a process or method in which the stringency of the control measures and conditions to be applied is commensurate, to the extent practicable, with the likelihood and possible consequences of and the level of risk associated with, a loss of control.
(2) An application of safety requirements that is commensurate with the characteristics of the facilities and activities or the source and with the magnitude likelihood of the exposures.

Hazard Assessment: The process of analysing systematically the hazards associated with facilities, activities or sources within or beyond the borders of a State in order to identify:

1. Those events and the associated areas for which protective actions and emergency countermeasures may be required within the State; and
2. The actions that would be effective in mitigating the consequences of such events.

Incident Commander: The person in charge of the emergency response at emergency site.

Longer Term Protective Action: A protective action, which is not an urgent protective action. Such protective actions are likely to be prolonged over weeks, months or years. These include measures such as relocation, agricultural countermeasures and remedial actions.

National Emergency: Consequences spread to off site and many stakeholders are involved to control the emergency

National Emergency Coordinator: The person who is responsible for national emergency preparedness, response coordination.

National Warning Point: A contact point that is staffed or able to be alerted at all times for promptly responding to, or initiating a response to an incoming notification, warning message, request for assistance or request for verification of a message, as appropriate, from the IAEA.

Non-Radiological Consequences: Effects on humans or the environment that are not deterministic or stochastic effects. These include effects on health or the quality of life resulting from psychological, social or economic consequences of the emergency or the response to the emergency.

Nuclear or Radiological Emergency: An emergency in which there is, or is perceived to be, a hazard due to: The energy resulting from a nuclear chain reaction or from the decay of the products of a chain reaction; Radiation exposure.

Off-Site: Outside the site area.

On-Site: Within the site area.

Operational Intervention level (OIL): A calculated level, measured by instruments or determined by **laboratory** analysis that corresponds to an intervention level or action level. OILs are typically expressed in terms of dose rates or of activity of radioactive material released, time integrated air concentrations, ground or surface concentrations, or activity concentrations of radionuclide in environmental, food or water samples. An OIL is a type of action level that is used immediately and directly (without further assessment) to determine the appropriate protective actions on the basis of an environmental measurement.

Operator (or operating organization): Any organization or person applying for authorization or authorized and/or responsible for nuclear, radiation, radioactive waste or transport safety when undertaking activities or in relation to any nuclear facilities or sources of ionizing radiation.

Protective Action: An intervention intended to avoid or reduce doses to members of the public in emergencies or situations of chronic exposure.

Radiation Emergency: A nuclear or radiological emergency.

Radiological Dispersal Device (RDD): A device constructed by terrorists to spread radioactive materials using conventional explosives or other means.

Relative Biological Effectiveness (RBE): Relative biological effectiveness is the ratio of biological effectiveness of one type of ionizing radiation relative to another, given the same amount of absorbed energy. The RBE is an empirical value that varies depending on the particles, energies involved, and which biological effects are deemed relevant.

Response Organization: An organization designated or otherwise recognized by a State as being responsible for managing or implementing any aspect of a response.

Source: Anything that may cause radiation exposure — such as by emitting ionizing radiation or by releasing radioactive substances or materials — and can be treated as a single entity for protection and safety purposes.

Standard Operation Procedures: A set of actions describing in detail to be taken by response organizations in an emergency.

Stochastic Effect: Radiation induced health effects which are demonstrated by probability of cancer and genetic damage.

Urgent Protective Action: A protective action that, in the event of an emergency, must be taken promptly (normally within hours) in order to be effective, and the effectiveness of which will be markedly reduced if it is delayed. The most commonly considered urgent protective actions in a nuclear or radiological emergency are evacuation, decontamination of individuals, sheltering, respiratory protection, iodine prophylaxis, and restriction of the consumption of potentially contaminated foodstuffs.

Worried-Well: A person who has received neither sufficient radiation exposure nor been sufficiently contaminated to warrant medical treatment or decontamination but who is worried and wishes to be assessed for radiation exposure/ contamination

For further definitions see IAEA Safety Glossary.

ABBREVIATIONS

ALARA	As Low as Reasonably Achievable
ALMERA	Analytical Laboratories for the Measurement of Environmental Radioactivity
BCP	Business Continuity Plan
CAA	Civil Aviation Authority
CAS	Central Alarm Station
CBRN	Chemical, Biological, Radiological and Nuclear
CEA	Central Environmental Authority
Convex	Convention Exercises
DET	Decontamination and Contamination Measurement Team
DG	Director General
DOM	Department of Meteorology
DMC	Disaster Management center
DPRD	Disaster Preparedness and Response Division
EAL	Emergency Action Level
EASY	European Commission
ECG	Emergency Coordination Group
EM	Emergency Manager
EMP	Emergency Management Plan
EOC	Emergency Operation Center
EP	Emergency Preparedness
EPC	Emergency Preparedness Categories
EPD	Emergency Planning Distance
EPR	Emergency Preparedness and Response
EPZ	Emergency Planning Zone
EST	Emergency Sampling and Food Monitoring Team
FAO	Food and Agriculture Organization of the United Nations
FPB	Fast Petrol Board
FR	First Responder
FT	Field Team
GSR	Generic Safety Requirements
HE	His Excellency
IAEA	International Atomic Energy Agency
ICAO	International Civil Aviation Organization
ICPD	Ingestion and Commodities Planning Distance
ICS	Incident Command System
IEC	Incident and Emergency Center
IEComm	Incident and Emergency Communication
INES	International Nuclear or Radiological Event Scale
INGO	International Non-Governmental Organization
IRMIS	International Radiation Monitoring Information System
LAS	Local Alarm Station
MEPA	Marine Environmental Protection Authority
MOA	Ministry of Agriculture
MOD	Ministry of Defense

MODM	Ministry of Disaster Management
MOF	Ministry of Fisheries
MOFA	Ministry of Foreign Affairs
MOH	Ministry of Health
MOU	Memorandum of Understanding
MOMM	Ministry of Mass Media
NARA	National Aquatic Resources Authority
NCA	National Competent Authority
NCA (A)	National Competent Authority for an Emergency abroad
NCA (D)	National Competent Authority for a Domestic Emergency
NDEWS	Nuclear Disaster Early Warning System
NEA	Nuclear Energy Agency of the OECD
NEC	National Emergency Coordinator
NEOP	National Emergency Operation Plan
NRERC	National Radiological Emergency Response Committee
NGO	Non-Governmental Organization
NHSL	National Hospital of Sri Lanka
NPP	Nuclear Power Plant
NSC	National Steering Committee
NWP	National Warning Point
NWSDB	National Water Supply and Drainage Board
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
OECD	Organization for Economic Corporation and Development
PAZ	Precautionary Action Zone
PIC	Public Information Officer
POC	Point of Contact
PPE	Personnel Protective Equipment
RANET	Response and Assistance Network
RBE	Relative biological effectiveness
RDD	Radiological Dispersal Device
RPM	Radiation Portal Monitors
RPO	Radiation Protection Officer
RST	Radiation Monitoring and Survey Team
RTG	Radioisotope Thermoelectric Generator
SIS	Secondary inspection Site
SLAEB	Sri Lanka Atomic Energy Board
SLAERC	Sri Lanka Atomic Energy Regulatory Council
SLCG	Department of Sri Lanka Coast Guard
SLPA	Sri Lanka Ports Authority
SLTB	Sri Lanka Transport Board
SOP	Standard Operation Procedures
SPM	Spectroscopy Portal Monitor
STF	Special Task Force
TAC	Technical Advisory Committee
TSO	Technical Support Organizations
UN	United Nations

UPZ	Urgent Protective Action Planning Zone
USIE	Unified System for Information Exchange in Incidents and Emergencies
WHO	World Health Organization
WMO	World Meteorological Organization
XRF	X ray Fluorescence

LIST OF ANNEXTURES

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4. Mr. Malinda Piyarathna, Scientific Officer, Sri Lanka Atomic Energy Regulatory Council
5. The representatives from following stakeholder organizations;
    - Disaster Management Center (DMC)
    - Sri Lanka Atomic Energy Board (SLAEB)
    - Department of Meteorology
    - National Water Supply and Drainage Board (NWSDB)
    - Marine Environment Protection Authority (MEPA)
    - National Aquatic Resource Research and Development Agency (NARA)
    - Central Environmental Authority (CEA)
    - Government Analyst's Department
    - Sri Lanka Transport Board
    - Civil Aviation Authority
    - Sri Lanka Customs
    - Sri Lanka Ports Authority (SLPA)
    - Airport Aviation Sri Lanka Ltd
    - Sri Lankan Airlines Ltd;
    - Department of Immigration and Emigration
    - Department of Police including Special Task Force (STF)
    - Municipal Fire Department (Fire Brigade)
    - Sri Lanka Army-CBRN Group
    - Sri Lanka Navy -CBRN Group
    - Sri Lanka Air Force-CBRN Group
    - Sri Lanka Coast Guard
    - National Ambulance Service
    - Ministry of Health

ANNEXURE 1 TO THE EMP

DETAILS OF RADIATION FACILITIES WHICH IS IDENTIFIED FOR EP CATEGORIES TO PREPARE EMERGENCY RESPONSE AS AT 30TH APRIL 2019.

EP Category	Facilities available in Sri Lanka	Locations of Facilities
III	Industrial Irradiation Facilities, Radiotherapy facilities (Teletherapy and brachy therapy), waste storage facility	1. Apeksha Hospital (National Cancer Institute), Maharagama, 2. Teaching Hospital Karapitiya, Galle. 3. General Hospital, Kandy 4. General Hospital, Anuradhapura 5. Provincial General Hospital, Badulla 6. Base Hospital, Tellippalai, Jaffna 7. Sri Lanka Gamma Center, Malwana , Biyagama 8. Ansell Lanka (Pvt.) Ltd; Biyagama 9. Human Tissue Bank, Colombo 10. Asiri Surgical Hospital, Narahenpita 11. Ceylinco Healthcare, Colombo 02 12. Horticultural Research and Development Institute (HORDI), Gannoruwa 13. Waste Storage Facility, Sri Lanka Atomic Energy Board
IV	Mobile dangerous sources such as industrial radiography sources, nuclear gauges etc.	**Industrial Radiography Ir-192 Sources** 1. Refinery Division, Ceylon Petroleum Corporation, Kelaniya 2. Electroref Engineers (Pvt.) Ltd, Colombo 08 3. Colombo Dockyard PLC, Colombo 4. National Centre for Non- Destructive Testing, Kelaniya 5. Indo East Engineering & Construction (Lanka) Ltd, Wattala **Dangerous Mobile sources** 1. Department of Soil Science Faculty of Agriculture, University of Peradeniya 2. Sinohydro Corporation Ltd., Moragahakanda 3. Sugarcane Research Institute, Udawalawa 4. Department of Agricultural Engineering Faculty of Agriculture, University of Ruhuna, Kamburupitiya 5. Department of Export Agriculture, Uva Wellassa University, Badulla 6. EV-Yol Construction Company Ltd., Elle/Bandarawela 7. Moshanir Laboratory, Bandarawela

EP Category	Facilities available in Sri Lanka	Locations of Facilities
V	Nuclear Power Plant, research reactor or nuclear reactor use in ships or submarines as described in Category I or II in Table 1. Power Reactors located in a neighbouring country is within the emergency Planning Distance (<300km) as described in Appendix 1. Nuclear powered vessels visiting territorial waters in Sri Lanka	Any nuclear power plant accident can potentially impact Sri Lanka. However, the biggest impact may have the Kudankulam NPP situated in Kudankulam in Thirunalveli district in India, which is the only one to be categorized as EPC V. The Kudankulam NPP has two units generating 2 x 3000 MW and another two units with the same power under construction. According to distance calculation Sri Lanka is within the 300km distance which is classified as ICPD zone for this NPP as shown in figure An.1.1 Therefore, according to EPR categories this is considered as EPR V category.

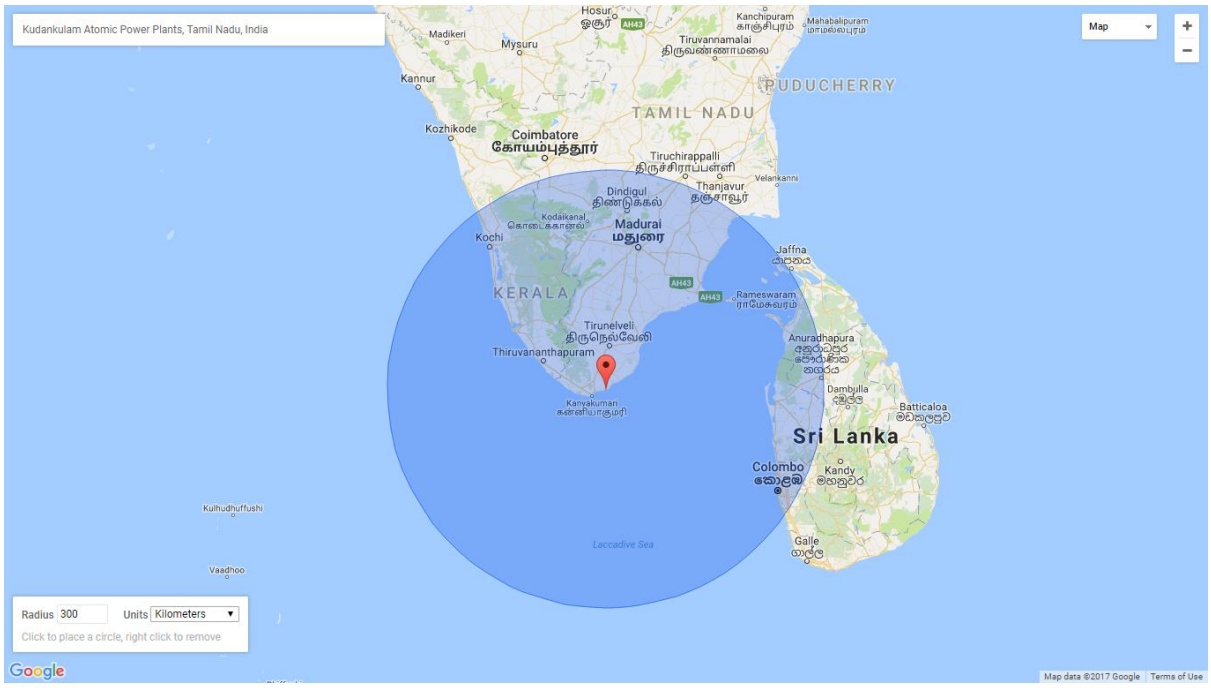

Figure An.1.1 ICPD Zone to nearest NPP to Sri Lanka

ANNEX 2 TO THE EMP
EMERGENCY RESPONSE COMMUNICATION DETAILS (AS AT 30.04.2019)

SLAERC EMERGENCY CONTACT LIST

HOT LINE FIXED: 0112984096 MOBILE: 0718330846

Table An.2.1 Contact Number List of SLAERC Emergency Technical Advisory Committee (TAC)

Name	Designation/Institute	Emergency Role	Telephone Office Hours	Telephone After Office Hours
Chairman	Chairman/SLAERC	Advisory Role	0112987860	-
A Board Member	Board Member,	Advisory Role	0112987860	-
Mr. H. L. Anil Ranjith	Director General (EM) /SLAERC	Lead the Technical Advisory Group, declaration of Emergency, Advice to the Emergency Coordinator	0718111650 0773683940 0112987858	0718111650 0773683940 0112913138
Mr. T.H.S. Shantha	Director-Authorization	Support to the DG to lead the technical Advisory group and lead the group when DG is not available	0718111660 0112984098	0718111660 0112971370
Mr. K.K.P.I.K. Kadadunna	Deputy Director, Emergency Coordinator	Coordination of work as per the directives given by the Technical Advisory committee and National and international emergency preparedness and coordination.	0718330846	0718330846 0362253942
Mr. Kapila De Silva	Deputy Director, Team Leader	Provide information to TAC of safety matters and contamination measurement of personnel and equipment and decontamination	0766685656 0112984097	0766685656
Mr. Sumith Kolombage	Deputy Director, Team Leader	Provide information of field Radiation Survey	0718071372	0718071372 0912246154
Mr. Neel Fernando	Deputy Director, Team Leader	Provide information of Security Incident and results of Food monitoring and Sampling	0777202021	0777202021 0312249510

Table An.2.2 Emergency Coordination Group (ECG)

Name	Designation/ Institute	Role of the Emergency	Contact No's- Office Hours	Contact No's after Office hours
Mr. K.K.P.I.K. Kadadunna **(Team leader)-NEC**	Deputy Director	National Emergency Coordinator, Emergency Contact Point for IAEA NCA (A) and (D), Initial Notification Point –Local Emergencies, Coordinator for other agencies, Facilitator for Advisory Committee.	0718330846	0362253942 0718330846
Ms. Kaushalya Gamage	Scientific Officer	Supporting role for NEC, Meteorological Data Collection, and Gathering of worldwide data. Coordination of other emergency groups. Alternative NEC	0718305749	0718305749 0352266851
Mr. W.M.D. Malinda Piyarathna	Scientific Officer	Supporting role for NEC, Maintenance of Emergency equipment, IT support. Develop the relevant emergency response procedures, collection and provide details of emergency coordinator during emergency.	0716286064	0716286064 0453450617
Ms. Asoka Dunusinghe	Admin Officer	Human resource management as needed and logistical support to the emergency response. Coordinate with other relevant officers and get their support to manage the activities	0718151083	0718151083 0112828647
Management Assistants, supporting staff and all drivers		Assist to Admin officer and other work assigned to them	-	-

Table An.2.2 Contact list of International Atomic Energy Agency

Institute	Telephone	Fax	Contact Person
International Atomic Energy Agency, Incident & Emergency Centre (IEC)	00431260022026 00431260022745 Mail: iec3@iaea.org	004312600729309	Duty Officer

Table An.2.3 Contact List of First Responders

Institute	Telephone	Fax	Contact Person
Police Head Quarters Information room Duty Officer, Command room	011 2421111 0112854931 0112854893 0112854880	0112440440	NOT SPECIFIC
Police Emergency Service	119 or 0112433333	-	NOT SPECIFIC
Special Task Force (STF)-Hot line Operational Room 24 h	0112580518	0112588499	Duty Officer
Colombo Fire Brigade Mr. P. D. K. A. Wilson	011 2422222 0112422223 110 0718233602 0112678928	0112692222	NOT SPECIFIC DEPUTY CHIEF FIRE OFFICER
Army Head Quarters Major Asanka Hidellaarchchi	011 2432682-5 0773626121	0112434862	NOT SPECIFIC
SL Navy	Navy Head Quarters (0112445368 0112212230)	0112441454	DUTY STAFF OFFICER
	SLNS Rangalla Operations room (0112213650)	0112432929	OPERATIONS ROOM OFFICER
Air force Head Quarters	0112495495	0112343969	NOT SPECIFIC

Table An.2.4 Contact List of National Emergency Services

Emergency Service	Telephone
National Help Desk	118
Government Help Desk	1919
Accident Service General Hospital	011 2691111
Ambulance Service St. John	011 2437744, 0777805944 (Hotline)
Bomb Squad -Army	011 2434251
Sri Lanka Coast Guard Mr. D. T. Rajapaksha	0 412 260 265/0412 260 268/0412 260 267/0412 260 312/0412 254 752 0717298095/0715877879
Crimes Division, Police	011 2333496
Emergency Police Mobile Squad	011 5717171
Electricity Break Down	011246660, 4617575 / 1987 24 h hotline- 0115988988
Red Cross Ambulance	011 2691095
Sri Lanka Telecom	1212
Government Ambulance Service	1990
National Blood Bank	0112369931, 011 2368070

Table An.2.5 Other relevant Institutions

Institute	Telephone	Fax	Contact Person
Disaster Management Centre (DMC) Director General (DG) Emergency Operation Centre (EOC) Disaster Emergency Hotline Mr. Chathura Liyanaarachchige	011 2136136 0112136100 011 2136000 0773957900 0773957903 0773957901 0718134298	011 2670079 0112670048 0112670079	Commodore AAP Liyanage-Director EOC Assistant Director (Preparedness)
Disaster Prevention Unit, Ministry of Health	0113071073 0711071979 0777846226	0112686113	REPONSIBLE MEDICAL OFFICER DR. H.D.B. HERATH
Sri Lanka Atomic Energy Board (SLAEB)	011 2533427-8 OR 011 2533449	011 2533448	Mr. Prasad Mahakumara (Director)
Department of Meteorology (DOM) Emergency Director- Meteorological data Processing National Early Warning and Meteorological Centre	0112694846 011 2686686 0112686499 0112682661	011 2698311-Director	Ms. A.R. Warnasuriya DD
Sri Lanka Customs	011 2445147	011 2446364	Not Specific
Sri Lanka Ports Authority (SLPA)	Security Control Room (2482612/2482548) and Duty Officer SLPA Fire Brigade Control Room (2482323, 2432332)	011 2440651	Duty Officer
Civil Aviation Authority	0112358830	0112204682	Duty Officer

Table An.2.5 Other relevant Institutions (contd.)

Institute	Telephone	Fax	Contact Person
Department of Immigration and Emigration	HOTLINE: 1962 0115329000 0115329400	0112674621	Controller General of Immigration and emigration
Government Analysts' Department	0112176800 0112786395	0112786394	Government Analyst
National Disaster Relief Services Mr. U. G. S. G. Wijayarathne	0112665258 (HOTLINE) 0714314095	-	Not specific Development officer
Airport Aviation (Sri Lanka) Ltd;	0112264444	0112253187	Chairman
Sri Lankan Airlines Ltd:	0197332324, 0710212324		Operations control Manager, Airlines operations Control Centre (AOCC)
Sri Lanka Transport Board	0117706000, 0112581120 - 4	0112589683 0112586491	
Water Supply and drainage board Mr. Nalin Thewarapperuma	0112638999/2611589 0772984165	0112636449	 Manager Maintenance
Marine Environment Protection Authority (MEPA)	0112690604, 0112690605	0114615960	
National Aquatic Resource Research and Development Agency (NARA)	0112521000 0112521006	0112521932	
Central Environmental Authority (CEA)	0117877277 - 80		

Table An.2.6 Ministries

Ministry	Telephone	Fax
Ministry of Power and Renewable Energy (MOPE) 24/7 Hotline	0112574922 1901 0719994133	0112574743 0112665170
Ministry of Disaster Management (MODM)	011 2665170	
Ministry of Defence (MOD)	011 2430860-9,	0112472364 (Additional Secretary Technical) 0112324433 (Admin)
Ministry of Foreign Affairs (MOFA)	011 2325371-3 0112325375	011 2446091 0112333450
Ministry of Law and Order and Southern Development (MOLO)	0112186101-4	0112186109
Ministry of Health (MOH) indigenous medicine -Director General of Health Services	011 2694860	0112693869
Ministry of Agriculture (MOA)	011 2869553	011 2868910
Ministry of Provincial Councils and Local Governments (MPCLG)	011 2305326	0112305326
Ministry of Fisheries and Aquatic Resources (MOF&AR)	011 2446183-4	011 2541184
Ministry of Finance and Mass Media (MOMM)	011 2484500, 011 2484600, 011 2484700	011 2449823
Ministry of Mahaweli Development and Environment	0112865452	0112888248
Ministry of City Planning and Water supply	0112177240	0112177242
Ministry of Transport and Civil Aviation	0112187200-1	0112865093 0112187226
Ministry of Higher Education	011 2694486/ 011 2697133/ 011 2697721/ 011 2691378	011 2697239
Ministry of Education	011 2785141-50	

ANNEXURE 3 TO THE EMP
SLAERC EMERGENCY RESPONSE TEAMS AND EQUIPMENT

This annexure provides SLAERC Emergency response teams and their equipment used to response during radiation emergencies.

An.3.1. Emergency Coordination Group (ECG)

Expertise- This team is capable to manage all type of emergencies with coordination of all required resources and have responsibility to coordinate all stakeholders during preparedness.

Resources: Communication equipment
Logistics, Vehicles, Documents
Emergency kit maintenance

An.3.2. Radiation Monitoring and Survey Team: RST

Expertise – This team should have competence and experience within the following areas.

1. Basic radiation protection.
2. Radiation survey and monitoring techniques.
3. Contamination monitoring and mapping techniques.
4. Dose calculation

Radiation survey instruments and sources.

RST1: Low range gamma/ beta survey monitor.
RST2: High range gamma/ beta survey monitor.
RST3: Alpha/ beta contamination monitor or probe
RST4: Neutron dose rate meter.
RST5: Set of check sources.

Sampling equipment

RST7: Portable air sampler.
RST8: Aerosol filter.
RST9: Charcoal cartridges.
RST10: GPS

Personal protecting equipment and supplies per team member

RST11: Self – reading dosimeter
RST12: TLD
RST13: Overall
RST14: Boots
RST15: Respirator full and half face
RST16: Cotton gloves
RST17: Vinyl gloves
RST18: Rubber gloves
RST19: Decontamination kit
RST20: Identification badge
RST21: Torch with batteries

General Supplies for team

RST22: Portable radio (Walkie talkie)
RST23: Cellular phone
RST24: Binoculars
RST25: Radiation warning signs and labels.

General Supplies for team (cont.)

RST26: Writing pads
RST27: Log book
RST28: Work sheets
RST29: Carrying cases for equipment
RST30: Logistics (Vehicle, meals, etc.)

Supporting documents

RST31: Area Maps
RST32: Survey procedure.
RST33: Sampling procedure.
RST34: Personal radiation protection procedure.

An.3.3. DET: Decontamination and Contamination Measurement Team

Expertise – The DET should have competence and experience within the area:

1. Basic radiation protection
2. Personal and equipment decontamination techniques
3. Contamination monitoring of person equipment, vehicle etc.

Radiation survey instrument

DET1: Low range gamma+ beta survey monitor.
DET2: Alpha+ beta contamination monitors or probe.
DET3: Set of check sources.

Personal protection equipment and supplies per team member

DET4: Self reading dosimeter
DET5: TLD
DET6: Overall
DET7: Dust masks (half face filter)
DET8: Full face mask
DET9: Cotton gloves
DET10: Vinyl gloves
DET11: Rubber gloves
DET12: Boots
DET13: Identification Badge
DET14: Torch with batteries

Decontamination equipment and supplies

DET15: Water
DET16: Pressurized water spray
DET17: Wet-dry vacuum cleaner
DET18: Brushes, Swabs, nail brushes
DET19: Shaving soap and brush, razors, hair clippers
DET20: Detergents

Sampling equipment

DET21: Filter paper smears or shears

General equipment

DET22: Portable radio (walkie talkie)
DET23: Cellular phone
DET24: First aid kit
DET25: Plastic sheets, cover
DET26: Paper tissues
DET27: Plastic tape – narrow, wide
DET28: Ordinary waste bags
DET29: Plastic bags for radioactive waste/ (with warning lables)
DET30: Permanent markers (Red, Green, Blue)
DET31: Writing pads
DET32: Radiation warning labels and signs.
DET33: Tags for contaminated equipment
DET34: Logistics
DET35: Log book, work sheets
DET36: Power supply-Generator
DET37: Carrying cases for equipment

Supporting documentation

DET38: Procedure for conducting contamination monitoring and recording results.
DET39: Decontamination procedure.
DET40: Personal radiation protection procedure.
DET41: Instructions to be given to contaminated person.
DET42: Communication procedure.
DET43: Guidance Values

An.3.4. EST: Emergency Sampling and Food Monitoring Team

Expertise – The EST should have competence and experience within the following areas:

1. Basic radiation protection
2. Sampling strategies and sampling techniques
3. Radiation survey and monitoring
4. Dose calculation

Radiation survey instruments and sources

EST1: Low range gamma+ beta survey meter
EST2: Alpha+ beta contamination monitors or probe
EST3: Gamma Spectroscopy System
EST4: Set of check sources

Personal protection equipment and supplies per team member

EST5: Self reading dosimeter
EST6: TLD's
EST7: Overall
EST8: Boots
EST9: Dust marks
EST10: Cotton gloves
EST11: Vinyl gloves
EST12: Rubber gloves
EST13: Decontamination kit.
EST14: Identification Badge

EST15: Torch with batteries

Sampling equipment

EST16: GPS
EST17: Portable air sampler
EST18: Filters (aerosol)
EST19: Charcoal cartridges

Sampling equipment (cont.)

EST20: Soil sampling devices
EST21: Filter paper or shears
EST22: Shovel
EST23: Funnel
EST24: Knives and spoons
EST25: Measuring tape
EST26: Plastic bags
EST27: Plastic containers
EST28: Plastic bottles
EST29: Sample tags
EST30: Permanent markers (Red/Blue/Black or Green)

General equipment

EST31: Portable radio (Walkie talkie)
EST32: Caps
EST33: Cellular phone
EST34: First and kit
EST35: Plastic sheets
EST36: Paper tissues
EST37: Plastic tape
EST38: Writing pads
EST39: Logistics
EST40: Log book/ work sheets
EST41: Carrying cases for equipment

Supporting documentation

EST42: area Maps
EST43: Sampling procedures
EST44: Personal radiation protection procedures
EST45: Communication procedure
EST46: Guidance Values

ANNEXURE 4 TO THE EMP
D- VALUES [REF 8]

The following table consists of all D-values which are taken from the Ref 8. These values help to identify dangerous sources described in SOP's

Table An.4.1 D-values (TBq)

Sources and material[a]		
Radionuclide	D_1[b]	D_2[c]
Ce-141	1.E+00	2.E+01
Ce-144 (Pr-144m, Pr-144)[f]	9.E-01	9.E+00
Pm-147	8.E+03	4.E+01
Eu-152	6.E-02	3.E+01
Eu-154	6.E-02	2.E+01
Gd-153	1.E+00	8.E+01
Tm-170	2.E+01	2.E+01
Yb-169	3.E-01	3.E+01
Re-188	1.E+00	3.E+01
Ir-192	8.E-02	2.E+01
Au-198	2.E-01	3.E+01
Hg-203	3.E-01	2.E+00
Tl-204	7.E+01	2.E+01
Po-210	8.E+03	6.E-02
Ra-226 (progeny) [f]	4.E-02	7.E-02
Th-230	9.E+02	7.E-02[h]
Th-232	UL[e]	UL[e,h]
U-232	7.E-02	6.E-02[h]
U-235(Th-231) [f]	8.E-05[k]	8.E-05 [k]
U-238	UL[e]	UL[e,h]
U Natural	UL[e]	UL[e,h]
U Depleted	UL[e]	UL[e,h]
U Enriched>20%	8.E-05[k]	8.E-05 [k]
U Enriced>10%	8.E-04 [k]	8.E-04 [k]
Np-237(Pa-233)[f]	3.E-01	7.E-02
Pu-238	3.E+02[k]	6.E-02
Pu-239	1.E+00 [k]	6.E-02
Pu-239/Be	1.E+00 [k]	6.E-02
Pu-240	4.E+00 [k]	6.E-02
Pu-241(Am-241) [f]	2.E+03 [k]	3.E+00
Pu-242	7.E-02 [k]	7.E-02 [h]
Am-241	8.E+00	6.E-02
Am-241/Be	1.E+00	6.E-02
Cm-242	2.E+03	4.E-02

Table An.4.1 D-values (TBq) (cont.)

Sources and material[a]		
Radionuclide	D_1[b]	D_2[c]
Cm-244	1.E+04	5.E-02
Cf-252	2.E-02	1.E-01
H-3	UL[e]	2.E+03[g]
C-14	2.E+05	5.E+01
P-32	1.E+01	2.E+01
S-35	4.E+04	6.E+01
Cl-36	3.E+02	2.E+01[h]
Cr-51	2.E+00	5.E+03
Fe-55	UL[e]	8.E+02
Co-57	7.E-01	4.E+02
Co-60	3.E-02	3.E+01
Ni-63	UL[e]	6.E+01
Zn-65	1.E-01	3.E+02
Ge-68	7.E-02	2.E+01
Se-75	2.E-01	2.E+02
Kr-85	3.E+01	2.E+03[i]
Sr-89	2.E+01	2.E+01
Sr-90 (Y-90)[f]	4.E+00	1.E+00
Y-90	5.E+00	1.E+01[j]
Y-91	8.E+00	2.E+01
Zr-95 (Nb-95m/Nb-95)[f]	4.E-02	1.E+01
Nb-95	9.E-02	6.E+01
Mo-99 (Tc-99m)[f]	3.E-01	2.E+01[j]
Tc-99m	7.E-01	7.E+02[j]
Ru-103 (Rh-103m)[f]	1.E-01	3.E+01
Ru-106 (Rh-106)[f]	3.E-01	1.E+01
Pd-103(Rh-103m)[f]	9.E+01	1.E+02
Cd-109	2.E+01	3.E+01
Te-132 (I-132)[f]	3.E-02	8.E-01[j]
I-125	1.E+01	2.E-01
I-129	UL[e]	UL[e,h]
I-131	2.E-01	2.E-01[j]
Cs-134	4.E-02	3.E+02
Cs-137 (Ba-137m)[f]	1.E-01	2.E+01
Ba-133	2.E-01	7.E+01

[a]The amount of material if not controlled in the public domain (i.e. allowing removal of shielding or allowing dispersal) that could give rise to exposure resulting in a permanent injury that would decrease the quality of life.

[b]This is for external exposure and applies to both dispersible and non-dispersible materials. It is the amount of material without shielding that, if carried in a pocket for 10 hours could result in a severe injury (deliver 25 Gy at 2.0 cm in 10 hours) except where the amount needed would be too big to put in a pocket for which it is the amount that could be life threatening if people are near it for a long time (days-weeks) (deliver 0.01 Gy/h at 1 m). Both gamma emissions and bremsstrahlung from beta and conversion electrons were considered. They were based, except for neutron sources, on absorbed dose coefficients from Ref. [25].

[c]This is the quantity of material that if dispersed could deliver long term doses that could result in permanent injuries that decrease the quality of life. Airborne dispersal by fire or explosion, inadvertent ingestion and intentional contamination of water was considered. For low LET emitters, quantities that can result in 6 Gy to the lung, 1 Gy to the red bone marrow, or 5 Gy to the thyroid delivered over two days [2,3,26] following intake and for high LET emitters (e.g. alpha) quantities that can deliver 25 Gy to the lung over one year [27] were considered to deliver long term doses that are at the threshold for the onset of permanent injuries that would decrease the quality of life. The absorbed doses from intake were, except for Cf-252, based on absorbed dose coefficients from Ref. [25].

[e] Unlimited quantity – emergency planning for dealing with radiological consequences is not recommended

[f] It was assumed that this source is up to 10 years old at the time of the emergency and that the D value is the quantity of the parent remaining at the time of the emergency. The D values were calculated considering both the parent and important decay products that are present after up to 10 years (radionuclide shown in parenthesis). Decay products with a half-life of less than 1 year can be assumed to be in equilibrium with their parents

[g] Assumes skin absorption doubles the absorbed dose from intake via inhalation.

[h] Emergencies involving these amounts of these radionuclides may result in airborne concentrations exceeding the immediate danger to life or health concentration for chemical toxicity. Emergency arrangements to deal with the chemical toxicity and perceived risks may be warranted.

[i] The amount of Kr-85 that can deliver 1 Gy from submersion in 0.5 hours if 100% is released into a 300m3 room – the exposure scenario from Ref. [28].

[j] Not a long term concern as it is short lived (has a half life of less than about 7 days) and within one month (and in most cases much less), the radiological hazard will be greatly diminished.

[k] There is no immediate radiation hazard from this material; the D value is established at a level that places them in “Nuclear Material Category II” according to Ref.[29] (10 kg for 10 % U-235; 1 kg for 20% U-235, or 0.5 kg for Pu). These amounts are about one tenth of the amount at which there is a criticality threat. They warrant an immediate response to promptly regain control of lost or stolen material. These and lesser amounts should be physically protected in accordance with Ref. [29].

ANNEXURE 5 TO THE EMP
OILS FOR SCREENING FOOD MILK AND WATER CONCENTRATIONS

Table An 5.1: SCREENING OILs FOR FOOD, MILK AND WATER CONCENTRATIONS FROM LABORATORY ANALYSIS (OIL 5)

OIL	OIL value	Response action if the OIL is exceeded
OIL 5	Gross beta (β): 100 Bq/kg	Above OIL5: Assess using OIL6
	or	Below OIL5: Safe for consumption during the emergency phase
	Gross alpha(α): 5 Bq/kg	

Table An 5.2: RADIONUCLIDE SPECIFIC OILs FOR FOOD, MILK AND WATER CONCENTRATIONS FROM LABORATORY ANALYSIS (OIL 6)

Radionuclide		OIL 6 (Bq/kg)	Radionuclide		OIL (Bq/kg)
H-3		2×10^5	Sc-44		1×10^7
Be-7		7×10^5	Sc-46		8×10^3
Be-10		3×10^3	Sc-47		4×10^5
C-11		2×10^9	Sc-48		3×10^5
C-14		1×10^4	Ti-44	+	6×10^2
F-18		2×10^8	V-48		3×10^4
Na-22		2×10^3	V-49		2×10^5
Na-24		4×10^6	Cr-51		8×10^5
Mg-28	+[a]	4×10^5	Mn-52		1×10^5
Al-26		1×10^3	Mn-53		9×10^4
Si-31		5×10^7	Mn-54		9×10^3
Si-32	+	9×10^2	Mn-56		3×10^7
P-32		2×10^4	Fe-52	+	2×10^6
P-33		1×10^5	Fe-55		1×10^4
S-35		1×10^4	Fe-59		9×10^3
Cl-36		3×10^3	Fe-60		7×10^1
Cl-38		3×10^8	Co-55		1×10^6
K-40		NA[b,c]	Co-56		4×10^3
K-42		3×10^6	Co-57		2×10^4

[a] '+' indicates radionuclides with progeny listed in Table An. 5.3 attached here that are assumed to be in equilibrium with the parent radionuclide and therefore do not need to be considered independently when assessing compliance with OILs.

[b] NA: not applicable.

[c] The dose from ingestion of ^{40}K is considered not to be relevant because ^{40}K does not accumulate in the body and is maintained at a constant level independent of intake [Ref 20].

Table An 5.2: RADIONUCLIDE SPECIFIC OILs FOR FOOD, MILK AND WATER CONCENTRATIONS FROM LABORATORY ANALYSIS (OIL 6) (cont.)

Radionuclide		OIL6 (Bq/kg)	Radionuclide		OIL (Bq/kg)
K-43		4×10^6	Co-58		2×10^4
Ca-41		4×10^4	Co-58m		9×10^7
Ca-45		8×10^3	Co-60		8×10^2
Ca-47	+	5×10^4	Ni-59		6×10^4
Ni-63		2×10^4	Sr-89		6×10^3
Ni-65		4×10^7	Sr-90	+	2×10^2
Cu-64		1×10^7	Sr-91		3×10^6
Cu-67		8×10^5	Sr-92		2×10^7
Zn-65		2×10^3	Y-87	+	4×10^5
Zn-69		6×10^8	Y-88		9×10^3
Zn-69m	+	3×10^6	Y-90		9×10^4
Ga-67		1×10^6	Y-91		5×10^3
Ga-68		2×10^8	Y-91m		2×10^9
Ga-72		1×10^6	Y-92		1×10^7
Ge-68	+	3×10^3	Y-93		1×10^6
Ge-71		5×10^6	Zr-88		3×10^4
Ge-77		6×10^6	Zr-93		2×10^4
As-72		4×10^5	Zr-95	+	6×10^3
As-73		3×10^4	Zr-97	+	5×10^5
As-74		3×10^4	Nb-93m		2×10^4
As-76		4×10^5	Nb-94		2×10^3
As-77		1×10^6	Nb-95		5×10^4
Se-75		4×10^3	Nb-97		2×10^8
Se-79		7×10^2	Mo-93		3×10^3
Br-76		3×10^6	Mo-99	+	5×10^5
Br-77		5×10^6	Tc-95m	+	3×10^4
Br-82		1×10^6	Tc-96		2×10^5
Rb-81		8×10^7	Tc-96m		2×10^9
Rb-83		7×10^3	Tc-97		4×10^4
Rb-84		1×10^4	Tc-97m		2×10^4
Rb-86		1×10^4	Tc-98		2×10^3
Rb-87		2×10^3	Tc-99		4×10^3
Sr-82	+	5×10^3	Tc-99m		2×10^8
Sr-85		3×10^4	Ru-97		2×10^6
Sr-85m		3×10^9	Ru-103	+	3×10^4
Sr-87m		3×10^8	Ru-105		2×10^7
Ru-106	+	6×10^2	Sb-126		3×10^4
Rh-99		1×10^5	Te-121		1×10^5
Rh-101		8×10^3	Te-121m	+	3×10^3
Rh-102		2×10^3	Te-123m		5×10^3
Rh-102m		5×10^3	Te-125m		1×10^4
Rh-103m		5×10^9	Te-127		1×10^7
Rh-105		1×10^6	Te-127m	+	3×10^3
Pd-103	+	2×10^5	Te-129		2×10^8
Pd-107		7×10^4	Te-129m	+	6×10^3
Pd-109	+	2×10^6	Te-131		4×10^8
Ag-105		5×10^4	Te-131m		3×10^5

Table An 5.2: RADIONUCLIDE SPECIFIC OILs FOR FOOD, MILK AND WATER CONCENTRATIONS FROM LABORATORY ANALYSIS (OIL 6) (cont.)

Radionuclide		OIL6 (Bq/kg)	Radionuclide		OIL (Bq/kg)
Ag-108m	+	2×10^3	Te-132	+	5×10^4
Ag-110m	+	2×10^3	I-123		5×10^6
Ag-111		7×10^4	I-124		1×10^4
Cd-109	+	3×10^3	I-125		1×10^3
Cd-113m		4×10^2	I-126		2×10^3
Cd-115	+	2×10^5	I-129		NA[d]
Cd-115m		6×10^3	I-131		3×10^3
In-111		1×10^6	I-132		2×10^7
In-113m		4×10^8	I-133		1×10^5
In-114m	+	3×10^3	I-134		2×10^8
In-115m		5×10^7	I-135		2×10^6
Sn-113	+	1×10^4	Cs-129		1×10^7
Sn-117m		7×10^4	Cs-131		2×10^6
Sn-119m		1×10^4	Cs-132		4×10^5
Sn-121m	+	5×10^3	Cs-134		1×10^3
Sn-123		3×10^3	Cs-134m		3×10^8
Sn-125		2×10^4	Cs-135		9×10^3
Sn-126	+	5×10^2	Cs-136		4×10^4
Sb-122		2×10^5	Cs-137	+	2×10^3
Sb-124		5×10^3	Ba-131	+	1×10^5
Sb-125	+	3×10^3	Ba-133		3×10^3
Ba-133m		9×10^5	Eu-156		2×10^4
Ba-140	+	1×10^4	Gd-146	+	8×10^3
La-137		4×10^4	Gd-148		1×10^2
La-140		2×10^5	Gd-153		2×10^4
Ce-139		3×10^4	Gd-159		2×10^6
Ce-141		3×10^4	Tb-157	+	9×10^4
Ce-143		5×10^5	Tb-158		3×10^3
Ce-144	+	8×10^2	Tb-160	+	7×10^3
Pr-142		6×10^5	Dy-159		7×10^4
Pr-143		4×10^4	Dy-165		7×10^7
Nd-147		6×10^4	Dy-166	+	6×10^4
Nd-149		8×10^7	Ho-166		5×10^5
Pm-143		3×10^4	Ho-166m		2×10^3
Pm-144		6×10^3	Er-169		2×10^5
Pm-145		3×10^4	Er-171		6×10^6
Pm-147		1×10^4	Tm-167		1×10^5
Pm-148m	+	1×10^4	Tm-170		5×10^3
Pm-149		3×10^5	Tm-171		3×10^4
Pm-151		8×10^5	Yb-169		3×10^4
Sm-145		2×10^4	Yb-175		4×10^5

[d] Not a significant source of radiation because of the low specific activity

Table An 5.2: RADIONUCLIDE SPECIFIC OILs FOR FOOD, MILK AND WATER CONCENTRATIONS FROM LABORATORY ANALYSIS (OIL 6) (cont.)

Radionuclide		OIL6 (Bq/kg)	Radionuclide		OIL (Bq/kg)
Sm-147		1×10^2	Lu-172		1×10^5
Sm-151		3×10^4	Lu-173		2×10^4
Sm-153		5×10^5	Lu-174		1×10^4
Eu-147		8×10^4	Lu-174m		1×10^4
Eu-148		2×10^4	Lu-177		2×10^5
Eu-149		9×10^4	Hf-172	+	2×10^3
Eu-150b		3×10^6	Hf-175		3×10^4
Eu-150a		4×10^3	Hf-181		2×10^4
Eu -152		3×10^3	Hf-182	+	1×10^3
Eu -152m		4×10^6	Ta-178a		1×10^8
Eu -154		2×10^3	Ta -179		6×10^4
Eu -155		1×10^4	Ta -182		5×10^3
W-178	+	2×10^5	Hg-194	+	2×10^2
W -181		1×10^5	Hg -195		2×10^7
W -185		2×10^4	Hg -195m		8×10^5
W -187		1×10^6	Hg -197		1×10^6
W -188	+	3×10^3	Hg -197m		2×10^6
Re -184		2×10^4	Hg -203		1×10^4
Re -184m	+	3×10^3	Tl-200		5×10^6
Re -186		1×10^5	Tl -201		3×10^6
Re -187		5×10^5	Tl -202		2×10^5
Re -188		7×10^5	Tl -204		3×10^3
Re -189		8×10^5	Pb-201		2×10^7
Os-185		2×10^4	Pb -202	+	1×10^3
Os -191		8×10^4	Pb -203		2×10^6
Os -191m		1×10^7	Pb -205		2×10^4
Os -193		7×10^5	Pb -210	+	2.0
Os -194	+	8×10^2	Pb -112	+	2×10^5
Ir-189		2×10^5	Bi-205		7×10^4
Ir -190		6×10^4	Bi -206		8×10^4
Ir -192		8×10^3	Bi -207		3×10^3
Ir -194		6×10^5	Bi -210		1×10^5
Pt-188	+	6×10^4	Bi -210m		2×10^2
Pt -191		9×10^5	Bi -212	+	7×10^7
Pt -193		8×10^4	Po-210		5.0
Pt -193m		3×10^5	At-211	+	2×10^5
Pt -195m		3×10^5	Ra-223	+	4×10^2
Pt -197		2×10^6	Ra-224	+	2×10^3
Pt -197m		1×10^8	Ra-225	+	2×10^2

Table An 5.2: RADIONUCLIDE SPECIFIC OILs FOR FOOD, MILK AND WATER CONCENTRATIONS FROM LABORATORY ANALYSIS (cont.)

Radionuclide		OIL6 (Bq/kg)	Radionuclide		OIL (Bq/kg)
Au-193		8×10^6	Ra-226	+	2×10^1
Au -194		1×10^6	Ra-228		3.0
Au -195		2×10^4	Ac-225		3×10^3
Au -198		3×10^5	Ac -227	+	5.0
Au -199		5×10^5	Ac -228		7×10^6
Th-227	+	9×10^1	Pu-242		5×10^1
Th -228	+	2×10^1	Pu -244	+	5×10^1
Th -229	+	8.0	Am -241		5×10^1
Th -230		5×10^1	Am -242m	+	5×10^1
Th -231		2×10^6	Am -243	+	5×10^1
Th -232		4.0	Am -244		4×10^6
Th -234	+	8×10^3	Am-241/Be-9		5×10^1
Pa -230		5×10^4	Cm -240		4×10^3
Pa -231		2×10^1	Cm -241		3×10^4
Pa -233		3×10^4	Cm -242		5×10^2
U -230	+	8×10^2	Cm -243		6×10^1
U -232		2×10^1	Cm -244		7×10^1
U -233		1×10^2	Cm -245		5×10^1
U -234		2×10^2	Cm -246		5×10^1
U -235	+	2×10^2	Cm -247		6×10^1
U -236		2×10^2	Cm -248		1×10^1
U -238	+	1×10^2	Bk-247		2×10^1
Np -235		7×10^4	Bk -249		1×10^4
Np -236l	+	8×10^2	Cf -248		2×10^2
Np -236s		4×10^6	Cf -249		2×10^1
Np -237	+	9×10^1	Cf -250		4×10^1
Np -239		4×10^5	Cf -251		2×10^1
Pu -236		1×10^2	Cf-252		4×10^1
Pu -237		2×10^5	Cf-253		3×10^4
Pu -238		5×10^1	Cf-254		3×10^1
Pu -239		5×10^1	Es-253		5×10^3
Pu -240		5×10^1	Pu-239/Be-9		5×10^1
Pu-241		4×10^3			

Table An 5.3: EQUILIBRIUM RADIOACTIVE CHAINS

Parent radionuclide	Progeny radionuclides considered in OIL6 assessment as being in equilibrium with the parent
Mg-28	Al-28
Si-32	P-32
Ca-47	Sc-47 (3.8)[a]
Ti-44	Sc-44
Fe-52	Mn-52m
Zn-69m	Zn-69 (1.1)
Ge-68	Ga-68
Sr-90	Y-90
Y-87	Sr-87m
Zr-95	Nb-95 (2.2)
Zr-97	Nb-97m (0.95), Nb-97
Tc-95m	Tc-95 (0.041)
Mo-99	Tc-99m (0.96)
Ru-103	Rh-103m
Ru-106	Rh-106
Pd-103	Rh-103m
Pd-109	Ag-109m
Ag-108m	Ag-108 (0.09)
Ag-110m	Ag-110 (0.013)
Cd-109	Ag-109m
Cd-115	In-115m (1.1)
In-114m	In-114 (0.96)
Sn-113	In-113m
Sn-121m	Sn-121 (0.78)
Sn-126	Sb-126m, Sb-126 (0.14)
Sb-125	Te-125m (0.24)
Te-121m	Te-121
Te-127m	Te-127
Te-129m	Te-129 (0.65)
Te-132	I-132
Cs-137	Ba-137m
Ba-131	Cs-131 (5.6)
Ba-140	La-140 (1.2)
Ce-144	Pr-144m (0.018), Pr-144
Pm-148m	Pm-148 (0.053)
Gd-146	Eu-146
Dy-166	Ho-166 (1.5)
Hf-172	Lu-172
Hf-182	Ta-182

[a] The value inside the parentheses is the activity of the daughter radionuclide, per unit of the parent, assumed to be present

Table An 5.3: EQUILIBRIUM RADIOACTIVE CHAINS (cont.)

Parent radionuclide	Progeny radionuclides considered in OIL6 assessment as being in equilibrium with the parent
W-178	Ta-178a
W-188	Re-188
Re-184m	Re-184 (0.97)
Os-194	Ir-194
Pt-188	Ir-188 (1.2)
Hg-194	Au-194
Pb-202	Tl-202
Pb-210	Bi-210, Po-210
Pb-212	Bi-212, Tl-208 (0.40), Po-212 (0.71)
Bi-210m	Ti-206
Bi-212	Tl-208 (0.36), Po-212 (0.65)
At-211	Po-211 (0.58)
Rn-222	Po-218, Pb-214, Bi-214, Po-214
Ra-223	Rn-219, Po-215, Pb-211, Bi-211, Tl-207
Ra-224	Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.65)
Ra-225	Ac-225 (3.0), Fr-221 (3.0), At-217 (3.0), Bi-213 (3.0), Po-213 (2.9), Pb-209 (2.9), Tl-209 (0.067), Pb-209 (0.067)
Ra-226	Rn-222, Po-218, Pb-214, Bi-214, Po-214
Ac-225	Fr-221, At-217, Bi-213, Po-213 (0.98), Pb-209, Tl-209 (0.022)
Ac-227	Th-227 (0.99), Ra-223 (0.99), Rn-219 (0.99), Po-215 (0.99), Pb-211 (0.99), Bi-211 (0.99), Tl-207 (0.99), Fr-223 (0.014), Ra-223 (0.014), Rn-219 (0.014), Po-215 (0.014), Pb-211 (0.014), Bi-211 (0.014), Tl-207 (0.014)
Th-227	Ra-223 (2.6), Rn-219 (2.6), Po-215 (2.6), Pb-211 (2.6), Bi-211 (2.6), Tl-207 (2.6)
Th-228	Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
Th-229	Ra-225, Ac-225, Fr-221, At-217, Bi-213, Po-213 (0.98), Pb-209 (0.98), Tl-209 (0.02), Pb-209 (0.02)
Th-234	Pa-234m
U-232	Th-226, Ra-222, Rn-218, Po-214
U-235	Th-231
U-238	Th-234, Pa-234m
Np-237	Pa-233
Pu-244	U-240, Np-240m
Am-242m	Am-242, Cm-242 (0.83)
Am-243	Np-239

ANNEXURE 6 TO THE EMP
STANDARD OPERATIONAL PROCEDURES (SOP)

SOP LIST

SOP 1 : Disconnected or damaged source use for industrial radiography

SOP 2 : Radioactive releases from unshielded radioactive materials at the Facility: Contamination of person or object

SOP 3: Dangerous source in a Fire

SOP 4: Accidental medical overexposure

SOP 5 : Loss or damage of a source above D-value given in Annexure 4

SOP 6 : Theft or sabotage of radioactive sources

SOP 7 : Serious overexposure non-medical person

SOP 8: Detection of medical symptoms due to radiation exposure

SOP 9: Public contamination or exposure due to orphaned radioactive source found in a public place or any other places

SOP 10: Accidents during transport of radioactive material or sources,

SOP 11: Detonation of a Radiological Dispersal Device (RDD)

SOP 12: Credible or confirmed terrorist threats

SOP 13: Non- credible terrorist threats

SOP 14: Intentional contamination of water supply

SOP 15: Intentional contamination of food and commodities

SOP 16: Radioactive satellite re-entry

SOP 17: Recovery of an uncontrolled dangerous source

SOP 18: Detection of elevated radiation levels

SOP 19: Nuclear Weapon Accident

SOP 20: Category V or Transnational Emergency

SOP1: Disconnected or damaged source use for industrial radiography

Description

Emergencies involving disconnected or damaged radiography source that cannot be returned to its shielded container.

Potential hazards

Handling an unshielded source can cause permanent injury within minutes and being in the vicinity of an unshielded source can be life threatening within hours.

Emergency response

Operator

1. Carry out a radiation survey; verify the location of the source; set up barricades at controlled area boundary at 100 µSv/h.
2. Prevent access to the area; do not leave controlled area unattended.
3. Record names of potentially exposed individuals.
4. Obtain radiological assessment assistance to co-ordinate with RPO and SLAERC.
5. If there is public intervention, exposure to the public, possibility of contamination, immediately inform to RPO

RPO

1. If so, inform to NEC and implement the SOP 9 for "**Public contamination or exposure due to orphaned radioactive sources found in a public place or any other places"**
2. Stop operation, secure site, notify off-site officials, and obtain additional assistance if anyone is injured, the source cannot be fully shielded, public exposure or contamination is possible, illegal or criminal acts are suspected, or there is excessive public interest in the operations.
3. Develop mitigatory retrieval (recovery and decontamination) plan to minimize dose to the workers.
   - obtain technical assistance from the manufacturer if appropriate;
   - estimate the dose during the operation and rehearse mitigatory operations;
   - keep the doses as low as possible; they should not exceed the occupational dose limits (20 mSv whole body or 500 mSv to the hands).
4. Have an observer ensure that dose limits are not exceeded and that other dangerous situations are avoided.
5. Once a source has been shielded, confirm this by monitoring and check for contamination immediately
6. Investigate and conduct interviews to document the cause of the event, provide a report to the SLAERC.

NEC/SLAERC

1. Verify the call; Assess the level of hazard; record details of the incident.
2. Provide verbal instructions to mitigate the consequences.
3. Dispatch Emergency Response Teams to the location if required.

4. If serious overexposure or contamination is suspected, implement the SOP 06 for "**Serious overexposure (non-medical)".**

Radiological assessment (Radiological assessor)

1. Radiation survey of the location.
2. Isolate the area to appropriate distance if it was not done (Appendix 3 table A.3.1) and check whether radiation warning signs are displayed.
3. Follow-up on exposed personnel; Examine personnel dosimeter results if available.
4. Ensure location of the source is known at all times during the operation
   - Brief workers on radiation protection and other safety issues and continuously monitor their doses during recovery operations.
   - Ensure that source is not damaged or leaking. If it is damaged, notify off-site officials and check for contamination spread.
   - Store source in an appropriate container in a secure area.
5. Reconstruct /record the doses received and inform those exposed about the risks, inform off-site officials of any dose in excess of occupational limits and arrange, where appropriate, for long term medical follow-up.

SOP 2: Radioactive releases from unshielded radioactive materials at the Facility: Contamination of persons or object

Perform by Operator/RPO:

1. Isolate the laboratory
2. Switch off the ventilation system but leave the fume cupboard on.
3. Measure dose rate and contamination levels
4. Identify potentially contaminated or exposed persons.
5. Contact medical authorities.
6. Survey the area and monitor involved personnel.
7. Decontaminate person/s.
8. Collect wastes and Clean up the area as required
9. If the assistance is required from SLAERC to control the situation, contact NEC or person in Table An.2.1.1 in Annexure 2

Perform by NEC:

1. Verify the situation
2. Assess the hazard
3. Send SLAERC emergency response teams to the location if required

Perform by SLAERC Emergency Response Teams

1. Measure the dose rate and contamination level
2. Identify exposed and contaminated personnel
3. Contact medical authorities if required
4. Survey area and monitor involved personnel
5. Advice decontaminate the persons.
6. Advice clean up the area as required
7. Advice collect wastes and clean up the area as required

SOP 3: Dangerous Source in a Fire

Description- Emergencies involving a dangerous source in a fire

Potential hazards

The primary risk comes from the fire. There is a small probability that the shielding or container for the radioactive material could be damaged. Handling an unshielded dangerous source can cause permanent injury and being in the vicinity of an unshielded source can be life threatening within hours. There may be a small inhalation hazard for those within a room or within with a fire or within a few meters of a source in the open that is in a fire.

There will be little or no health risks to response personnel provided that in taking response actions near any hazardous material they take normal precautions, such as the use of respiratory protection against material released in a fire or explosion. Limited stays (such as for rescues) near a radioactive source or material would probably not be dangerous.

Perform by Operator or RPO:

1. Evacuate area and perform lifesaving actions
2. Inform to fire firefighting personnel
3. If inside fire fighters are not available contact firefighting department or SLAERC/DMC for assistance of first responders
4. Remove unnecessary personnel from the location
5. Do not approach the incident area without the dose rate being measured.
6. Measure the dose rate with a gamma survey meter.
7. Do not handle the sources or containers with bear hands.
8. If feasible move undamaged containers present at the scene to a safe area.
9. Cordon off the area to appropriate distance (Table A.3.1 in Appendix 3) and display radiation warning signs.
10. Identify potentially exposed personnel and contact medical authorities if required.
11. Perform personnel and equipment contamination survey using standard procedures.
12. Do not take any equipment or other item from the area which was affected by this accident prior to being checked for possible contamination.
13. Limit the time spent in the hazard area and use long handling tongs for source handling.
14. Send personnel dosimeters to the SLAEB for dose evaluation.
15. Inform SLAERC, if situation cannot be controlled/ contact NEC or person in Table An.2.1.1 in Annexure 2.
16. Prepare accident report.

If the situation is controlled by RPO

1. Record Details of incident.
2. Prepare accident report and send to SLAERC within 48 hours.

Perform by NEC/SLAERC:

1. Verify call and notify to Fire Brigade.
2. Give verbal instructions to mitigate the consequences.
3. Send Emergency Response Team to the location if required.

Perform by Fire Brigade

1. Dispatch the teams to the scene with fire equipment
2. Implement ICS
3. Take actions to prevent the fire and lifesaving actions

Perform by SLAERC Emergency Response Team:

1. Isolate the area to appropriate distance (Table 1) and display radiation warning signs.
2. Guided to fire fighters to radiological response
3. Follow up on exposed personnel; Examine personnel dosimetry results.
4. Contact medical authorities if required.
5. Plan the course of action to replace the sources or remove the sources to a lead pot.
6. Check integrity of the sources.
7. Provide a report to TAC by the NEC on present status and action taken for mitigation of consequences

SOP 4: Accidental medical over exposures

Description

Significant unplanned overexposures of patients resulting from uncontrolled medical sources such as radiotherapy devices. Equipment, software, human factors or confusing procedures could be contributing causes

Potential hazards

Other uses (national and international) using similar devices or procedures could have similar emergencies, inadequate treatment resulting in unnecessary suffering of the overexposed patient.

Emergency response

Operator:

1. Reconstruct the scenario of the accidental medical overexposure; include an assessment of the dose and dose distribution within the patient needed for medical prognosis.
2. Perform a clinical assessment of the radiation effects due to the overexposure.
3. Initiate appropriate treatment; consult with physicians with relevant expertise in treating severe overexposures (contact SLAERC for assistance).
4. Investigate to determine the cause of the overexposure, take action to prevent further overexposures, and protect information that may be important in a further investigation of the case.
5. Submit a report to the SLAERC that states the cause of the incidents as soon as possible after the investigation of an accident.
6. Inform the patient and his/her doctor about the incident.

Incident commander (Probably RPO):

1. Co-ordinate the response using the ICS from an incident command post near the scene.
2. Ensure that SLAERC and other relevant organizations are informed.
3. Prepare and provide emergency team of radiation specialists (radiological assessor)
4. Contact NEC for SLAERC radiological assessors.
5. If significant public contamination or exposure is possible, implement the SOP 9 for **"Public contamination or exposure due to orphaned radioactive sources found in a public place or any other places"**

Incident investigation (NEC/SLAERC)

1. Promptly determine the cause of the overexposure. If it may have resulted from a problem that could occur in another facility or State (e.g. potentially a transnational emergency), take actions by NEC to notify the IAEA.

NEC /EM/RPO

1. If there is public interest in the emergency, initiate media briefings as appropriate and activate PIC if needed.
2. Initiate action, as appropriate, to prevent similar emergencies at this facility or others using similar practices.

EM/SLAERC

1. Contact the IAEA to arrange for consultation with physicians with expertise in treating severe overexposure.

Notify potentially affected States and the IAEA if there are indications that other States or their citizens may be affected or may have involved a fault and/or problem (such as in equipment or software) that could have serious implications for safety internationally (transnational emergencies)

SOP 5: Loss or damage of a source above D-value given in Annexure 4

Sources involved-Industrial radiography at site, nuclear soil moisture gauge at site, teletherapy, etc.

Description

Loss of a source containing sufficient radioactive material above D value given in Annexure 4. If theft is suspected, follow the SOP 6 for "**Theft or sabotage of dangerous source"**.

Potential hazards

Unknowingly handling unshielded/unconfined dangerous quantities (Above D value given in Annexure 4) can result in permanent injuries from external exposure or inadvertent ingestion and in localized contamination, requiring cleanup. Unknowingly handling quantities 10-100 times the criteria in Annexure 4 for a dangerous source could be immediately life threatening.

Perform by Operator or RPO:

1. Report loss of the source to the appropriate officials, providing a description of the device and threat.
2. Conduct a local search and investigate possible means of loss (e.g. returned shipping container, waste, left in patient).
3. Obtain assistance from the radiation protection officer of the facility.
4. Check and ensure physical security and control of other sources.

Perform by RPO

Investigate (Collect details of the lost source; last user of the source known locations etc. refer log book if available)

1. Inquire all radiation workers non- radiation workers of the facility; explain the shape of the source, color, weight etc.
2. Search for the source using a gamma survey meter in suspected areas.
3. Use the following source search procedure
    I. Search team should wear Personnel Monitoring Badges.
    II. Visually search for the object bearing radiation symbol.
    III. Visually search for lead or other heavy shielding containers.
    IV. Use gamma survey meters (GM Counter) with measuring range 0.01 μSv -1000 μSv or more.
    V. Use telescopic probes and long handling tongs if available.

If the Source found by facility personnel do the following.

Perform by RPO:

1. Do not handle the source with bear hands.
2. Remove unnecessary personnel from the location
3. Do not approach the incident area without the dose rate being measured.
4. Measure the dose rate with a gamma survey meter.

5. Cordon off the area to 30 m and display radiation warning signs.
6. Identify potentially exposed personnel and contact medical authorities.
7. Plan the course of action to replace the source.
8. Limit the time spent at the hazard area and use long handling tools for source handling.
9. Send personnel dosimeters to the SLAEB for dose evaluation.
10. Check source integrity.
11. Prepare accident report.
12. Inform SLAERC, if cannot control the situation.

Perform by NEC/SLAERC:

1. Verify the call
2. Assess the level of hazard.
3. Inform to first responders and send SLAERC Emergency Response Teams to the location

Perform by lead first responder

1. Co-ordinate the response using the ICS.
2. Ensure that all relevant governmental agencies are informed.
3. Evaluate all available information; retrace the sequence of events. If illicit trafficking or any criminal act is suspected, notify appropriate law enforcement authorities and integrate the law enforcement response into the ICS.
4. Obtain radiological assessment assistance to co-ordinate the radiological response and radiation protection with SLAERC.
5. Brief the responders on the risks and provide measures to protect emergency workers, including law enforcement, and control their dose (see Appendix 8).
6. Obtain emergency medical assistance to advice and co-ordinate with medical facilities on recognition of radiation injuries.
7. Obtain public information officer assistance to provide information to the public. Promptly inform nearby medical facilities, border crossings and scrap metal dealers to be alert for the source or for radiation-induced injuries. Provide them with a description of the source and its container and indications of radiation injuries (e.g. burns with no apparent cause).
8. Initiate public searches if appropriate.
9. If potential source is found, confirm the location and establish an inner-cordoned area (safety distance) in accordance with Appendix 3 (Table A.3.1).
10. If terrorism is indicated, contact NEC/EM and implement the SOP 12 for "**Credible or confirmed terrorist threats".**
11. If public contamination or exposure is possible, contact NEC/EM and implement the SOP 09 for "**Public contamination or exposure due to orphaned radioactive sources found in a public place".**
12. If serious overexposure is suspected, contact NEC/EM and implement the SOP 06 for "**Serious overexposure (non-medical)".**

13. If a device is found, contact NEC/EM and implement the SOP 17 for "**Recovery of an uncontrolled dangerous source".**

Perform by SLAERC Emergency Response Teams:

1. Search the source by using a source search equipment in suspected areas.
2. Brief to IC the search actions
3. Perform under the ICS

Perform by SLAERC emergency teams with NEC/EM:

1. Measure the dose rate of the source
2. Isolate the area to 30 m and display radiation warning signs (if not done by the first responders)
3. Plan the course of action to replace the source.
4. Identify potentially exposed personnel and contact medical authorities if required.
5. Examine personnel dosimetry results.
6. Prepare accident report.
7. Follow up on victims.
8. Inform IAEA by using USIE website (use forms as necessary)

If source could not be found

Perform by SLAERC (EM) with National Radiological response

1. Start search operations with National Level.
2. In conjunction with the radiological assessment and search operation already conducted determine what further actions to be taken.

Consider the following:

1. Assistance will be taken from police special task force for further source search operations
2. Alert the local hospitals and ask to be notified if persons with symptoms of radiation exposure or contamination arrived at the hospital (Coordination with the disaster preparedness unit of the ministry of Health).
3. Inform to IAEA by USIE (use forms as necessary)
4. Alert the media to warm the population about the missing source how it can be recognized, what it can do, what to do if it discovered and who to call for questions or for responding that the source has been seen. (Press release 1 by DG SLAERC with DMC)
5. Based on initial investigation repots start search operations at the suspected areas. This will be involved with owner, police, and SLAERC Emergency response teams.
6. Organize search teams with proper instrumentation and equipment. Brief them thoroughly in the operational aspects of search task and what radiological hazards they could expect. All activities shall be conducted so that exposure is maintained as low as reasonably achievable (ALARA).

7. For search over wide area, vehicle surveys with backpack or other suitable search detectors could help in quickly determine the location. A search on foot will always complete the survey.
8. Survey sanitary, disposal sites, junkyards, and recycling facilities.
9. Supervise the search. Keep a record of all actions, decisions and findings, dose measurements etc.
10. If need IAEA assistance, use the USIE website by emergency coordinator and fill-up the request assistance form and send to IEC.

If source has been found do the followings

Perform by Radiological EM/NEC with the assistance of national emergency teams:

1. Take immediate actions to shield the source.
2. Check the source integrity.
   Inform the public that the source has been found. (Press Release 2)
3. Ensure that all persons who may have been exposed or contaminated are identified.
4. Initiate decontamination of persons if required
5. Provide radiological assistance to the hospital, if required.
6. Medical follow up.
7. Develop plans for waste management if required
8. Prepare accident report. Inform to IAEA as necessary
9. Informed the public about final results (Press release 3)

If the search was unsuccessful, document all facts and re-assess Search strategy (IAEA Assistance may be required)

SOP 6: Theft or sabotage of dangerous source

Description

Theft of a source containing radioactive source above D-value given in Annexure 4

Potential hazards

Unknowingly handling unshielded/unconfined dangerous quantities (see D- values given in Annexure 4) can result in permanent injuries from external exposure or inadvertent ingestion and in localized contamination, requiring cleanup. Unknowingly handling quantities 10-100 times the D- values given in Annexure 4 for a dangerous source could be immediately life threatening.

Emergency response

Perform by Operator (Responsible for control of the source):

1. Report theft to the appropriate officials, providing a description of the device and threat.
2. Obtain assistance from the radiation protection officer.
3. Secure the scene to allow for forensic examination.
4. Conduct additional response actions in co-operation with law-enforcement, including:
   - Local search
   - Providing technical support to off-site officials;
   - Checking and ensuring physical security and control of other sources.

Perform by RPO

1. Secure the scene to allow for forensic examination.
2. Inform the SLAERC and law enforcement
3. Conduct additional response actions in co-operation with law-enforcement, including:
   - Local search
   - Providing technical support to off-site officials;
   - Checking and ensuring physical security and control of other sources.
4. If the source is found, ensure it is not damaged or leaking
5. If damaged or leaking take precautions to safety of source and if required take assistance from SLAERC and ensure it is surveyed for contamination.

Perform by NEC:

1. Verify the call
2. Assess the level of hazard.
3. Inform to first responders and Send SLAERC Emergency Response Teams to the location,
4. Coordinate with EM and TAC for further actions

Perform by lead first responder

1. Co-ordinate all response actions in co-operation with law-enforcement using the ICS from an incident command post near the scene.
2. Ensure that all governmental agencies are informed.
3. Obtain radiological assessment assistance to co-ordinate the radiological response and radiation protection from SLAERC.

4. Obtain emergency medical assistance to advice and co-ordinate with medical facilities in the recognition of radiation injuries.
5. Obtain public information officer to provide information to the public.
6. Brief the responders on the risks and provide measures to protect emergency workers, including law enforcement, and control their dose (Obtain assistance from radiological assessors).
7. Promptly inform nearby medical facilities, border crossing, and scrap metal dealers to be alert for the source or for radiation-induced injuries. Provide them with a description of the source and its container and indications of radiation injuries (e.g. burns with no apparent cause).
8. If potential source found, establish an inner-cordoned area (safety distance) in accordance with Appendix 3 (Table A.3.1).
9. If significant public contamination or exposure is possible, contact NEC/SLAERC and implement the SOP 09 for "**Public contamination or exposure due to orphaned radioactive source found in a public place".**
10. If serious overexposure is suspected, contact NEC/SLAERC and implement the SOP 07 for **"Serious overexposure (non-medical)".**
11. If device found, contact NEC/SLAERC and implement the SOP 17 for "**Recovery of an uncontrolled dangerous source".**

Perform by SLAERC Emergency Response Teams (Radiological assessor)

1. Operate under the ICS incident commander.
2. According to hazards provide technical assistance to off-site officials and operator.
3. Brief incident commander on risks and provide measures to protect emergency workers (including law enforcement) and control their dose.
4. Promptly locate and keep people away from the significant source(s)/contamination.
5. If public exposure or contamination is possible or reported, implement the SOP 09 for "**Public contamination or exposure due to orphaned radioactive source found in a public place".**
6. Reconstruct/record the doses received and informed and inform those exposed about the risks. Arrange, where appropriate, for long term medical follow-up after consultation with medical management teams and EM.

Incident investigator/team:

1. Operate under the ICS incident commander.
2. Conduct and investigation, in close co-operation with law enforcement, to determine why the source was not properly controlled and if additional sources may have been lost or stolen.

Emergency medical responder/team:

1. Operate under the ICS incident commander.
2. Provide medical advice and support to local medical community on recognition of radiation injuries and treatment of contaminated/exposed individuals and on staff risk (negligible).

Perform by SLAERC (EM) with National Radiological response teams

1. Start search operations with National Level if source is not found.
2. In conjunction with the radiological assessment and search operation already conducted determine what further actions to be taken.

Consider the following:

1. Assistance will be taken from police special task force for further source search operations
2. Alert the local hospitals and ask to be notified if persons with symptoms of radiation exposure or contamination arrived at the hospital (Coordination with the disaster preparedness unit of the ministry of Health).
3. Inform to IAEA by USIE (use forms as necessary)
4. Alert the media to warm the population about the theft source describing the source and stressing the hazard, what it can do, what to do if it discovered and who to call for questions or for responding that the source has been seen. (Press release 1 by DG SLAERC - Emergency Manager with DMC)
5. Set out PIC for public information
6. Respond to international inquiries and provide information that is not confidential, on transnational emergencies. If need IAEA assistance, use the USIE website by NEC and fill-up the RFA (request Assistance Form) and send to IEC.
7. If terrorism is indicated, implement the SOP 12 for "**Credible or confirmed terrorist threats".**

SOP 7: Serious overexposure (non-medical)

Description

Severe overexposure not involving a medical procedure. For medical overexposures follow the SOP 4: Accidental medical over exposures

Potential hazards

Inadequate treatment of the overexposure resulting in unnecessary suffering. Additional unnecessary overexposures from failure to promptly identify and correct the cause of the overexposure.

Emergency response

Operator (Operator, if known, of practice resulting in the overexposure):

1. At the scene, conduct interviews and gather and secure information needed to estimate the dose.
2. Report the event to RPO

RPO

1. Inform the event to SLAERC.
2. Initiate measures to protect emergency workers and control their doses
3. Conduct and investigation to determine the cause of the overexposure, take action to prevent further overexposure, and protect information that may be important for further investigation.

NEC/SLAERC

1. Verify the information received and assess the hazard level
2. Instructions given to RPO for investigations of overexposure
3. If significant public contamination or exposure is possible, implement the SOP 9 for "**Public contamination or exposure due to orphaned radioactive sources found in a public place or any other places".**
4. If radiological terrorism is suspected/confirmed, implement the SOP 12 for "**Credible or confirmed terrorist threats".**
5. Contact the IAEA and arrange for consultation with physicians with expertise in treating severe overexposures.
6. Notify potentially affected States and the IAEA if there are indications that other States or their citizens may be affected (Transnational emergency).

Medical facility treating the victim:

1. Operate under the ICS incident commander.
2. Treat injuries.
3. Brief medical staff treating casualties on negligible risk in treating exposed/contaminated patients and appropriate precautions.
4. Initiate measures to protect emergency workers and control dose.
5. Perform physical examinations and blood tests promptly to assist in estimating the dose.

6. In consultation with the experts, determine a course of treatment based on the estimated dose received. Consider both the physical and psychological suffering of the patient.

Incident commander:

1. Co-ordinate the response using the ICS from an incident command post near the scene.
2. Ensure the all governmental agencies are informed.
3. Ask national officials for advice and an emergency team of radiation specialists (radiological assessor).
4. Evaluate all available information: retrace the sequence of events. Be aware of the possibility of criminal acts. If illicit trafficking or any criminal act is suspected, notify appropriate law enforcement authorities and integrate them into the ICS.

Incident investigator/team:

1. Operate under the ICS incident commander.
2. Investigate, in close co-operation with law enforcement if criminal activity is suspected, to determine the cause and take appropriate action to prevent similar emergencies.

EM/ Public information officer/team:

1. Respond to international inquiries and rumors.
2. If there is public interest in the event, initiate media briefings.

SOP 8: Detection of medical symptoms of radiation exposure

Description

Symptoms of radiation exposure are diagnosed or suspected and the source of the exposure is unknown. The physician should consider the possibility of radiation induced injures when facing burns without an apparent cause, suspicions expressed by the patient that some 'object' was making them sick, the patient being in a profession where there is an increased risk of encountering a dangerous source (e.g. scrap metal dealer).

Potential hazards

The patient could be suffering from radiation injuries warranting specialized treatment. This could indicate a public contamination or exposure emergency and the source of exposure or contamination that could continue to represent a severe hazard unknown to those in the vicinity.

There is little or no health hazard to the medical staff treating or transporting exposed or contaminated people provided they protect themselves from inadvertent ingestion of contamination by use of the normal barrier methods (e.g. gloves) used to protect against infectious agents.

Perform by Medical Professionals (Diagnosing medical professional):

1. Prevent inadvertent ingestion of contamination (e.g. wear gloves, do not smoke, or eat).
2. Perform life saving measures and provide first aid for serious injuries immediately, before conducting radiological monitoring.
3. Keep people away from any potential source of exposure (at least 10 m from the public).
4. Arrange to transport seriously injured people to local medical facility. If they may be contaminated, wrap them in a blanket to control the spread of contamination. Tell those transporting the victim and the receiving medical facility that the person may be contaminated and that the risk to those treating such a patient is negligible but care should be taken to prevent inadvertent ingestion of contamination.
5. Identify and register potentially exposed or contaminated individuals, gather information that could be useful in reconstructing their dose to include medical symptoms and description of events.
6. Report to SLAERC and obtain instructions
7. Remain in the area until monitored.

Perform by NEC/SLAERC

1. Verify the call and situation
2. Assess the hazard
3. Contact relevant first responders
4. Dispatch the SLAERC emergency response teams to the location
5. Prepare for requesting IAEA assistance if required

Incident commander (lead first responder):

1. Co-ordinate the response using the ICS from an incident command post near the scene. If illicit trafficking or criminal act is suspected, notify and incorporate police in the response under the ICS.
2. Continue actions by medical professionals listed above
3. Isolate potential sources of exposure in accordance with Table A.3.1 in Appendix 3.
4. Obtain radiological assessment assistance to co-ordinate radiological response from SLAERC.
5. Obtain emergency medical assistance to co-ordinate the medical response.
6. If the emergency receives media or public attention, obtain information from public information officer
7. Ensure that all governmental agencies are informed.
8. Monitor public response and deal with inappropriate behavior.
9. If terrorism is indicated, implement, as appropriate, the SOP 12 for "**Credible or confirmed terrorist threats".**
10. If public contamination or exposure is possible, implement the SOP 09 for "**Public contamination or exposure due to orphaned radioactive source found in a public place"**
11. If serious overexposure is suspected, implement the SOP 07 for **"Serious overexposure (non-medical)".**
12. If a dangerous source is to be recovered, implement the SOP 17 for "**Recovery of an uncontrolled dangerous source".**

Radiological assessment (Radiological assessor- SLAERC):

1. Operate under the ICS incident commander.
2. Provide the medical professional and incident commander reporting the event with instructions by phone (by NEC) on radiation protection actions to take before assistance arrives.
3. Dispatch radiation survey team (radiological assessor) to perform monitoring to determine if injuries are radiation induced and isolate possible sources of exposure. If public exposure is possible, implement the SOP 09 for "**Public contamination or exposure due to orphaned radioactive source found in a public place"**.

Emergency medical responder/team:

1. Operate under the ICS.
2. Obtain national medical advice on determining if the injuries are radiation induced and on the immediate precautions to be taken during treatment. If public exposure is possible, implement the SOP 09 for "**Public contamination or exposure due to orphaned radioactive source found in a public place"**.
3. Gather potentially exposed or contaminated people, who are not seriously injured, in a safe location (victim assembly point) to: register them, give them a medical and radiological evaluation (triage), and arrange for their treatment.
4. Arrange to alert local medical facilities of the potential for arrival of concerned people well.

5. Reconstruct/record the doses received and inform those exposed about the risks. Arrange, where appropriate for long term medical follow-up.

EM /Public information officer

1. If the emergency receives media or public attention, implement media briefings and appropriate public action; activate a PIC if needed.
2. If the public announcement is delayed, prepare public information and a spokesperson to be used when the news of the emergency reaches the media and public

SOP 9: Public contamination or exposure due to orphaned radioactive sources found in a public place or any other places

Description

Discovery of contamination of the public or public places. This could occur as the result of members of the public, unaware of the hazard, handling a lost or stolen dangerous source (Activity of sources greater than D-values given in Annexure 4). This could also occur as a result of a deliberate act. These emergencies are often discovered; unfortunately, after several people have been exposed and there has been considerable spread of radioactive material.

Potential hazards

The exposed individuals could be suffering from radiation injuries warranting specialized treatment. The source of exposure or contamination could represent a severe hazard unsuspected by those in the vicinity. The material could be dispersed by human activity and could involve widespread contamination of areas and local products. There can be significant adverse and inappropriate public reaction and economic consequences if public and financial institution concerns are not promptly addressed. Limited stays (minutes) near the material by response personnel should not be hazardous but holding the material could produce injuries in minutes. The inhalation hazard is probably limited to the plume (e.g. within the smoke) within 100 meters of a source in a fire or explosion. Resuspension of material on the ground should not be hazardous except for Pu contamination. External contamination is probably not hazardous but inadvertent ingestion (e.g. by putting hands in the mouth) of contamination could be hazardous. Excess cancers should not be detected following these types of emergencies, even those involving large amounts of radioactive material.

Fire fighters are generally equipped with respiratory protection that provides good protection against the inhalation hazard. Common radiation survey instruments can detect significant external exposure hazards but may not be able to detect significant inhalation hazards. There is little or no health hazard to the medical staff treating or transporting exposed or contaminated people provided they protect themselves from inadvertent of contamination by use of the normal barrier methods (e.g. gloves) used to protect against infectious agents.

Emergency response

Incident commander (lead first responder) (First officials to be aware of a potential emergency):

1. Ensure that those approaching scene take action to prevent inadvertent ingestion of contamination (e.g. wear gloves, do not smoke – or eat).
2. Perform life saving measures and provide first aid for serious injuries immediately, before conducting radiological monitoring.
3. Conduct interviews to identify the possible source of the contamination and its possible location.
4. Inform the SLAERC for national response
5. Keep people away from suspected contaminated areas. Establish an inner-cordoned area (safety distance) in accordance with Appendix 3 (Table A.3.1).

6. Arrange to transport seriously injured people to local medical facility. If they may be contaminated, wrap them in a blanket to control the spread of contamination. Tell those transporting the victim and the receiving medical facility that the person may be contaminated and that the risk to those treating such a patient is negligible but care should be taken to prevent inadvertent ingestion of contamination.
7. Gather potentially exposed or contaminated people, who are not seriously injured, in a safe location (victim assembly point) to: register them, give them a medical and radiological evaluation (triage) and arrange for their treatment.
8. Obtain radiological assessment assistance to co-ordinate the radiological response and radiation protection from SLAERC.
9. Obtain emergency medical assistance from medical experts to advice and co-ordinate with medical facilities.
10. Obtain public information officer at the scene to provide information to the public.
11. Activate response using the ICS coordinated under an incident commander from an incident command post near the scene.

Perform by NEC/SLAERC

1. Verify the call
2. Assess the level of hazard
3. Provide instruction to IC to mitigate consequences
4. Dispatch the SLAERC Emergency response teams including decontamination team to the scene
5. If the emergency assessed as medium level take the role of EM and provide public warnings and instructions
6. Take actions to notify potentially affected States and the IAEA if there are indications that other States or their citizens may be affected (Transnational emergency).
7. If national radiological response resources are insufficient – request international assistance through the IAEA.

Perform by Incident Commander:

1. Evaluate all available information; retrace the sequence of events. Be aware of the possibility that radioactive material may be a subject of illicit trafficking or other criminal act. If illicit trafficking or any criminal act is suspected, notify appropriate law enforcement authorities and integrate them into the ICS. All details communicate with EM
2. Implement action to protect the public, workers, responders, and the economy from the actual or perceived radiological risk by implementing action consistent with international standards (see Ref. [19]).
3. Relocate people from areas, identified by the emergency response teams of radiation specialists (radiological assessor), where contamination levels exceed OILs for relocation and keep them informed of their status, the risks to their health and the status of their homes and property.
4. Monitor public response and deal with inappropriate behavior.
5. If terrorism is indicated, implement the SOP 12 for "**Credible or confirmed terrorist threats".**
6. If serious overexposure is suspected, implement the SOP 06 for **"Serious overexposure (non-medical)".**

7. If a dangerous source is to be recovered, implement the SOP 17 for "**Recovery of an uncontrolled dangerous source".**

Perform by SLERC Emergency teams- Radiological Assessment (radiological assessor)

1. Operate under the ICS incident commander.
2. Provide measures to protect emergency workers (including law enforcement) and control their dose (Appendix 8 Table A.8.1.)
3. Identify and keep people away from significant contamination and identify potentially contaminated people, products, and locations based on appropriate OILs.

Urgent Protective actions- Coordinated with EM

- Areas that should be evacuated;
- Members of the public and workers who should:
  - Be immediately decontaminated,
  - Be decontaminated as soon as reasonable,
  - Be released – no further action needed,
  - Get a medical follow up.
- Water/food/products that should be restricted.

4. Brief incident commander and responders on risks and provide measures to protect emergency workers (including law enforcement) and control their doses
5. Provide support to medical response to include conducting radiological assessment at victim assembly point and arranging support for the medical facilities treating possibly contaminated victims.
6. Inform those monitored of the results, risk, and actions they should take.
7. Establish, if appropriate, a programme to assess long term radiological consequences.
8. Establish radiological assessor base near the scene if needed to co-ordinate radiological field operations.

Emergency medical responder/team:

1. Implement and manage medical response, including:
   - Establish, with support from SLAERC (radiological assessment), a victim assembly point near the scene of the emergency to perform medical and radiological triage – field treatment.
   - Identify medical facilities for use in treatment of potentially contaminated/exposed victims; brief their staff on treatment of exposed and contaminated casualties and risks.
2. Provide selected medical facilities with expert support, if needed, on radiological monitor, decontamination or radiation protection.
3. Implement provisions to assess concerned people (worried-well) for radiation exposure/ contamination (not at a hospital or other crucial facility).
4. Arrange to alert local medical facilities of the potential for arrival of concerned people (worried-well) wanting to be monitored if there is wide spread public concern.
5. Provide medical advice and support to local medical community on treatment of contaminated/exposed individuals and the risk (minimal) to their staff. Attend the representative in NRERC for joint media briefing

EM (national Level)-

1. Coordinate all responses by NRERC
2. Advises to NEC for further actions
3. Public information /media briefing with NRERC representatives- Promptly making a public announcement describing the hazard realistically followed by media briefings with NRERC official and activating a PIC if needed at the scene under ICS.
4. Ensure that all governmental agencies are informed of who is leading the response and that they receive an explanation of the risk and their role.
5. Provide instructions to an emergency team of radiation specialists (radiological assessors).
    - Take action to mitigate the economic and psychological consequences of the threat, including:
6. Restricting national and international trade or movement of potentially contaminated items or people.
7. Develop a recovery plan (include objectives and criteria) before recovery efforts being made.
8. Implement a longer-term medical monitoring programme if appropriate

Incident investigator/team:

1. Operate under the ICS incident commander.
2. Conduct and investigation, in close co-operation with law enforcement if criminal activity is suspected, to determine the cause, origin of the material or device involved, and the possible involvement of other sources.

Perform by NEC at national level:

1. Coordinate all response according to EM instructions and information from incident commander.
2. Inform to IAEA and submit necessary forms through USIE and if need assistance request assistance via RANET
3. Respond to international inquiries and provide information on transnational emergencies.

SOP 10: Accident During Transport of Radioactive Material.

Description

An emergency involving radioactive material being transported in accordance with international standards. Police will likely be the first responder on the scene if a transport accident occurred in the public road.

Potential hazards

During transport accidents there is a small possibility of:
1) a release resulting in an inhalation hazard near the source,
2) contamination that is hazardous if ingested and
3) hazardous levels of external exposure from being near the accident for an extended time.

Fire fighters are generally equipped with protective clothing and respiratory protection equipment, which provides good protection against radioactive contamination and inhalation of airborne radioactive material. Being in the vicinity of the material for a short period (e.g. to conduct lifesaving) should not be hazardous (See Ref [19] Figure B5 for more details).

Emergency response
Carrier

1. Perform lifesaving actions and provide first aid for serious injuries immediately, before conducting radiological monitoring.
2. Keep people away from the emergency scene and implement other actions in carrier response guidance.
3. Call RPO or emergency services.

Incident Commander Lead first responder (Police)- duties

1. Observe from a distance and assess all possible hazards.
2. Approach from upwind or use respiratory protection if possible and ensure those approaching scene take action to prevent inadvertent ingestion of contamination (Eg. Wear gloves, do not smoke or eat)
3. Remove the injured persons from the hazard area as soon as possible and send them to the nearest hospital before conducting monitoring.
4. If there is a fire, take actions to control fire by contacting SLAERC or fire department (instructions for fire fighters are given in Ref [10])
5. Inform SLAERC Immediately for radiological assessment.
6. Obtain emergency medical assistance coordinate with SLAERC
7. Cordoned off the area in accordance with Table A.3.1 in Appendix 3.
8. Arrange to transport seriously injured people to local medical facility. If they may be contaminated, wrap them in a blanket to control the spread of contamination. Tell those transporting the victim and the receiving medical facility that the person may be contaminated

and that the risk to those treating such a patient is negligible but care should be taken to prevent inadvertent ingestion of contamination.

9. Identify the victim assembly point and establish with labeling. Then gather potentially exposed or contaminated people, who are not seriously injured, in a victim assembly point, register them, give them a medical and radiological evaluation consultation with NEC (SLAERC) and arrange for their treatment
10. Activate response using the Incident commander system (ICS) and establish the points as necessary according to figure A.3.1 in Appendix 3.
11. Get Information about the material transported, from the victims or rescued persons, if possible.
12. Inspect the packages or goods transported by accident vehicle. Considering the following.
    I. Packages or goods being labeled with radiation symbol.
    II. Is there a placard with radiation symbol
    III. If the packages were labeled, identify the category of packages.
    (I-WHITE or II –YELLOW or III- YELLOW)
13. If the packages contained radiation symbol, do not handle them with bear hands.
14. Check whether the packages were damaged or any spillage.
15. Remove non- essential personal from the scene.
16. Do not remove the accident vehicles or packages from the spot even for traffic controlling purposes.
17. If the owner of the packages were identified inform them immediately.
18. Record names and address of all personnel involved in the accident.

Remain at the scene until arrival of full Emergency Response Teams. Brief them the situation and action taken.

Incident investigation Team (POLICE)

1. Operate under the ICS
2. Investigate in close co-operation with IC if criminal is suspected to determine the root cause of the accident

Perform by NEC/SLAERC

1. Verify the call by police or initiator
2. Get information from the police (Incident Commander, IC); present situation at the scene and actions taken.
3. Give verbal instructions to IC to control the scene if required.
4. Assess the hazard level and if it is high level hazard inform EM for extended response.
5. Dispatch SLAERC emergency response teams to the location.
6. Communicate with EM for further actions.

Radiological assessment (Emergency response teams SLAERC):

1. Measure gamma dose rate and adjust an inner cordoned area in accordance with the values observed (see appendix 04).
2. Coordination with IC and carryout radiological assessment and communicate the result with him.
3. Brief incident commander on risks and provide measures to protect emergency workers and control their dose
4. If there are indications that a dangerous neutron source (Eg. Cf-252, Am/Be well logging), take assistance from NEC to further neutron measurement if the team does not have neutron survey meter. If Neutron survey meter is available carry out the task and evaluate the results.
5. All measurement should be communicated with EM/NEC

EM

1. If the emergency receives media or public attention, provide public information and carryout media briefings, on the threat and appropriate public action. Activate a PIC if needed. Arrange it with the coordination of DMC emergency Operational Unit.

Emergency Responder Medical team

1. Operate under the ICS
2. Provide medical advice and support to on scene response and local medical community on treatment of contaminated individuals and the risk to their staff.

SLAERC Decontamination Team

1. Establish the decontamination area in consultation with IC and fire brigade
2. Carryout personnel contamination according to the procedure and if the results under the OIL send them home if contamination are detected send them to decontaminate
3. If the number of people is exposed and cannot bear the situation with the team inform NEC to dispatch other teams

EM/NEC

1. Contact SLAEB for more response personnel and equipment and dispatch to the scene

SOP 11: Detonation of a Radiological Dispersal Device (RDD)

Description

An RDD has been or may be used to spread radioactive material or has been located before detonation

Potential hazards

The greatest threat comes from the direct effects of an explosion rather than from radiation exposure or contamination. The greatest radiological hazard comes from inadvertent inhalation or inadvertent ingestion of the material dispersed by an explosion or fire or from handling radioactive debris or material in an unexploded device. There would only be a negligible radiological threat if the source belongs to source category III-V are involved. An RDD containing Category I and II for a dangerous source would be required to result in dispersal of material that is life threatening to unprotected people. The inhalation hazard is probably limited to the plume (e.g. within the smoke) within 100 meters of the source of the release. Resuspension of Pu on the ground could be hazardous near the source. External contamination is probably not hazardous but inadvertent ingestion (e.g.by putting hands in the mouth) of contamination could be hazardous.

While an RDD may not release enough radiation to cause fatalities or cause severe illnesses, the main threat of an RDD is from the direct effect of an explosion rather than that from radiation exposure. Depending on the scenario, an RDD explosion could create fear and panic and may contaminate personnel and property. The extent of local contamination would depend on the amount and type of explosive and the radioactive material used, the means of dispersal and weather conditions, and the decontamination of the affected area may involve considerable time and expense. An early assessment of the possible radiological impact of an RDD would help in reducing unwarranted fears of the public and also help the first responders to act more efficiently in protecting the victims of blast injuries. It is to be ensured that the teams of emergency responders are well equipped with radiation detection equipment. Even if radioactive contamination is suspected/ detected, life-saving rescues and emergency first aid for serious injuries are to be undertaken immediately by the responders. For a suspected RDD incident, an initial inner-cordoned area (safety perimeter) of 400m is recommended (Table A.3.1 in Appendix 3). This will be extended based on actual radiological monitoring, beyond the initial area, to a place where the actual dose rate is 100 μSv/hr at 1m height from the ground.

Initial Response Actions In the light of the above, the first responders equipped with personal dosimeter; portable dose rate meter which is able to measure alpha, beta and gamma radiations; Personnel Protective Equipment; full body covering suit; impermeable mask or preferably Self-Contained Breathing Apparatus (SCBA); and water supply hose (because water is the best option to decontaminate wounds, personnel, clothing, buildings, etc.) will perform the response actions once they reach the radiological incident/accident site. Broadly, these actions involve mobilizing and operating incident command; overseeing victims triage; cordoning the site, and managing and controlling the perimeter; providing notification and activation of special teams; providing traffic and access control; providing protection to at risk and special population; providing resources support and requests for assistance; providing public works coordination; providing direction and control of critical infrastructure mitigation; and providing public information, outreach, and communication activities. However, these steps are given as guidance for first responders to respond to radiological incidents/accidents and actual action will depend upon the ground realities at the scene of incidence/accident.

Common radiation survey instruments can detect significant external exposure hazards but cannot detect significant inhalation hazards. There can be significant adverse and inappropriate public reaction and economic consequences if public and financial institution concerns are not promptly addressed. Excess, radiation induces, cancers should not be detected following this type of emergency, even for emergencies involving large amounts of radioactive material.

Emergency response

Incident commander group (lead first responder): probably from Police or STF

1. Observe from a distance and assess all possible hazards- be aware of the potential for other bombs/devices/threats.
2. Approach from upwind.
3. Save lives and prevent/treat serious injuries before conducting radiological monitoring. Deal with the conventional hazard; request assistance from bomb disposal unit of STF and Police experts (do not handle the device).
4. Conduct immediate field assessment for indications that the device may be radioactive:
   - Was a threat received in advance?
   - Is there a message at the scene?
   - Radiation symbol? (Not a reliable indicator)
   - Gamma radiation levels significantly above background (> 1μSv/h)
5. Prepare for bobby traps (police group), a second device intended to injure responders, a second device intended to injure evacuees.
6. Activate response using the ICS coordinated under an incident commander near the scene. Establish the incident command post upwind (See Fig A.3.1 in Appendix 3), at a safe distance and in a secure area.
7. If radiological terrorism is suspected/confirmed:
   - Establish an inner-cordoned area (safety distance) in accordance with Fig A.3.1 in Appendix 3
   - Request assistance from law enforcement other responders;
   - Avoid the smoke or use standard inhalation protection while in the smoke; and ensure those approaching scene take action to prevent inadvertent ingestion of contamination (e.g. wear gloves, do not smoke, or eat).
   - Inform SLAERC and asked for assistance from radiological assessments
   - Only approach the device or debris to protect lives until radiological assessment is performed; keep time in the immediate vicinity (<1 m) of device to a minimum;
   - Arrange to transport seriously injured people to local medical facility. If they may be contaminated, wrap them in a blanket to control the spread of contamination. Tell those transporting the victim and the receiving medical facility that the person may be contaminated and that the risk to those treating such a patient is negligible but care should be taken to prevent inadvertent ingestion of contamination.
   - Contact Medical Management coordinate with EM
   - Gather potentially exposed or contaminated people, who are not seriously injured, in a safe location (victim assembly point) to: register them, give them a medical and radiological evaluation (triage) and arrange for their treatment.
   - Get monitored by the radiological team before leaving.
   - Get equipment monitored before leaving the area

Incident commander:

1. Integrate the response (including law enforcement, investigative, radiological components and public safety/administration) using the ICS (the incident commander should be a member of law enforcement).
2. Ensure that all governmental agencies are informed of who is leading the response and that they receive an explanation of the risk and their role.
3. Coordination with SLAERC to dispatch to perform radiological monitoring.
4. Implement action to protect the public, workers, responders, and economy from the actual or perceived radiological risk by implementing action consistent with international standards (see Ref. [19]).
5. Monitor public response and deal with inappropriate behavior.
6. Once it becomes known to the public, implement provisions to address public concerns and to mitigate the economic and psychological consequences.
7. Be prepared for hoaxes (cheat) once the event is publicly known.
8. If an emergency lead to lost or stolen dangerous source, theft or public contamination contact EM and ask to activate relevant SOP and follow his instructions to extended response.

Perform by NEC/SLAERC

1. Verify and assess the hazard
2. Activate National emergency and inform to EM to activate
3. Coordination with first responders and IC and provide initial advises
4. NEC take actions to coordinate with EM and dispatch the group to the scene for measurements
5. Have the SLAERC notify potentially affected States and the IAEA if there are indications that other States or their citizens may be affected (Transnational emergency.
6. If a lost or stolen dangerous source may be involved implement the SOP 6 for a "**Theft of a dangerous source".**
7. If significant public contamination is possible, implement the SOP 9 for "**Public contamination or exposure due to orphaned radioactive sources found in a public place or any other places"**
8. If serious overexposure is suspected, implement the SOP 7 for "**Serious overexposure (non-medical)".**
9. If a dangerous source is to be recovered, implement the SOP 17 for "**Recovery of an uncontrolled dangerous source".**

Emergency medical responder/team:

1. Operate under the ICS incident commander.
2. Implement and manage the on-scene medical response, including:
   - Establish, with support from the radiological assessor, a victim assembly point near the scene of the emergency for medical and radiological triage – field treatment.

- Identify local medical facilities to be used for treatment of potentially contaminated/exposed victims; brief their staff on treatment of exposed and contaminated casualties and risks. Arrange, with the radiological assessor, to provide these local medical facilities with expert support, if needed, on radiological monitoring, decontamination and radiation protection.

3. Implement provisions to assess the concerns of members of the public (worried-well) about radiation exposure/contamination (not at a hospital or other crucial facility).
4. Provide medical advice and support to local medical community on treatment of contaminated/exposed individuals and the risk (negligible) to their staff.

EM:

1. Assess the situation with all available details
2. Provide advises to IC to lead the scene
3. Develop and implement a recovery and cleanup plan in order to return to normality
4. Inform to DMC for activate NRERC for extended response
5. Prepare for immense media attention once the emergency becomes publicly know.
6. Provide media briefings with technical experts on the threat and the appropriate and inappropriate public response actions (e.g. who should be monitored and where to go) and actions being taken to ensure public safety, to protect products and international trade etc; activate a PIC if needed.
7. If national radiological response resources are insufficient – request international assistance through the IAEA.

SLAERC Emergency response teams:

1. Operate under the ICS incident commander.
2. Monitor for gamma, beta and alpha and establish or adjustment of an inner-cordoned area (safety distance) in accordance with Table A.3.1 in Appendix 3.
3. If there are indications that a dangerous neutron source (e.g. Cf-252, Be/Am well logging) further team should be requested from NEC/EM.
4. All results should be communicated with EM and brief incident commander on risks and provide measures to protect emergency workers (including law enforcement and medical responders) and control their dose.
5. Prepare for bobby traps, a second devise intended to injure responders, a second devise intended to injure evacuees.
6. Provide support to medical response to include conducting radiological assessment at victim assembly point and arranging support for the medical facilities treating possibly contaminated victims.
7. Establish radiological assessor base near the scene and activate a Radiological Measurement Assessment Center if needed to co-ordinate radiological field operations.
8. Protect evidence needed by law enforcement to the extent possible consistent with public protection including:
    - Working with law enforcement.

- Preventing possible criminal acts at the scene (e.g. theft, introduction of contamination);
- Preserving documents, samples etc. associated with radiological response;
- Identifying and recording people involved. Ensure that law enforcement activities do not cause safety concerns.

9. Ensure that law enforcement responders are provided with adequate protection as emergency workers.
10. Ensure that the radiological response does not interfere with law enforcement (e.g. unnecessary interference with collection or preservation of evidence).

Disaster Management Center

1. Activate NRERC
2. Follow the recommendations issued by EM
3. Provide necessary funds to mitigate the consequences
4. Alert all extra resources

SOP 12: Credible or confirmed terrorist threats

Description

A credible threat of committing a terrorist act perceived by the public or officials as a nuclear or radiological emergency. This could involve an RDD, contamination of places, food, water or products, exposure of people, sabotage, or attacks on facilities.

Potential hazards

For a description of the radiological hazards, see the potential hazards sections of the SOP for RDD, international contamination of water supplies, international contamination of food/products, and theft of a dangerous source or public contamination/exposure. The objective of the perpetrators may be to create "terror" among the public with the resulting psychological and economic impact. Experience shows that the public's perception of the risk posed by the threat may be more important than the actual risk. Consequently, an important part of the response will be providing the public with timely, informative (understandable) and consistent information on the true risk.

Emergency response

Incident commander (lead first responder):

1. Activate an integrated response (including law enforcement, investigative and public safety/radiation components) using the ICS under an incident commander operating from an incident command post.
2. Take actions to neutralize the threat such as:
    - Apprehending suspects;
    - Eliminating the opportunity to carry out the threat (e.g. improved security, establish means for early detection); or
    - Removing the motive for the threat.
3. Take actions to mitigate the economic and psychological consequences of the threat, including provisions to promptly make a public announcement describing the hazard realistically and to limit the spread of contamination and contaminated products.
4. Implement action consistent with international standards (see Ref. [19]) to protect the public, workers, responders, and the economy from the actual or perceived radiological risk.
5. Prepare secondary/simultaneous threats.
6. Prepare for bobby traps, a second device intended to injure responders, a second device intended to injure evacuees.
7. Prepare for hoaxes once the threat is publicly known.
8. Prepare to implement additional response actions using one of the following guides as appropriate:
    - RDD
    - International contamination of water
    - International contamination of food/products
    - Theft of a dangerous source
    - Public contamination/exposure
    - Serious overexposure

NEC/EM

1. Take actions to mitigate the economic and psychological consequences of the threat, including provisions to promptly make a public announcement describing the hazard realistically and to limit the spread of contamination and contaminated products.
2. Notify potentially affected States and the IAEA through USIE if there are indications that other States or their citizens may be affected (Transnational emergency.
3. Monitor public response and deal with inappropriate behavior.
4. If the emergency receives media or public attention, implement media briefings on the threat and appropriate public action. Activate a PIC if needed.

Radiological assessment (SLAERC Emergency teams}:

1. Operate under the ICS incident commander.
2. Conduct radiation monitoring and brief to EM
3. If there are indications that a dangerous neutron source (e.g. Cf-252, Be/Am well logging) may be involved obtain experts to conduct neutron monitoring (possibly with IAEA assistance if not available within the state).
4. Ensure operational guidance (OILs) is available for assessment and implementation of evacuation, relocation, medical follow-up, and treatment of contaminated individuals, restriction of water and food, and restriction of products and commodities. Provide a plan language explanation of the risk and appropriate public action with the guidance.
5. Provide measures to protect emergency workers (including law enforcement) and control their dose.

Emergency medical responder/team:

1. Operate under the ICS incident commander.
2. Make provisions to implement and manage the on-scene medical response, including.
    - Establishing, with support from the radiological assessor, a victim assembly point near the scene of the emergency for medical and radiological triage – field treatment.
    - Identifying local medical facilities to be used for treatment of potentially contaminated/exposed victims. Brief their staff on treatment of exposed and contaminated casualties and risks. Arrange, with the radiological assessor, to provide these local medical facilities with expert support, if needed, on radiological monitoring, decontamination and radiation protection.
    - Implementing provisions to assess the concerns members of the public (worried-well) who are concerned about radiation exposure/contamination (not at a hospital or other crucial facility).
3. Prepare to provide medical advice and support to local medical community on treatment of contaminated/exposed individuals and the negligible risk to their staff.

SOP 13: Non-credible terrorist threats

Description

A non-credible threat to commit a terrorist act perceived by the public as posting a radiological hazard.

Potential hazards

The objective of the perpetrators may be to create "terror" among the public with the resulting psychological and economic impact. Experience shows that the public's *perception* of the risk posed by the threat may be more important than the actual risk. These perceptions could result in significant adverse and inappropriate public reaction and economic consequences if public and financial institution concerns are not promptly addressed.

Emergency response

Incident commander (lead first responder - national official) Police/ NEC/EM:

1. Ensure that all governmental agencies are informed of the results of assessment, the names of those leading the response and an explanation of their role.
2. Monitor public response and deal with inappropriate behavior.
3. Report to law enforcement criminal hoaxes for investigation.
4. If the emergency receives media or public attention, implement media briefings on the threat and appropriate public action; activate a PIC if needed

Incident investigator/team:

1. Operate under the ICS incident commander.
2. Conduct an investigation and further analysis to confirm the assessment of credibility.

SOP 14: Intentional contamination of water supply

Potential hazards

It is probably impossible to contaminate a public water supply with a volume greater than 1000 m^3 to a level that would result in doses that are immediately life threatening, or that would warrant long term medical follow-up. It would be possible to contaminate water supplies to levels above the action levels recommended for emergencies [Table A.2.3]. However, water contaminated to levels of 100 or more times these levels could be consumed safety for a limited time. There can be significant adverse and inappropriate public reaction and economic consequences if public and financial institution's concerns are not promptly addressed. Restrictions of the use of the water supply could result in public safety and sanitation concerns. Excess, radiation induced, cancers should not be detected following this type or emergency, even if large amounts of radioactive material are involved.

Emergency response

Incident commander (lead first responder):

1. Integrate the response (including law enforcement, investigative, radiological components and public safety/administration) using the ICS. Operate from an incident command post near the scene.
2. Conduct immediate field assessment for indications that there may be radioactive contamination:
    - Was a credible threat received?
    - Is there a message at the scene?
    - Radiation levels significantly above background (> 1 μSv/h)
3. If radiological terrorism is suspected/confirmed: Request assistance from SLAERC;
    - Take action to prevent, delay, and reduce contamination of water supply if it will not have an immediate impact on public health or safety.
4. Evacuate workers from potential areas with high levels of contamination (e.g. site where contamination may have been introduced) unless they are needed for continued safe operations.

NEC/SLAERC

1. Coordinate all responses
2. Activate national response after assess the hazard level
3. Prepare radiological assessment teams
4. Contact EM for further decision making
5. Notify potentially affected States and the IAEA if there are indications that other States or their citizens may be affected (Transnational emergency).
6. Request IAEA assistance if required for radiological dose assessment or If national radiological response resources are insufficient.

EM

1. Restrict use of the water if replacement water is available (contact water supply and drainage Board).
2. Inform DMC
3. Advise to IC regarding the water replacement.
4. If replacement water is not available, allow use of levels up to 100 times the levels in Table A.6.3 for a short time.
5. Inform pubic of the risk; note that consumption at levels of the water is safe if levels are < 100 times those in Table A.6.3.
6. If water with contamination levels above the levels in Table A.6.3 are being used have the medical and radiological assessment teams conduct an assessment of the risks and make recommendations.
7. Prepare for hoaxes once the threat is publicly known.
8. Monitor public response and deal with inappropriate behavior.
9. Prepare for immense media attention once the emergency becomes publicly known.
10. Provide media briefings on the threat and appropriate and inappropriate public response actions (e.g. do not drink water) and actions being taken to ensure public safety, to protect products and international trade etc.; activate a PIC if needed.
11. If a lost or stolen dangerous source may be involved, implement the SOP 6 for a "**Theft of a dangerous source".**
12. If significant public contamination is possible, implement the SOP 9 for "**Public contamination or exposure due to orphaned radioactive sources found in a public place or any other places"**
13. If serious overexposure is suspected, implement the SOP 7 for "**Serious overexposure (non-medical)".**
14. If a dangerous source is to be recovered, implement the SOP 17 for "**Recovery of an uncontrolled dangerous source".**

Emergency medical responder/team:

1. Operate under the ICS incident commander.
2. Implement and manage the on-scene medical response, including:
   - Establish, with support from the radiological assessor, a victim assembly point near the scene of the emergency for medical and radiological triage – field treatment.
   - Identify local medical facilities to be used for treatment of potentially contaminated/exposed victims; brief their staff on treatment of exposed and contaminated casualties and risks. Arrange, with the radiological assessor, to provide these local medical facilities with expert support, if needed, on radiological monitoring, decontamination and radiation protection.
3. Implement provisions to assess the concerns of members of the public (worried-well) about radiation exposure/contamination (not at a hospital or other crucial facility).
4. Provide medical advice and support to local medical community on treatment of contaminated/exposed individuals and the risk (negligible) to their staff.

Radiological assessment (SLAERC radiological assessor team):

1. Operate under the ICS incident commander.
2. Monitor for gamma, beta and alpha and establish an inner-cordoned area (safety distance) in accordance with Appendix 4.
3. If there are indications that a dangerous neutron source (e.g. Cf-252, Be/Am well logging) conduct neutron monitoring.
4. Promptly locate and keep people away from the significant source(s)/contamination.
5. Brief incident commander/EM on risks and provide measures to protect emergency workers (including law enforcement) and control their dose.
6. Provide support to medical response to include conducting radiological assessment at victim assembly point and arranging support for the medical facilities treating possibly contaminated victims.
7. Establish radiological assessor base near the scene and conduct monitoring if needed to co-ordinate radiological field operations.
8. Establish a system to take and analyses samples of potentially contaminated water at the source; use locations where contamination may have been introduced and possible contamination concentrators (e.g. filters).
9. Estimate possible levels of contamination at the points of use, and time contamination will arrive three.
10. Establish a process to control the dose to the water system processing workers.
11. Identify members of the public and workers who should;
    - Be immediately decontaminated;
    - Be decontaminated as soon as reasonable;
    - Be released – no further action needed;
    - Get a medical follow-up because of possible exposures.
12. Inform those assessed of the results, risk, and actions they should take.
13. Protect evidence needed by law enforcement to the extent possible consistent with public protection including:
    - Working with law enforcement;
    - Securing the scene against possible criminal acts (e.g. theft, introduction of contamination);
    - Preserving documents, samples etc. associated with radiological response.
14. Ensure law enforcement activities do not cause safety concerns.
15. Ensure law enforcement responders are provided with adequate protection as emergency workers.
16. Ensure that the radiological response does not interfere with law enforcement (e.g. unnecessary interference with collection or preservation of evidence).

DMC:

1. Ensure all governmental agencies are informed of who is leading the response and that they receive an explanation of the risk and their role.
2. Restrict national or international export of potentially contaminated water or items.
3. Develop and implement a recovery and cleanup plan in order to return to normality.

SOP 15: Intentional contamination of food/products

Description

Actual or potential contamination of food and commercial products

Potential hazards

Contamination of food/products resulting in significant exposure of large numbers of the public is very unlikely. However, there is a potential for significant exposure to small numbers (e.g. contamination of products on store shelves) and to those working with or transporting the products/food. Contamination in excess of national and international standards for commodities is possible. Allowing contaminated or potentially contaminated products in the international or local distribution system could have large economic consequences. Excess cancers should not be seen following this type of emergency, even if large amounts of radioactive material are involved.

There can be significant adverse and inappropriate public reaction and economic consequences if public and financial institutions concerns are not promptly addressed.

Emergency response

Incident commander (lead first responder)

1. Activate an integrated response (including law enforcement and radiological components) using the ICS under an incident commander to implement actions to reduce any radiological, psychological, and economic impact.
2. Ensure that all governmental agencies are informed including SLAERC who is leading the response and that they receive an explanation of the risk and their role.
3. Monitor pubic response and deal with inappropriate behavior.

EM

1. Take actions to prevent contaminated products from entering the distribution system – consider cross contamination by use of common process or distribution systems. Keep people away from and remove potentially contaminated food or products from public use until they have been assessed.
2. Track existing supplies through the distribution chain and recall all suspect products.
3. Conduct national monitoring of potentially contaminated food, products, and population to confirm adequacy of controls.
4. Prepare for hoaxes once the threat is publicly known.
5. Monitor pubic response and deal with inappropriate behavior.
6. Make arrangement to dispatch a radiation assistance team (radiological assessor) to perform monitoring and analyses.
7. Provide measures to protect workers in the industry involved and emergency workers (including law enforcement) and control their dose.
8. Coordinate with NRERC
9. Develop and implement a recovery and cleanup plan in order to return to normality
10. Prepare for immense media attention once the emergency becomes publicly known.
11. Once the emergency receives media or public attention, implement media briefings with DMC on the threat and the appropriate and inappropriate public response actions (e.g. who should be

monitored and where to go) and actions being taken to ensure public safety, to protect products and international trade etc.; activate a PIC if needed.

NEC/SLAERC

1. Coordinate with EM
2. notify potentially affected States and the IAEA if there are indications that other States or their citizens may be affected (Transnational emergency).
3. If national radiological response resource is insufficient – request international assistance through the IAEA.
4. If a lost or stolen dangerous source may be involved, implement the SOP 6 for a "**Theft of a dangerous source".**
5. If significant public contamination is possible, implement the SOP 9 for "**Public contamination or exposure due to orphaned radioactive sources found in a public place or any other places".**
6. If serious overexposure is suspected, implement the SOP 7 for **"Serious overexposure (non-medical)".**
7. If a dangerous source is to be recovered, implement the SOP 17 for "**Recovery of an uncontrolled dangerous source".**

Emergency medical responder/team:

1. Operate under the ICS incident commander.
2. Implement and manage the on-scene medical response, including:
   - Establish, with support from the radiological assessor, a victim assembly point near the scene of the emergency for medical and radiological triage – field treatment.
   - Identify local medical facilities to be used for treatment of potentially contaminated/exposed victims; brief their staff on treatment of exposed and contaminated casualties and risks. Arrange, with the radiological assessor, to provide these local medical facilities with expert support, if needed, on radiological monitoring, decontamination and radiation protection.
3. Implement provisions to assess the concerns of members of the public (worried-well) about radiation exposure/contamination (not at a hospital or other crucial facility).
4. Provide medical advice and support to local medical community on treatment of contaminated/exposed individuals and the risk (negligible) to their staff.

Radiological assessment (Emergency response teams SLAERC):

1. Operate under the ICS incident commander.
2. Take and analyses samples at possible locations were contamination may have been introduced.
3. Determine if members of the public may have been exposed or if there may have been a spread of contamination.
4. Estimate possible levels of contamination at the points of use, and time contamination will arrive there.

5. Monitor for gamma, beta and alpha and establish a safety perimeter at 100 μSv/h and where there is a potential for significant alpha emitter contamination.
6. Brief EM and IC on risks and provide measures to protect emergency workers (including law enforcement) and control their dose.
7. Provide support to medical response to include conducting radiological assessment at victim assembly point and arranging support for the medical facilities treating possibly contaminated victims.
8. Establish radiological assessor base near the scene if needed to co-ordinate radiological field operations.
9. Establish a system to take and analyses samples of potentially contaminated food or products at their source; use locations and possible contamination concentrators (e.g. filters).
10. Establish a process to control the doses to food or process workers.
11. Identify members of the public and workers who should:
    - Be immediately decontaminated;
    - Be decontaminated as soon as reasonable;
    - Be released – no further action needed;
    - Get a medical follow-up because of potential exposures.
12. Inform those assessed of the results, risk, and actions they should take.
13. Protect evidence needed by law enforcement to the extent possible consistent with public protection, including:
    - Working in concert with law enforcement;
    - Securing the scene against possible criminal acts (e.g. theft, introduction of contamination);
    - Preserving documents, samples etc. associated with radiological response.
14. Ensure law enforcement activities do not cause safety concerns.
15. Ensure law enforcement responders are provided with adequate protection as emergency workers.
16. Ensure that the radiological response does not interfere with law enforcement (e.g. unnecessary interference with collection or preservation of evidence).

SOP 16: Radioactive satellite re-entry

Description

Re- entry of nuclear power sources from space. Reentry may be foreseen several weeks or months in advance, although some accident sequences could occur within hours. Estimates of the time and location for the reentry are often inaccurate. Typically, the radioactive components are less than one cubic meter in volume and shatter upon re- entry. Debris can fall over an area of 100000km^2 or more and in most cases, it would be virtually impossible to identify the area of impact with sufficient accuracy to allow reasonable precautionary protective actions to be taken.

Potential hazards

The risk is very low and comes principally from someone finding and handling radioactive debris. Surface radiation levels or up to 5 Gy/h have been recorded from satellite debris, which could result in server or fatal injuries. However, none of the re-entries to date has resulted in a known case or significant public exposure or significant food or water contamination.

Emergency response

NEC/SLAERC

1. Receive information from IAEA through USIE/fax/ call etc. or receiving information from state responsible for the satellite
2. Assess the level of hazard-transnational emergency and coordinate the national response
3. Dispatch the radiological monitoring teams to suspected areas
4. If national radiological response resources are insufficient – request international assistance through IAEA.
5. If significant public contamination or exposure is possible, implement the SOP 9 for "**Public contamination or exposure due to orphaned radioactive sources found in a public place or any other places".**
6. If serious overexposure is suspected, implement the SOP 7 for "**Serious overexposure (non-medical)".**
7. If a dangerous source is to be recovered, implement the SOP 17 for "**Recovery of an uncontrolled dangerous source".**

Perform by Incident commander:

1. Co-ordinate the response using the ICS under an incident commander.
2. Obtain radiological assessment assistance to co-ordinate the radiological response and radiation protection from SLAERC.
3. Obtain emergency medical assistance to advice and co-ordinate with medical facilities.
4. Obtain public information officer to provide information to the public.
5. Implement action to protect the public, workers, responders, and the economy from the actual or perceived radiological risk by implementing action consistent with international standards.
6. If, after re-entry, the area of impact can be bounded, implement provision to locate debris and instruct the public to avoid and report suspicious objects.

7. Coordinate response with NEC/EM for extended response

EM/Public information officer/team:

1. Initiate media briefings from a single official source if the emergency receives media or public attention.

Emergency medical responder/team:

1. Operate under the ICS incident commander.
2. Advice medical community on recognition of radiation induced injuries and immediate action to take if such injuries are suspected.
3. Prepare to assess concerned people (worried-well) for radiation exposure/contamination (not at a hospital or other crucial facility)

SLAERC Emergency Teams-Radiological assessment:

1. Operate under the ICS incident commander.
2. Establish monitoring point and conduct monitoring to locate radioactive debris if the search area can be reasonably limited.
3. On locating satellite debris, perform immediate actions to render it safe.
4. Monitor public response and deal with inappropriate behavior).

SOP 17: Recovery of an uncontrolled dangerous source

Description

Recovery of an unshielded / confined dangerous source

Potential hazards

Unknowingly handling unshielded/unconfined dangerous quantities (see Annexure 4) can result in permanent injuries from external exposure or inadvertent ingestion and in localized contamination, requiring cleanup. Unknowingly handling quantities 10-100 times the D- values given in Annexure 4 for a dangerous source could be immediately life threatening.

Perform by lead first responder

1. Take lifesaving and first aid action immediately, before conducting radiological monitoring.
2. Evacuate people from affected area and establish a safety perimeter at 100 μSv/h and in accordance with Table A.3.1 in Appendix 3.
3. Evaluate all available information; retrace the sequence of events. If illicit trafficking or any criminal act is suspected, notify appropriate law enforcement authorities and integrate them into the ICS.
4. If public contamination or exposure is possible, implement, as appropriate, the SOP for Public contamination/exposure.
5. Obtain radiological assessment assistance from SLAERC.
6. Obtain emergency medical assistance to co-ordinate the medical response.
7. If the emergency receives media or public attention activate national response and keep the public informed.
8. Activate response using the ICS co-ordinate under an incident commander near the scene.
9. Fully characterize the radiological and physical situation before proceeding.

Perform by EM with national response

1. Notify potentially affected States and the IAEA if there are indications that other States or their citizens may be affected (Transnational emergency).
2. Monitor public response and deal with inappropriate behavior.
3. Develop recovery plan that address:
    - Determination of the location of the source and any contamination and of the radiological characteristics (beta, alpha, and gamma emitters), chemical characteristics affecting spread of contamination (e.g. water solubility), and physical characteristics (e.g. size, weight, shape, robustness) affecting worker safety or recovery methods;
    - If there are indications that a dangerous neutron source (e.g. Cf-252, Be/Am well logging) may be involved obtain experts to conduct neutron monitoring (possibly with IAEA assistance if not available within the State)
    - On-scene issues including local inhabitants, assembly areas, access routes, and means for spreading contamination (e.g. streams);

- Control of worker risk (e.g. protection from hazardous chemicals, tracking and limiting dose) and provision of medical support (see also guide for Radiography disconnected or damaged source);
- Co-ordination with local officials;
- Transport/storage containers (design and construction), storage and long-term security;
- Public and media relations;
- Security, legal and law enforcement concerns;
- Gathering and preservation of information;
- Recovery methods and remote handling tools;
- Transport (e.g. special approval for uncertified containers, security, and vehicle);
- Formation of a recovery team (with replacements) using the ICS that supports incident command, operational safety, public information, planning, operations (liaison, radiological assessment, recovery, security, law enforcement/investigation, medical), logistics (transport, food, housing, communication), and financial and administrative issues; and

4. Conduct of team training to limit individual dose, involving realistic rehearsals of all aspects of the recovery operations.
5. If terrorism is indicated, implement the SOP 12 for "**Credible or confirmed terrorist threats".**
6. If serious overexposure is suspected, implement the SOP 7 for **"Serious overexposure (non-medical)".**
7. If public exposure or contamination is possible or reported, implement the SOP 9 for "**Public contamination or exposure due to orphaned radioactive sources found in a public place or any other places".**

Perform by SLAERC Emergency response teams- (radiological assessor):

1. Operate under the ICS incident commander.
2. Monitor for gamma, beta, and alpha, confirm exact location of the source, and establish an inner-cordoned area (safety distance) in accordance with Table A.3.1 in Appendix 3.
3. If there are indications that a dangerous neutron source (e.g. Cf-252, Be/Am well logging) may be involved conduct neutron monitoring (more teams requested from EM)
4. Determine if the source is leaking and check for contamination spread;
5. Provide measures to protect emergency workers (including law enforcement) and control their dose.
6. Brief incident commander on risks and provide measures to protect emergency workers (including law enforcement) and control their dose.
7. Reconstruct/record the doses received and inform those exposed about the risks and arrange, where appropriate, for long term medical follow-up contact EM or Medical Management teams.

Emergency medical responder/team:

1. Operate under the ICS incident commander.
2. Implement and manage the on-scene medical support.

3. If public exposure or contamination is possible or reported, implement the SOP 9 for "**Public contamination or exposure due to orphaned radioactive sources found in a public place or any other places"** be followed.

Incident investigator/team:

1. Operate under the ICS incident commander.
2. Conduct an investigation, in close co-operation with law enforcement if criminal activity is suspected, to determine the cause, origin of material or device involved, and possible involvement or other sources. Take appropriate action to prevent similar emergencies.
3. Coordinate with Emergency Manager (EM) and inform the investigation results

SOP 18: Detection of elevated radiation levels

Description

Elevated radiation levels of ambient radiation or radioactive contamination in air, food/water or commercial products (at the time of discovery of unknown origin) raising suspicion of an emergency situation of actual, potential or perceived radiological significance

Potential hazards

Elevated radiation levels of unknown origin in air/food/water/products resulting in significant exposure of the public are very unlikely. However, if the elevated radiation levels in air or water are due to a significant release of radioactive material from a facility in EP category I or II, contamination in excess of national and international standards is possible. Allowing contaminated food/water/products in the international or local distribution system could have serious economic consequences. Detection of elevated radiation levels in food or consumer products can indicate an accident at a manufacturing facility, possibly from another State (e.g. accidental incorporation of an 'orphan source' into recycled scrap metal). There can be significant adverse and inappropriate public reaction and economic consequences if public and financial institution's concerns are not promptly addressed.

Emergency response

Incident commander (NEC/EM/law enforcement)

1. Obtain radiological assessment assistance to identify and investigate the source of elevated radiation levels and to assess possible impact and its radiological significance.
2. Obtain public information officer to provide information to the public.
3. Evaluate all available information: retrace the sequence of events. Be aware of the possibility of criminal acts. If illicit trafficking or any criminal act is suspected, notify appropriate law enforcement authorities and integrate them into the ICS.
4. Take actions to prevent contaminated products from entering the distribution system. Keep people away from and remove potentially contaminated food or products from public use until they have been assessed.
5. Inform the public of the risk.
6. NEC inform to the IAEA, if transnational emergency.
7. Monitor public response and deal with inappropriate behavior.
8. If a lost or stolen dangerous source may be involved, implement the SOP 6 for a "**Theft of a dangerous source".**
9. If radiological terrorism is suspected/confirmed implement the SOP 12 for "**Credible or confirmed terrorist threats".**
10. If significant public contamination or exposure is possible implement the SOP 7 for "**Public contamination or exposure due to orphaned radioactive sources found in a public place or any other places".**

Radiological assessment (SLAERC teams)/EM:

1. Increase the frequency of routine monitoring; enhance environmental and food monitoring; use locations where contaminated and assess the radiological significant of contamination.
2. Establish a system to take and analyses samples of contaminated items.
3. Identify the contaminant and assess the radiological significance of contamination.
4. Brief local/national officials on risks based on actual radiological data.
5. Analyze the course of events and identify members of the public and workers (if any) who should be checked for contamination.
6. Assess likely exposures of public and workers since originating event.
7. Inform those assessed of the results, risk, and actions they should take.

NEC/EM/DMC:

1. Prepare for media attention once the event becomes publicly known.
2. Provide media briefings on the threat and appropriate and inappropriate public response actions (e.g. do not drink water) and actions being taken to ensure public safety, to protect products and international trade etc.; activate a PIC if needed.

EM/NEC:

1. Ensure all governmental agencies are informed of who is leading the response and that they receive an explanation of the risk and their role.
2. Restrict national or international export of potentially contaminated water/food or items.
3. Notify the IAEA if:
    - The elevated levels are unusually high (for example, at least ten times above normal),
    - There are indications that other States or their citizens may be affected (Transnational emergency).

SOP 19: Nuclear Weapon Accident

Description

A crash, without a nuclear explosion, of a vehicle or aircraft carrying a nuclear weapon.

Potential hazards

Detonation of the high explosives contained in the weapon represents a hazard near the crash. Inhalation of plutonium and other toxic material from the smoke from a burning aircraft, vehicle, or conventional explosives and from resuspension of the Pu deposited on the ground could be immediately life threatening to those without inhalation protection to about 1 km downwind. Normally available radiation monitoring instruments may not be able to detect hazardous levels of Pu. Fire fighters are generally equipped with respiratory protection, which provide good protection against the inhalation hazard.

Emergency response

Incident commander (lead first responder):

- Observe from a distance and assess all possible hazards.
- Approach from upwind or use respiratory protection if possible and other available protective clothing and ensure those approaching scene take action to prevent inadvertent ingestion of contamination (e.g. wear gloves, do not smoke – or eat).
- Perform life saving measures and provide first aid for serious injuries immediately, before conducting radiological monitoring.
- Control fires and other consequences that are an immediate threat to life.
- Establish an inner-cordoned area (safety distance) in accordance with Table A.3.1. in Appendix 3.
- Record names of potentially exposed individuals.
- Activate response using the ICS coordinated under an incident commander from an incident command post near the scene.
- Establish the incident command post upwind at a safe distance (> 1 km) and in a secure area.
- Arrange to transport seriously injured people to local medical facility. If they may be contaminated, wrap them in a blanket to control the spread of contamination. Tell those transporting the victim and the receiving medical facility that the person may be contaminated and that the risk to those treating such a patient is negligible but care should be taken to prevent inadvertent ingestion of contamination.
- Gather potentially exposed or contaminated people, who are not seriously injured, in a safe location (victim assembly point) to: register them, give them a medical and radiological evaluation (triage) and arrange for their treatment.
- Arrange to alert local medical facilities of the potential for arrival of concerned people (worried well) if there is wide spread public concern.

NEC/SLAERC

- Confirm the call
- Assess the level of hazard
- Notify EM.
- Dispatch SLAERC emergency response teams.

Radiological assessment (Radiological assessor national team):

- Operate under the ICS incident commander.
- Provide respiratory protection to protect emergency workers and control their dose.
- Implement action to protect the public, workers, responders, and the economy from the actual or perceived radiological risk by implementing action consistent with international standard.
- Monitor for gamma, beta, and alpha radiation levels to confirm contamination and establish an inner-cordoned area (safety distance) in accordance with Table A.3.1 in Appendix 3.
- Brief incident commander on risks and provide measures to protect emergency workers (including law enforcement) and control their dose.
- Provide support to medical response to include conducting radiological assessment at victim assembly point and arranging support for the medical facilities treating possibly contaminated victims.
- If significant public contamination or exposure is possible, implement the action guide SOP 9 for "**Public contamination or exposure due to orphaned radioactive sources found in a public place or any other places".**
- If serious overexposure is suspected, implement the action guide SOP 7 for **"Serious overexposure (non-medical)".**
- If a dangerous source is to be recovered, implement the action guide SOP 17 for "**Recovery of an uncontrolled dangerous source".**

EM:

- Provide specialized monitoring and technical support, including recommending OILs for relocation and return to normal.
- Support recovery operations.
- Initiate media briefings from a single official source if the emergency receives media or public attention. Activate a Pic if needed.
- If national radiological response resources are insufficient-request international assistance through the IAEA.
- If needed, request support of specialist from the responsible State.
- Notify potentially affected State and the IAEA if there are indications that other States or their citizens may be affected (Transnational emergency).

Emergency medical responder/team:

- Operate under the ICS incident commander.
- Implement and manage the on-scene medical response, including:
- Establish, with support from the radiological assessor, a victim assembly point near the scene of the emergency for medical and radiological triage – field treatment.
- Identify local medical facilities to be used for treatment of potentially contaminated/exposed victims; brief their staff on treatment of exposed and contaminated casualties and risks. Arrange, with the radiological assessor, to provide these local medical facilities with expert support, if needed on radiological monitoring, decontamination and radiation protection.
- Implement provisions to assess the concerns members of the public (worried-well) who are concerned about radiation exposure/contamination (not at a hospital or other crucial facility).
- Provide medical advice and support to local medical community on treatment of contaminated/exposed individuals and the risk (negligible) to their staff.

Ministry of Foreign Affairs:

- Co-ordinate with EM for necessary response.
- Co-ordinate with the State responsible for the weapon; ask them to provide monitoring and other assistance.

SOP 20: Wide spread contamination due to nuclear accident in a neighboring country (Category V Emergency and Transnational Emergency)

Description

Any nuclear power plant accident can potentially impact Sri Lanka. However, the biggest impact may have the Kudankulam NPP situated in Kudankulam in Thirunalveli district in India, which is the only one to be categorized as EPC V. Although accidents in other countries may not be in the 300km radius, the preparedness and response for all of them is essentially the same.

The Kudankulam NPP has two units generating 2 x 3000 MW and another two units with the same power under construction. According to distance calculation Sri Lanka is within the 300km distance which is classified as ICPD zone for this NPP as shown in figure An 1.1 in Annexure 1 Therefore, according to EPR categories this is considered as EPR V category.

Therefore, it is possibility to initiate appropriate protective actions for this area, If the plume is expected to Sri Lanka.

Preparedness steps- Before the event

1. Establish a mechanism to receive data from the early warning system of the Sri Lanka, Atomic Energy Board.
2. Bilateral agreement should be established with India in case of any Nuclear Emergency to receive early notification and information on emergency and emergency response throughout.
3. Identify key persons at various locations of the country who can provide data in case of nuclear emergency. Creation of small teams with training and knowledgeable person in radiation measurements at remote areas.
4. Identify the possible areas where protective actions may be warranted (Fig. An.1.1 in Annexure 1) in consultation with Divisional Secretariat in those areas and inform to the public through media

Response steps

NEC/SLAERC

1. Assess notification received from India/ IAEA.
2. Confirm the accident.
3. Analyze the data provided by the SLAEB from Early Warning System.
4. Call-up a meeting with Technical Advisory Committee.
5. Activate Emergency response teams.
6. Collect samples and measure radioactivity levels
7. Measure environmental doses in selected locations
8. Decide suitable precautionary measures and advice to DMC for implementation

TAC Actions

Emergency Manager's role (DG/SLAERC)

Initial steps

1. Confirming activation of TAC.
2. Informing TAC about situation.
3. Delegating critical tasks to TAC members.
4. Informing DMC

On-going Actions

- In case of release dispatch, the survey teams to monitoring (Prioritize the areas).
- Obtain information updates from India/Accident country.
- Take into account meteorological data from Contact Point.
- Assess all data: NDEWS, monitoring results, metrological (wind directions; wind speed; areas of rain).
- Recommend protective actions (What, Where) to DMC.
- Release alert to people in affected areas through DMC.
- Reassess the possible indirect impact based on information from affected countries or other sources and updated meteorological information.
- Help DG/DMC to implement protective actions. Call NRERC for further decisions.
- Advise the protective action recommendations to the relevant embassies to protect the Sri Lankan community living in affected state and nearby.
- Inform International Airports and other entry points (sea ports) to activate their radiation emergency management plans (Survey points, contamination control, flight schedule)
- Issuing press release in co-ordination with DMC 30 minutes after the activation.
- Attend media briefing with DG/DMC.
- Ensure that all actions, decisions and/or recommendations have been registered. Save all records, maps, status boards, press releases etc.
- Initiate and supervise dose assessment for the public.
- Once the acute stage is over developing plan for long-term follow up (if needed) by the radiological assessor and relevant national organizations.

Disaster Management Center

- Call-up a meeting with NRERC.
- Implement protective actions as advised by the SLAERC. Local level, regional level and national level
- Keep relevant governmental organizations informed about the progress of the situation decisions taken.
- Keep media and public well informed at all-time about actions taken and recommended measures.

- Ensure that all actions, decisions and/or recommendations have been registered. Save all records, maps, status boards, etc.

SLAEB

- Alerts warning from NDNEWs and communicate with SLAERC.
- Prepare all standard laboratories for sample analysis.
- Alert instructions provided by the Emergency Manager.

Ministry of Foreign affairs

- Coordinate with EM to further necessary action and support

Airport Aviation and Sri Lanka Limited.

- Coordinate with EM to further necessary action and support

National Nuclear or Radiological Emergency Management Plan (EMP)

by

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