FNCA
Forum for Nuclear Cooperation in Asia

FNCA Consolidated Report on Nuclear/Radiological Emergency Preparedness and Response

March 2017

Radiation Safety and Radioactive Waste Management Group, Forum for Nuclear Cooperation in Asia (FNCA)

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Preface

Through the activities of Radiation Safety and Radioactive Waste Management (RS & RWM) Group in the Forum for Nuclear Cooperation in Asia (FNCA), we present the book of "The Consolidated Report on Nuclear/Radiological Emergency Preparedness and Response in FNCA Countries". The purpose of this report is a summary of this region based on the mutual understanding on RS & RWM in FNCA countries. The authors believe the reference of this book will cause further improvements of radiation safety and radioactive waste managing level in FNCA countries.

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I. Framework of Regional Cooperation under FNCA

I-1. What is FNCA?

The 1st International Conference for Nuclear Cooperation in Asia (ICNCA) was held by the Atomic Energy Commission in March 1990 to promote cooperation in the field of nuclear energy with neighboring Asian countries more efficiently. Since then, the Atomic Energy Commission of Japan has held many ICNCAs where the ministers in charge of development and utilization of nuclear energy exchanged frank views on how to proceed with regional cooperation, and has carried out practical cooperation on specified subjects as well. At the 10th International Conference for Nuclear Cooperation in Asia held in March 1999, it was agreed to move to a new framework, "Forum for Nuclear Cooperation in Asia" (including Coordinator and Project Leader System) with a view and information to shifting to more effective and organized cooperation activities. Under this framework, view and information exchanges are made on the following fields: (1) Radiation Utilization Development (Industrial Utilization/Environmental Utilization, and Healthcare Utilization), (2) Research Reactor Utilization Development, (3) Nuclear Safety Strengthening, and (4) Nuclear Infrastructure Strengthening.

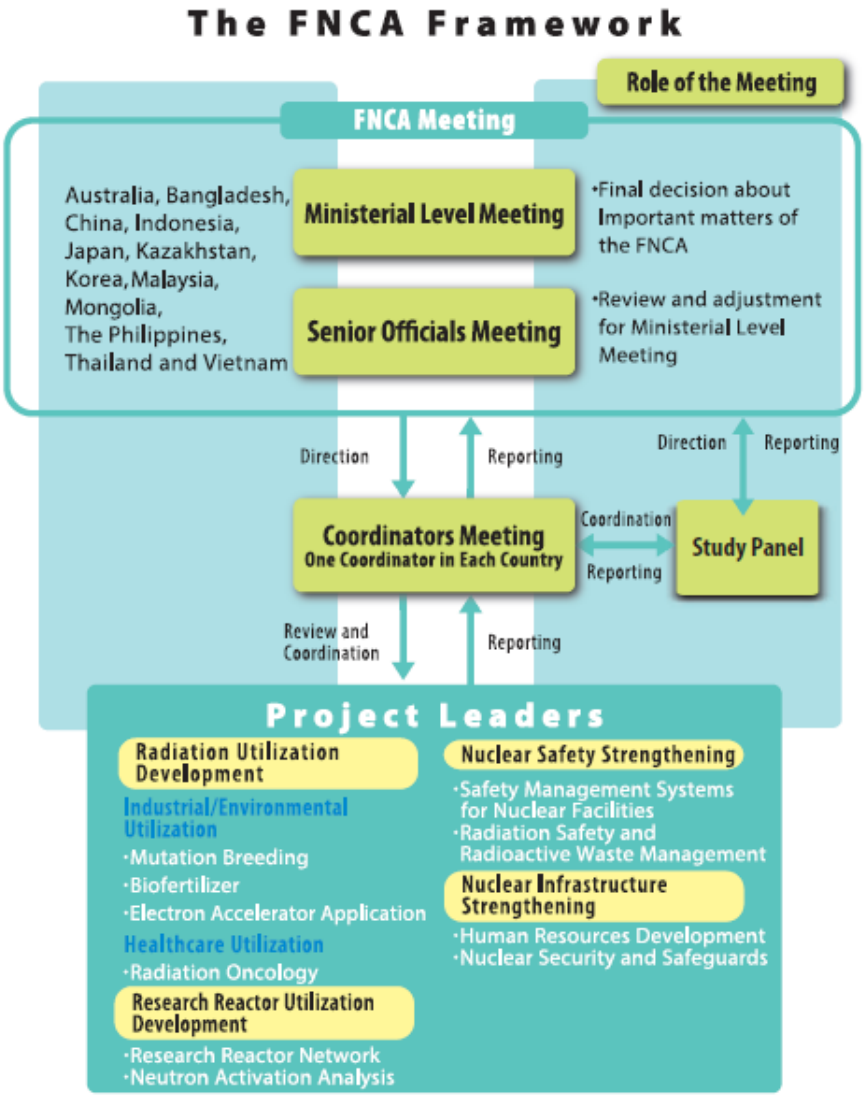
I-2. Participating Countries

Australia, Bangladesh, China, Indonesia, Japan, Kazakhstan, Republic of Korea, Malaysia, Mongolia, Philippines, Thailand and Viet Nam

I-3. Framework

The basic framework of cooperation consists of the following three (See the figure on the next page). :

- **Forum meeting**
  Discussion on cooperation measures and nuclear-energy policies.
  Forum meeting is comprised of a ministerial level meeting and a senior official level one.
- **Coordinators meeting**
  Discussion on the introduction, revision and abolishment, adjustment, and evaluation of cooperation projects by an appointed coordinator from each country.
- **Cooperation activities for each project**



I-4. FNCA Radiation Safety and Radioactive Waste Management Project

This project superseded Radioactive Waste Management Project and started in 2008 with the aims of sharing information and experiences in the area of Radiation Safety & Radioactive Waste Management processes and regulatory issues as well as facilitating safety improvement and understanding of RS&RWM to public perception in nuclear society.

In each member country, the use of radiation in industry, agriculture, medical treatment, and various other fields is rapidly increasing, and at the same time, several countries are looking into introducing nuclear power plants. In consideration of such tendency, member countries have been discussing how to promote the standardization (calibration) on personnel dosimeter, focusing on appropriate radiation exposure management.

The accumulated results acquired through these activities over ten years were published as a serried of FNCA Consolidated Report on RWM/RS. These reports are available on the FNCA Website.

[URL: http://www.fnca.mext.go.jp/english/e_project.html]

II. Emergency Preparedness and Response

II-1.General

It is a matter of indispensable for the safe use of nuclear and radiation to prepare the emergency preparedness and response against an emergency accident for the nuclear and radiological facilities. This emergency preparedness and response have features for each nuclear and radiation facility, and have characteristics for each country.

To discuss on the emergency preparedness, we need to understand the emergency type. There are two types of emergency, namely nuclear emergency and radiological emergency.

Nuclear emergency includes Chernobyl accident (1986) and Fukushima Daiichi Nuclear Power Plant Accident (2011), etc.

- nuclear power plant accident
- nuclear explosions:
  fallout (radioactive materials that can be carried long distances by the wind)

On the other hand, radiological emergency can be induced by mishandling of radiation, which includes Goiania accident (1987) and Thailand accident (2000).

- radiological exposure device accident
- transportation accidents
- occupational accidents
- terrorist attack by dirty bomb or radiological dispersal device

The main contents which concerned with emergency preparedness and response of the nuclear and radiological facilities, are the organizations for disaster prevention, a setup of a disaster-measures zone, the environmental emergency monitoring, the protection measure, emergency medical treatment, communication, public relations. Moreover, the maintenance of related law which is the foundation of these measures is also important.

Here, the situation of emergency preparedness and esponse for the nuclear and radiological facilities of each FNCA country are summarized. This integrated report not only shows the situation of FNCA countries, but also becomes mutual reference and understanding.

II-2.Items for emergency preparedness and response

The principle of emergency preparedness and response is as follows.

1) Prevent the disaster of nuclear and radiation beforehand.
2) When a radioactive material or radiation is emitted from nuclear installation in an accident, we have to prevent expansion of damage, reduce surrounding people's exposure as low as possible, and have to keep local resident's health and property by the countermeasures.
3) Seek a restoration of disaster.

The feature of nuclear and a radiation disaster is as follows.

1) Radiation cannot be caught by people's sense and organ.
2) It is difficult for people to judge what kind of influence may occur by the exposure.
3) The fundamental knowledge about radiation etc. is required.
4) However, if a special measuring instrument are used, even a very small level of radiation, can also be detected. And the required measures against protection can be taken.

5) Therefore, if a suitable measure is taken based on a specialist's advice, it is possible to stop the influence at worst.

This means the role, directions, advice, etc. of the organization which has the professional expertise about nuclear and radiation features, are quite important.

II-3.International Cooperation and Commitment

To promote the emergency preparedness, international cooperation and guidelines are useful and important. If accident happens in nuclear facilities in some country, the country needs to inform neighbor countries that they might be affected by the accident, and also needs to report IAEA on the accident. In case of nuclear accident or radiological emergency, IAEA will disseminate information and offers assistance.

The related international conventions, guidelines etc. are followings:

(a) Convention on Early Notification of a Nuclear Accident

- to notify nearby (might affect) countries
- to notify the lAEA
- Nuclear power plants (over 50 countries)

(b) Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency

- lAEA's role to disseminate information and co-ordinate assistance. Radiation use countries (over 80 countries)

(c) Guidelines:

- Food and drinking water guideline by Codex Alimentarius Commission of FAO and WHO.
- International Nuclear Event Scale (INES) by lAEA and OECD/NEA

III. Present Status of Emergency Preparedness and Response in FNCA Countries

III-1. Bangladesh

1.1. Policy

1.2. Regulatory Framework and Legislation

1.3. Emergency Classes and Condition

- 1.3.1. Personnel Emergency
- 1.3.2. Emergency Alert
- 1.3.3. On-site Emergency
- 1.3.4. Off-site Emergency

1.4. Participating Organizations (Enterprise, Government (central and local), Non-Government, and International Partnership)

1.5. Concept of Operation

- 1.5.1.. Mitigation and Prevention
- 1.5.2 Emergency Preparedness
- 1.5.3. Emergency Response
- 1.5.4. Emergency Rehabilitation and Restoration

1.6. Related Activities

- 1.6.1 Human Capacity Building (e.g. training, workshops, drills, and exercises)
- 1.6.2. Communication and Public Relation
  (e.g. information passage , mass media, and social media)

III-1. Bangladesh

1.1. Policy

According to Bangladesh Atomic Energy Regulatory Act -2012 and existing NSRC Rules 1997 there are provisions in order to deal with any type of nuclear or radiological emergency. As per NSRC Rules 1997, every licensee shall establish in pursuant to applicable standards an emergency response plan to deal with every foreseeable emergency.

1.2. Regulatory Framework and Legislation

Bangladesh Atomic Energy Regulatory Authority is responsible to establish and promote activities related to the international agreements, protocols and convention (in which Bangladesh is a party) on safeguards, physical protection including illicit trafficking of nuclear and radioactive materials, nuclear safety, radiation protection and radiological emergency situation.

An act named Bangladesh Atomic Energy Regulatory (BAER) Act-2012 has been passed in the National Parliament of Bangladesh. Nuclear or radiological emergency preparedness and response related separate chapter have been incorporated in this Act which is in the process of development.

According to BAER Act 2012 and NSRC Rules, requirements of emergency preparedness and response are ensured through the process of issuance of license, permit, inspection, monitoring etc. and the emergency response plan shall be approved by the Regulatory Authority.

1.3. Emergency Classes and condition

The entire operations of emergency condition at Radiation/ nuclear facility are: a. Personnel Emergency b. Emergency Alert, c. Onsite Emergency and d. Offsite Emergency.

1.3.1. Personnel Emergency

This class involves personnel accidents, injuries or occurrences at the Radiation or nuclear facilities, which require emergency treatment of individuals and may involve a radiological accident. The following subclasses are included in this class:

- **Bodily Injury**
  This class of emergency will include all common accidents or injuries.
- **Bodily Injury with Radioactive Contamination**
  This class of emergency will include common accidents or injuries where radioactive contamination is associated with the injury.

The head of the facility or in his absence the person in charge on duty will direct the response to this class of emergency. If bodily injury with radioactive contamination is involved the head of the facility will be assisted by the Radiation Control Officer (RCO).

1.3.2. Emergency Alert

This class involves situations brought on by man-made or natural phenomena which have not yet caused damage to the facility or harm to personnel but which have the potential of escalating to a more serious incident. Emergency alert conditions require an appropriate follow-up action. The following situations are included in this class:

- Fire in adjacent areas, which threatens the Facility site.
- Bomb threat or civil disturbance, which threatens the radiological/nuclear facility
- Severe natural phenomena such as flood, hurricane, tornado, earthquake, etc., which hreaten the facility.
- Release of a toxic, noxious, explosive, hazardous, poisonous gas near the facility.

The head of the facility or in his absence the facility in charge will direct the response for an emergency alert after getting verbal approval of the emergency director. All the groups of the emergency organization shall be in a state readiness when an emergency alert has been declared.

1.3.3. On-site Emergency

On-site emergency will be declared when any of the following situations prevails:

- Fire, which directly threatens the facility
- Explosions that result in facility damage
- Uncontrolled release of radioactive contamination in the facility building

1.3.4. Off-site Emergency

A hypothetical worst accident" like the missile or bullet hit to radiological or nuclear facility which may cause release of radioactive materials.

Off-site emergency actions are therefore, anticipated as worst-case preparation. Situation like this would be readily evaluated by the Technical Evaluation Coordinator and Technical Evaluation Group (TEG).

1.4. Participating Organisation (Enterprise, Government (Central and local), Non – Government and International Partnership)

At BAEC a Radiation emergency assessment sub-committee and medical emergency sub-committee under radiological emergency management committee have been working in order to deal with radiological emergency management and operations. In addition, coordination with the national participating relevant organizations and authorities relating to Food, Police, Fire service, Road transport, Civil defense, Environment, etc. are included in the draft National Radiological Emergency Response (NRER) Plan.

Bangladesh has been an IAEA Member State since 1972 and is a party to the Multilateral Agreements which includes following convention relating to nuclear or radiological emergency:

- Convention on Assistance in the case of Nuclear or Radiological Emergency (7 February 1988)
- Convention on Early Notification of Nuclear accident (7 February1988)

1.5. Concept of operation

Bangladesh Atomic Energy Regulatory Authority BAERA in cooperation with BAEC presently dealing radiation emergency situations.

A draft National Nuclear or Radiological Emergency Plan, which is in the process of development now, delineates the roles and responsibilities of relevant organizations in the event of a nuclear or radiological emergency. Under BAER Act 2012, a draft regulation on Management of a Nuclear

or Radiological Emergency is also in the process of development.

1.5.1. Mitigation and Prevention

BAEC has incorporated as a member in the National Disaster Management Committee and is playing the role of National Authority/Lead Organization in respect of radiological emergency.

A draft National Nuclear or Radiological Emergency Response Plan is in review stage under BAER Act 2012. There are adequate arrangements for radiation workers and staff to be aware of the medical symptoms of radiation exposure and notification procedures.

Some Medical centers have been identified as regional and national centers at different places around the country for providing medical management of injuries and/or contaminated victims. A medical emergency sub-committee under radiological emergency management committee is in place in order to deal with radiological medical response. The country adopted national intervention levels for taking urgent protective actions in accordance with international standards.

1.5.2. Emergency Preparedness

Bangladesh Atomic Energy Regulatory Authority in cooperation with BAEC's Health Physics and Radiation Monitoring Laboratories are presently dealing radiation emergency situations.

The contact point 24/7 has been established through the Bangladesh Atomic Energy Regulatory Authority. The on-site facilities in charge of operations as well as the local officials are aware of the indicators of a potential emergency such as notification, activating etc.

1.5.3. Emergency Response

The on-site managers of operations as well as the local officials of the nuclear or radiological facility are responsible for emergency response. Regular basis emergency related trainings are being conducted in order to make the facility personnel aware of it.

Emergency Management of Nuclear Facility at Atomic Energy Research Establishment (AERE), Savar

A Nuclear or radiological emergency committee is in place in order to deal with the radiological or nuclear emergencies at Atomic Energy Research Establishment, Savar site. The executive director is the authority for the overall direction and conduct of emergency operations in all its phases.

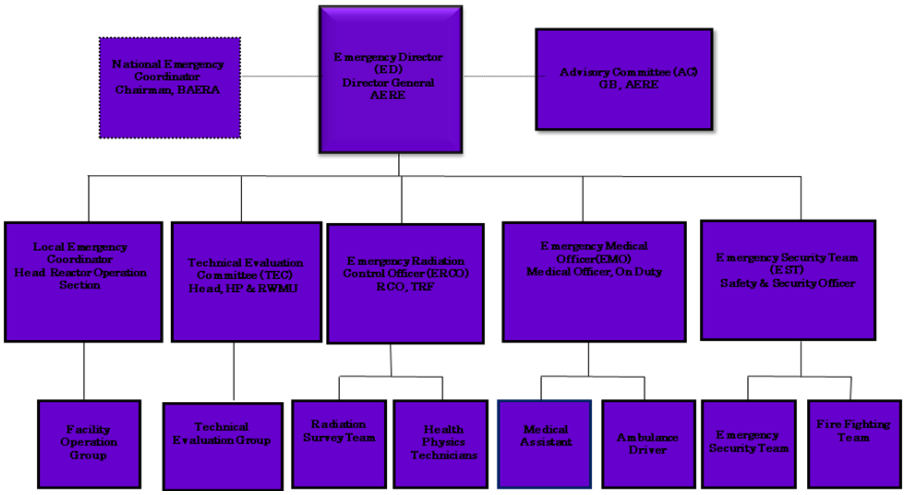


Figure 1.5-1. Emergency Management of Nuclear Facility at AERE

1.5.4. Emergency Rehabilitation and Restoration

Bangladesh Atomic Energy Regulatory Authority (BAERA) has been established under BAER Act-2012 on 12 February 2013. This is an independent regulatory body. National Nuclear or Radiological Emergency Response Plan as well as draft regulations on Management of a Nuclear or Radiological Emergency are in the process of development. In accordance with the new BAER Act-2012 the detail Emergency Rehabilitation and Restoration plans are in the development process.

1.6. Related Activities

1.6.1. Human Capacity Building (e.g, training, workshops, drills and exercises)

In house training course relating to nuclear or radiological emergency organized by BAEC and BAER. In addition, on site emergency drill and Follow–up Training Courses (FTC) arranged in order to inform and make aware the radiation working individuals and public as well.

1.6.2. Communication and Public Relation (e.g, information passage, mass media, and social media)

Some important activities like organizing training courses, emergency related poster, announcement and passage of information in the website are in place to alert public for the hazard of radiation sources and emergency related issues etc. A complete information system is in the process of development to inform the public about the regulated practices in the Emergency related aspects.

III-2. China

2.1. Policy

2.2. Regulatory Framework and Legislation

2.3. Emergency Classes and Condition

2.4. Participating Organizations (Enterprise, Government (central and local), Non-Government, and International Partnership)

2.5. Concept of Operation

2.5.1.. Mitigation and Prevention

2.5.2 Emergency Preparedness

2.5.3. Emergency Response

2.5.4. Emergency Rehabilitation and Restoration

2.6. Related Activities

2.6.1 Human Capacity Building (e.g. training, workshops, drills, and exercises)

2.6.2. Communication and Public Relation
(e.g. information passage , mass media, and social media)

III-2. China

2.1. Policy

China released the "Act of Protection and Remedy of Radioactive Contamination of the People's Republic of China", "Act of Emergency Response for Unexpected Events of the People's Republic of China", "Emergency Management Regulations for Nuclear Accidents of Nuclear Power Plant" and a series regulations and guides, which specify the national emergency management system and emergency preparedness of NPP operating organization.

The "Emergency Management Regulations for Nuclear Accidents of Nuclear Power Plant" specifies that the principles of emergency management of nuclear accidents should be unremitting preparedness, positive compatibility, unified command, energetic co-ordination, protection of the public, and protection of the environment

The fundamental mission of the nuclear emergency management in China is to effectively cope with nuclear accidents that have occurred or can potentially occur at nuclear facilities or in nuclear activities, to control and mitigate the accidental consequences at a maximum, alleviate or eliminate casualties and property loss, and maintain public safety, environmental safety and social stability.

China fulfils its international obligation as a member state of International Atomic Energy Agency (IAEA) and also as a Contracting Party to the International Convention on Nuclear Emergency and Nuclear Safety Convention. The Chinese government pays high attention to the work of nuclear emergency and nuclear safety, which have been regarded as a strategy concerned with national economy and social development.

By far, China has entered several relevant international conventions on nuclear emergency. For example, China entered the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency on 26 September 1986 and the Nuclear Safety Convention on 1 March 1996.

2.2. Regulatory Framework and Legislation

All the above mentioned laws, regulations, department rules, nuclear safety guides and all sorts of technical documents constitute relatively complete laws and regulations system for Chinese nuclear emergency response. Hence, the necessary and effective emergency response actions can be activated in case of a severe NPP accident.

According to the "Emergency Management Regulations for Nuclear Accidents of Nuclear Power Plant" and the "National General Plan of Emergency Preparedness on Unexpected Public Events", the State Council issued the "National Nuclear Accidents Emergency Plan".

The department rules, standards and guides on nuclear emergency are mainly as follows:

- Regulations of the People's Republic of China on Safety Control of Civilian Nuclear Installations (HAF001)(1986);
- Detailed Rules for Regulations on NPP Accident Emergency Management – Emergency Preparedness and Response of NPP Operators (I) (HAF002/01);
- Emergency Preparedness by Local Government for Nuclear Power Plant (HAF0702, HAD

002/02);

- Emergency Preparedness and Response to Radioactive Materials Transport Accident (2000);
- Training for Nuclear Accident Emergency at NPP (2001);
- Regulations on Transboundary Emergency Management for Radiation Impacts of Nuclear Accident (2002);
- Management Guides on Nuclear Emergency — Emergency Preparedness and Response to Radioactive and Radiation Technology Applications (2003);
- Regulations on Emergency Management of Spent Fuel Transport accident (2005);
- Criteria on Medical treatment of radiation injury;
- Criteria on Emergency plan and preparation at NPP—offsite emergency response functions and organizations;
- Criteria on Emergency plan and preparation at NPP—offsite emergency plan and implementation procedures;
- Criteria on Emergency plan and preparation at NPP—functions and features of offsite emergency facility;
- Criteria on Emergency plan and preparation at NPP—keeping of offsite emergency response capabilities;
- Criteria on Emergency plan and preparation at NPP—division of emergency plan zone;
- Criteria on Emergency plan and preparation at NPP—keeping of onsite emergency response capabilities;
- Criteria on Emergency plan and preparation at NPP—onsite emergency plan and implementation procedures;
- Criteria on Emergency plan and preparation at NPP—onsite emergency response emergency functions and organizations;
- Criteria on Emergency plan and preparation at NPP—functions and features of onsite emergency facility;
- Protection measures and recovery decisions in late phase of a serious accident;
- Intervention principles and levels in the event of a nuclear or radiation emergency;
- Criteria on Emergency plan and preparation at NPP—on-field emergency radiation monitoring, sampling and analysis by operators of NPPs

2.3. Emergency Classes and Condition

Based on the nature, severity, radiological consequences and affected extent of nuclear accidents, the emergency events are classified into four levels - emergency standby, plant emergency, plant area emergency, and offsite emergency (overall emergency), which corresponds to a Level-IV response, Level-III response, Level-II and Level-I response respectively.

(1) Emergency Standby: In cases where specific conditions or external events arise which may lead to the endangerment of the nuclear power plant's safety, appropriate plant personnel are placed on standby condition.

(2) Plant Emergency: In cases where the accident consequences are only confined to a limited section of the plant, on-site personnel are activated and appropriate off-site emergency organization are notified according to the on-site emergency plan.

(3) Site Emergency: In cases where the accident consequences spread over the site, the on-site personnel are activated and off-site department assigned by the provincial people's

government is notified, some off-site emergency organizations may be activated to take emergency response actions.

(4) Off-site Emergency: In cases where the accident consequences extend beyond the site boundary, the on-site and off-site emergency plans are to be executed.

While the emergency condition "Emergency Standby" is declared at a nuclear power plant， the on-site emergency organization should promptly report the accident situation to the higher competent authority of the nuclear power plant and the national nuclear safety authority of the State Council and the department assigned by the provincial people's government. In case of situation, where potential or actual release of radioactive materials occur, "Plant Emergency" or "Site Emergency" shall be declared timely, depending on the situation, and the on-site emergency organization should promptly report the accident situation to the higher competent authority of the nuclear power plant, the nuclear safety authority of the State Council and the department assigned by the provincial people's government. If the release of radioactive materials may or has extended beyond the site boundary, the on-site emergency organization should promptly recommend the department assigned by the provincial people's government to declare "off-site emergency", and take appropriate protective measures.

After receiving the report on accident situation from the on-site emergency organization of the nuclear power plant, the department assigned by the provincial people's government should promptly take appropriate emergency counter measures and emergency protective measures and report it to the department assigned by the State Council in a timely manner. Declaration of "Off-site Emergency" should be approved by the department assigned by the State Council. Under special urgent situation, the department assigned by the provincial people's government can declare "Off-site Emergency" in advance, but reporting to the department assigned by the State Council is needed forthwith.

2.4. Participating Organizations

The three-level emergency organizational system, which has been established in China and illustrated in Figure 1, consists of the national nuclear emergency organization, provincial emergency organizations (including autonomous region, municipality directly under central government where nuclear facilities are located) and the nuclear facility's emergency organizations.

The National Coordinating Committee for Nuclear Accident Emergency (NCCNAE) organizes and coordinates the country-wide nuclear emergency management arrangements. National Nuclear Accident Emergency Response Office (NNAERO) /CAEA takes charge of the day-to-day work of the NCCNAE. If necessary, the State Council shall lead, organize and coordinate country-wide nuclear accident emergency arrangements.

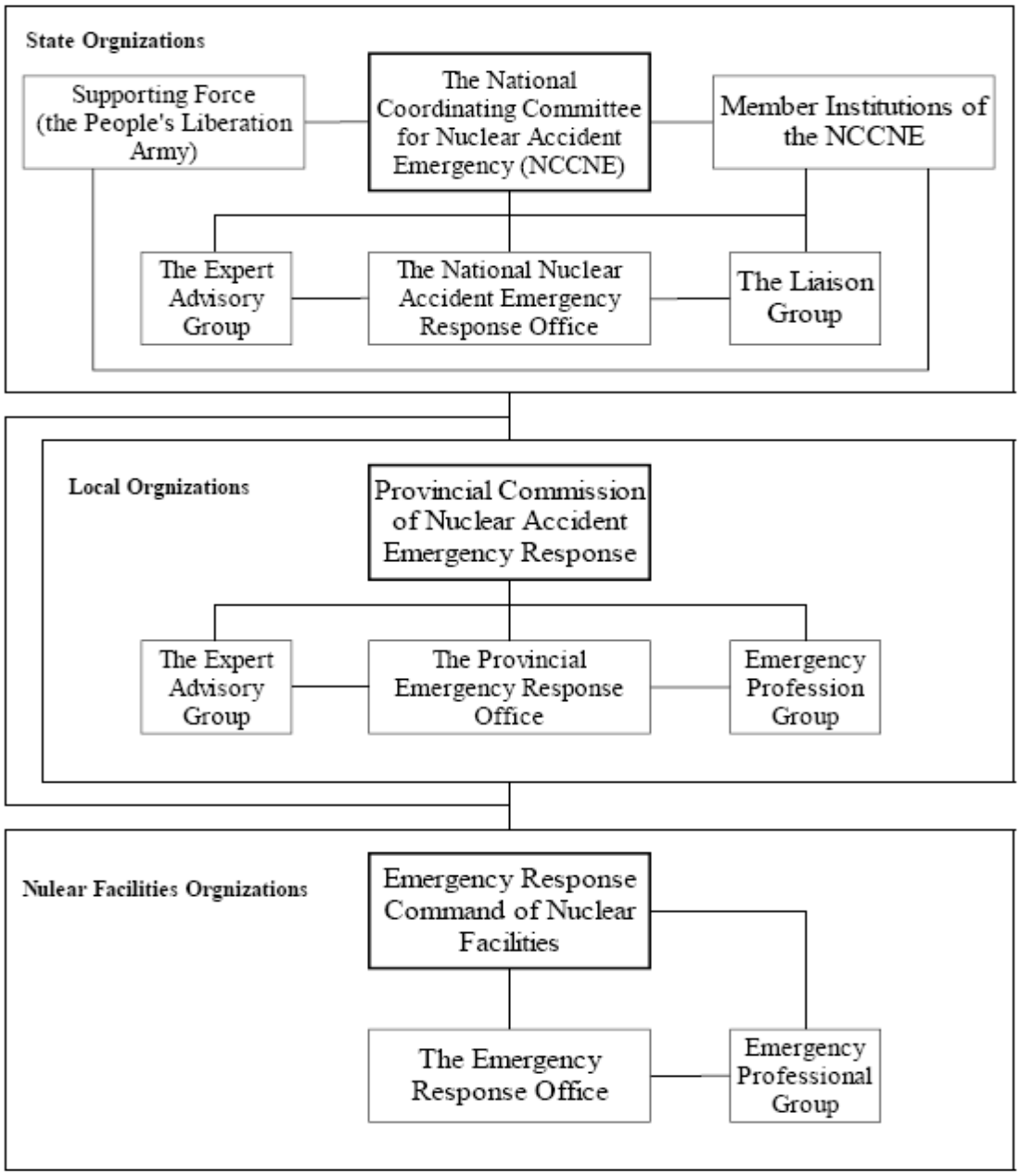


Figure 2.4-1. Organizational Structure of National Nuclear Emergency Response System

Provincial emergency organizations (including autonomous region, municipality directly under central government where nuclear facilities are located) are responsible for nuclear accident emergency preparedness and emergency response within their administrative areas, and command off-site nuclear accident emergency response actions.

Nuclear accident emergency organizations of nuclear facilities are responsible for onsite nuclear accident emergency preparedness and emergency response, command their own nuclear accident emergency response actions, assist and help the related agencies in making nuclear accident offsite emergency preparedness and emergency response, make suggestions on initiating timely off-site emergency and protective actions.

2.5. Concept of Operation

2.5.1. Mitigation and Prevention

A nuclear facility is being on the alert to take prevention and mitigation measures to allow the facility to maintain or recover to safe conditions and provide timely suggestions to national nuclear emergency office, provincial nuclear emergency office, nuclear power authorities, nuclear safety regulatory bodies, and upper corporation groups or institutes, and to conduct assessment of the nature and consequences of the accident.

Provincial nuclear emergency organization should pay close attention to the accident tendency, keep frequent emergency telecommunication, make effort to maintain communication with the public, and deploy the provincial nuclear emergency forces to enter emergency standby.

2.5.2. Emergency Preparedness

Emergency preparedness include the deployment of special forces, equipment and materials to conduct engineering rescue, mitigate and control accident to allow nuclear facilities to be recovered to normal conditions, and to prevent and reduce the release of radioactive materials to the environment.

It also involves carrying out radioactivity monitoring on the accident scene and in the surrounding environment, including mid-air, land, water, air, crops, foods and drinking water and dose monitoring of dose to emergency personnel and the public; conducting real time observation and forecasting of meteorology, water, geology, and earthquake; performing diagnosis of accidental condition, analyzing the of source terms, judgment of accident tendency, assessment of radiological consequences, determination of affected area, and providing technical support to emergency decision-making.

The national nuclear emergency office decides the activation of Level IV response, strengthens the liaison and communication with the related provincial nuclear emergency organizations, operates the organization of the facility, pay close attention to the accident tendency, and notify the member organizations of the NCCNAE. Various member organizations make every effort in emergency preparedness.

2.5.3. Emergency Response

(1) Level IV response

A nuclear facility will enter emergency standby to activate Level IV emergency response, when the condition or event that endanger such a facility is expected to have occurred or are likely to occur.

(2) Level III response

A nuclear facility will enter plant emergency to activate Level III emergency response, when the release of radioactive materials is expected to have to occurred or likely to occur and the resulting radiological consequences is only confined in part of plant area.

On the basis of the Level IV response, the following measures shall be taken: The operating organization of a nuclear facility takes control measures, conduct emergency radiation monitoring and meteorology observation, take radiation protection measures to protect personnel, enhance information report work and provide timely suggestions, and to maintain communication with the public.

(3) Provincial nuclear emergency committee organizes the relevant member organizations and expert groups to assess the nuclear emergency measures; deploy the provincial nuclear emergency forces to conduct radiation monitoring and meteorology observation.

(4) The NCCNAE determines the activation of Level III responses, deploy its member organizations and expert panel to study the trend development and the communication with the public. It also coordinates and guides the local and nuclear facility' nuclear emergency work.

(5) Level II response

A nuclear facility will enter plant emergency to activate Level II emergency response, when the release of radioactive materials is expected to have to occurred or likely to occur and the resulting radiological consequences is extended to the entire plant area (onsite) but without serious impact imposed upon the offsite public and the environment.

On the basis of Level III response, the following measures are undertaken: The operating organizations of a nuclear facility deploys engineering rescue, evacuate non-emergency persons, control radiation exposure to emergency personnel, establish the sign of contaminated area and onsite alert, carry out contamination monitoring of onsite persons and vehicles access to plant area, and, and keep coordination with offsite emergency forces.

Provincial nuclear emergency committee deploys the implementation of meteorology observation and forecast, radiation monitoring, organizes experts to analyze and judge the accident tendency; issues announcement in a timely manner, takes traffic regulation, if necessary, control entrance and exist, provides psychology assistance; release information according to rules, coordinate necessary supply of emergency resources within the administrative areas concerned to the operating organization of nuclear facility, and prepares for medical rescue.

When the NCCNAE decides to activate Level II response, it will deploy its member organizations and expert panel to conduct comprehensive study and judgment; deploy information release and stabilize social order according to rules; upon the requests from provincial government and operating organization of nuclear facility, provides necessary support to the accident mitigation and the rescue actions; deploy national emergency forces to provide guidance on radiation monitoring, meteorology observation and forecast and medical rescue.

(6) Level I response

A nuclear facility will enter offsite emergency to activate Level I emergency response, when large amounts of radioactive material release are expected to have occurred or likely to occur and the resulting radiological consequences is extended to the entire plant area (onsite).

The operating organization of nuclear facility deploys engineering rescue, mitigate and control accident extension, diagnose accidental conditions, and implement radiation emergency monitoring; takes protection measures for onsite personnel, evacuate non-emergency persons, control radiation exposure of emergency personnel, and perform medical rescue on injured or exposed persons; provides suggestions on actions of radiation protection action for the public; carry out assessment of the nature and radiological consequences; coordinate offsite rescue forces to complete rescue and assistance efforts; support the NCCNAE and provincial nuclear emergency committee in keeping communication with the public.

Provincial nuclear emergency committee will be deployed to implement offsite emergency radiation monitoring, meteorological observation and forecast, organizes experts to analyze and judge the accidental tendency, coordinates and deploys the emergency resources within the areas concerned to be supplied to the operating organization of nuclear facility in aspects of traffic, power, water, telecommunication and so on; takes measures in announcement issue, traffic control, distribution of stable iodine, access control, control of foods and drinking water, medical rescue, psychological rescue, decontamination and cleaning; organizes the population in the affected areas to shelter, evacuate, relocation, and settlement; provides accident notifications and suggestions to the affected adjacent provinces, autonomous regions or municipalities.

The NCCNAE will recommend to the State Council to activate the Level I response. The State Council will decide on the activation of the Level I response. The NCCNAE organizes and coordinates nuclear emergency management. If necessary, the State Council sets up national nuclear accident emergency commanding headquarter (NNAECH) to implement overall direction, organization, coordination of nationwide nuclear emergency management. The NNAECH will sets up working groups, if needed, responsible for accident rescue, radiation monitoring, medical assistance, radioactive contaminant disposition, public living security, information release and dissemination, foreign affairs, social stability and coordination.

2.5.4. Emergency Rehabilitation and Restoration

After evaluation and confirmation of nuclear facility safety, the operating organization of the nuclear facility will advise both national and provincial emergency offices with regard to the termination of the nuclear emergency condition. The national nuclear emergency office has the power to decide the termination of Level IV response. The national nuclear emergency coordination committee also has the power to decide the termination of Level III and Level II responses.

After a nuclear accident has been under the effective control, radioactive material release has ceased or has been controlled to acceptable level and such a facility has restored to safety condition, the national nuclear emergency coordination committee advises the termination of the Level I response, which is subject to approval by the State Council.

After termination of emergency response, provincial people's government and its related departments and the operating or organizations of nuclear facility shall at once deploy restoration actions withintheir respective scope of responsibility.

(1) Onsite restoration actions

The operating organization of nuclear facility is responsible for onsite restoration actions. It develops restoration plan for the nuclear facility and reports to higher competent authority for approval and to both the national and provincial nuclear emergency committees for archiving. The national and provincial nuclear emergency committees and the relevant corporation groups and institutes shall provide the necessary guidance and support to onsite restoration actions as needed.

(2) Offsite restoration actions

Provincial nuclear emergency committee is responsible for offsite restoration actions and the development of restoration plan for the nuclear facility. The plan shall be subjected to the approval by the State Council after authorization by the NCCNAE. Offsite restoration actions

include comprehensive environmental radioactivity level survey and assessment, integrated rehabilitation and cleanup, cease of emergency protective measures, restoration of production, livelihood and social order in affected areas, resettlement of population, evaluation of dose to personnel and the public, scientific propaganda, consultation and psychological assistance.

2.6. Related Activities

2.6.1. Human Capacity Building (e.g. training, workshops, drills, and exercises)

(1) Technical force preparation

The national emergency capability in an event of a nuclear accident has received much attention in China. Four national nuclear emergency support centers have been set up in conjunction with six emergency rescue teams. Initiatives in building basic nuclear emergency abilities have been undertaken by operators of NPPs, users of nuclear technology, and operators of other major nuclear facilities. Nuclear emergency committees, together with their routine administrative offices, have been established in 16 provinces. At present, national nuclear accident emergency rescue teams are in the process of being assembled, as required by the State Council.

Drawing upon the technical capabilities of member organizations, corporation groups and institutes, the NCCNAE strengthens its professional rescue forces in the following areas: enhanced rescue, radiation monitoring, decontamination and cleanup, contamination control, radiation protection, medical rescue, necessary deployment of special purpose materials and equipment, enhanced professional training and emergency exercise and drills.

(2) Emergency Drill and Exercise

Under NNEP, the nuclear accident emergency organizations at various levels should carry out nuclear emergency exercise through desktop and actual maneuvers to test, maintain and enhance emergency ability in response to a nuclear accident. The nuclear accident emergency joint exercise at the national level will be implemented under the coordination of the NNAECC, generally once every three to five years. Provincial level nuclear accident emergency exercise will be organized by provincial nuclear accident emergency committee for implementation, normally once every two to four years. Nuclear facility emergency exercise will be organized and implemented under the deployment of nuclear facility emergency headquarter, generally once every two years, but with appropriate addition for the site with more than three units. Prior to first fueling, the nuclear facility operators all participate with the onsite and offsite joint exercise organized by provincial nuclear accident emergency committee.

2.6.2. Communication and Public Relation

The National Nuclear Accidents Emergency Response Office has established information communication network to enhance communication with relevant departments, local governments, the NPPs and the public. In July, 2013, National Nuclear Emergency Coordination Committee carried out a “national nuclear emergency publicity week” activity. The theme of the publicity week activity is “strengthening nuclear emergency and nuclear safety, promote scientific development of nuclear energy”.

The operating organization of the NPP takes various measures such as publicizing propaganda material and inviting local public to visit plant and to take part in or to watch emergency exercises, and to effectively participate in emergency response activities in case of an emergency.

III-3. Indonesia

3.1. Policy

3.2. Regulatory Framework and Legislation

3.3. Emergency Classes and Condition

3.4. Participating Organizations (Enterprise, Government (central and local), Non-Government, and International Partnership)

3.5. Concept of Operation

3.5.1.. Mitigation and Prevention

3.5.1.1 Personnal Protection Action

3.5.1.2 Urgent Protection Action

3.5.1.3. Protection for First Responder, Radiation Worker, And Vulnerable Groups

3.5.1.4. Public Action to Off Site Radioactive Release

3.5.2 Emergency Preparedness

3.5.3. Emergency Response

3.5.4. Emergency Rehabilitation and Restoration

3.6. Related Activities

3.6.1 Human Capacity Building (e.g. training, workshops, drills, and exercises)

3.6.2. Communication and Public Relation
(e.g. information passage , mass media, and social media)

III-3. Indonesia

3.1. Policy

There are 3 research reactors in Indonesia currently, those are Kartini reactor of 100 kWth power in Yogyakarta, Triga Mark Reactor of 2 MWth power in Bandung, and G.A. Siwabessy Multi Purpose Reactor of 30 MWth power in Serpong. Considering that the biggest research reactors currently in Indonesia is G.A. Siwabessy Multi Purpose Reactor (category II), then discussion of nuclear emergency and response is focused to this reactor.

Nuclear emergency preparedness and response is regulated in Goverment Regulation number 54 year 2012 on The Safety and Security in Nuclear Installation. And it is regulated in BAPETEN Chairman Regulation number 1 year 2010 on The Nuclear Emergency Preparedness and Response. Beside refering to National Regulation it also refers to IAEA Regulation on The Nuclear Emergency ; i.e. GS-G-2 on The Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency, GS-G-2.1 on The Arrangements for Preparedness for a Nuclear or Radiological Emergency, GS-R-2 on The Preparedness and Response for a Nuclear or Radiological Emergency, IAEA Tecdoc 1162 on The Generic Procedures for Assessment and Response during a radiological emergency, EPR First Responder 2006 on The Manual for First Responders to a Radiological Emergency, EPR Methode 2003 on The Method for Developing Arrangements for Response to a Nuclear or Radiological Emergency.

3.2. Regulatory Framework and Legislation

Act number 10 year 1997 on The Nuclear Energy and it is implementation regulation define the need of nuclear preparedness and response system in order to achieve the objectives of supervision, ensure safety and health for worker and public and to protect environment.

Nuclear energy utilization which has radiological impact must have nuclear emergency programme. This programme is expected possible to minimize radiological consequency to worker, public, and environment. The emergency response programme uses the approach of all hazards with framework as in conventional emergency response system. The main difference to conventional emergency is the need of specialist expert for radiation hazard handling. While infrastructure and response function is mostly same.

The objectives of nuclear preparedness programme are :

1. minimize the risk or to decrease accident consequency to radiation sources (accident location)
2. prevent deterministic health effect
3. decrease stocastic health effect.

Nuclear preparedness programme made is based on National Legislation as follows :

1. Act no 10 year 1997 on The Nuclear Energy;
2. Act number 24 year 2007 on The Disaster Management;
3. Act number 32 year 2009 on The Protection and Environmental Management;
4. Government Regulation number 33 year 2007 on The Ionizing Radiation Safety and Radioactive Source Security;

5. Government Regulation number 54 year 2012 on The Safety and Security of Nuclear Installation;
6. Government Regulation number 2 year 2014 on Licensing of Nuclear Installations and Utilizations of Nuclear Material;
7. Presidential Decree number 81 year 1993 on Ratification of Convention on Early Notification of a Nuclear Accident;
8. Presidential Decree number 82 year 1993 on Ratification of Convention on Assistance on the Case of a Nuclear or Radiological Emergency;
9. BAPETEN Chairman Regulation number 1 year 2010 on The Nuclear Emergency Preparedness and Response.

3.3. Emergency Classes and Condition

Understanding about nuclear emergency and response, it firstly need to know about radiological hazard category. BAPETEN Chairman Regulation number 1 year 2010 on The Nuclear Emergency Preparedness and Response regulates radiological hazard category that constitutes representation of the facility potential hazards. The category can be shown on table 1 below.

Table 3.3-1. Radiological Threats Category

Category	Description	Radiation Facility/Nuclear Instalation
II	Instalation or facility has danger potencial to produce radioactive release with doses upper permited limmited but it does not give serious deterministic effect out of site.	• Reactor with power higher or equals to 2 MWth but lower or equals to 100 MWth. (e.g. nuclear power reactor or research reactor). • Spent fuel wet storage facilities wich has potential risk value equivalent with reactor core for power higher than 10 MWth and lower than 3000 MWth.

Several things must be done by operator who has category II facility :

1. Facility will give clarification an accident and inform onsite officer, off site and national officer;
2. Facility will provide recomendation action based on facility condition and monitoring result on field;
3. Facility will take actions to prevent and to reduce radioactive release;
4. Onsite and off site officer will take urgent countermeasure actions immediately on facility based on recomendation;
5. On site officer will conduct monitoring on site area to determine whether additional action is needed;
6. On site and off site officer will provide services of police, fire brigade, medic assistance to facility when needed;
7. Facility will ensure that first renponder provide radiation protection services;

8. National officer will help on site and off site officer to conduct further monitoring and to coordinate long term actions.

3.4. Participating Organizations (Enterprise, Central & Local Government , and International Partnership)

In the case of nuclear emergency preparedness and response in Serpong Nuclear Area (on site), the elements involved in nuclear emergency preparedness and response organization consists of :

1. BATAN (National Nuclear Energy Agency) covers radiation protection team, radiation environmental monitoring team, fire brigade and rescue team, medical team, nuclear security team, logistic team, evacuation team, supporting team, and public relation/PR;
2. PUSPIPTEK, Research Center of Science and Technology (RCST) covers emergency off site management, safety team (rescue, medic, evacuation, technical, and public relation);
3. POLICE, covers police of sector Cisauk Tangerang regency;
4. TNI (Indonesia National Army) covers the ZENI TNI AD Directorate of NUBIKA (nuclear, biology, and chemical) unit, and also Koramil (Military Rayon Command) of Serpong;
5. South Tangerang City Government covers BPBD (Regional Disaster Management Board), Dinas Kesehatan (Public Health Affairs), Dinas Pemadam Kebakaran (fire brigade) and Sub-district of Setu.

The Emergency response organizations have tasks and responsibles to conduct all nuclear emergency response on site and out site of Serpong Nuclear Area (SNA).

The implementation of nuclear emergency response is done in integrated implementation by all response teams as operation executive which involves emergency organizations on-off site of Serpong Nuclear Area (SNA).

The elements of nuclear emergency response off site consist of:

1. Head of Emergency Response (HER) of SNA is head of Center for Informatic Utilization and Nuclear Strategic Areas(CIUNSA) as response coorditaor at NSA.
2. Licencee is Head of Center for Multi Purpose Reactor as person in charge emergency response at the facility.
3. Operation Controller (OC) is operator officer control command center from nuclear security unit. Operation controller chaired by head of nuclear security unit of CIUNSA.
4. Operation Executive (OE) is emergency response teams of NSA consists of radiation protection, medic, radiation environment monitoring, radioactive waste management, fire brigade, rescue, evacuation, security, logistic, and supporting facilities.
5. Radiological Assessor is radiological assessor team chaired by head of personal dose and environment monitoring division CIUNSA collaborate with center for safety technology and radiation metrology, center for multipurpose reactor, center for nuclear material technology, center for radioactive waste technology, and center for technology and nuclear reactor safety as needed.
6. Public relation is public relation division of bureau for low, relation and cooperation collaborate with CIUNSA, to coordinate giving information nuclear emergency occurs, countermeasures efforts, and pasca countermeasures.
7. external assistance is organization of control for nuclear emergency response from outside of NSA coordinated by Head of emergency response of SNA and or Operation controller.

External assistance consist of CRST, army, police, regional disaster management agency and hospital.

Nuclear emergency response organization structure can be seen on figure 4.4-1.

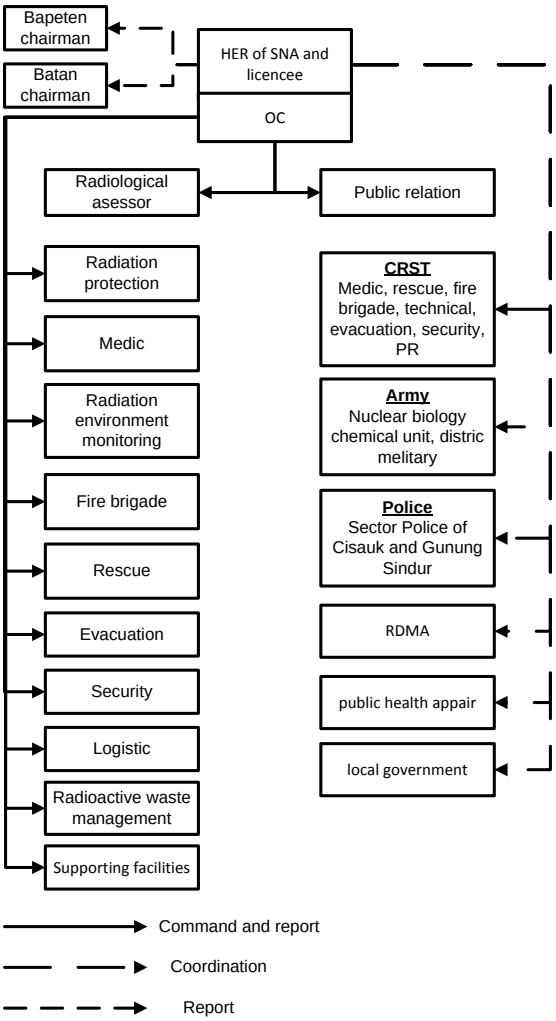


Figure 3.4-1. Nuclear Emergency Response Organization Structure on SNA

If nuclear emergency escalate to off site, handling of emergency will involve big emergency organization. Emergency response organizations have tasks and responsible to conduct all nuclear emergency response. Nuclear emergency response implemented in an integrated way by all response teams coordinated by Regional Disaster Management Agency of South Tangerang City Government.

The Major of South Tangerang City as a head of nuclear emergency response in South Tangerang City, and Chairman of RDMA/BPBD of South Tangerang as a Head of Daily Executive, conduct daily duty of nuclear emergency response on the field.

To handle emergency, nuclear emergency response sectors should be formed, i.e.:

1. management and control division
2. evacuation division
3. social and logistic division
4. security division

5. health division
6. nuclear division

Whereas elements involve in the nuclear emergency response out of SNA consist of :

1. Head of Countermeasures Nuclear Accident (HCNA), is Major of South Tangerang City as holder of command out of NSA or leader of nuclear emergency in South Tangerang Region.
2. Head of NSA control, is Head of CIUNSA as leader of nuclear emergency response on NSA.
3. Head of CRST area control, is Deputy Assistant for Provider Network with Users as controller for personnel evacuation process who present on CRST area to control vehicle access, to guard security, coordination with BATAN and local government of South Tangerang City.
4. Lisencee, is Head of Multipurpose Reactor as person in charge of emergency response on facility.
5. Operation control, is Head RDMA of South Tangerang City as nuclear emergency operation control out of NSA.
6. Operation executive, is nuclear emergency response team consist of 6 (six) division.
7. Radiological assessor, is radiological assessor team chaired by Head of Center for Safety Technology and Radiation Metrology Colaboration together with field asisstance team (FAT) of BATAN NSA and FAT of BATAN Nuclear Pasar Jum'at area, local environmental agencies of South Tangerang City and Climatology Meteorology and Geophysics Agency as needed.
8. Public relation, is PR chaired by PR bureaulocal government of South Tangerang City involving element of BATAN, Army, Police, or else.

Nuclear emergency response organization structure of south Tangerang City can be seen on figure 4.4-2.

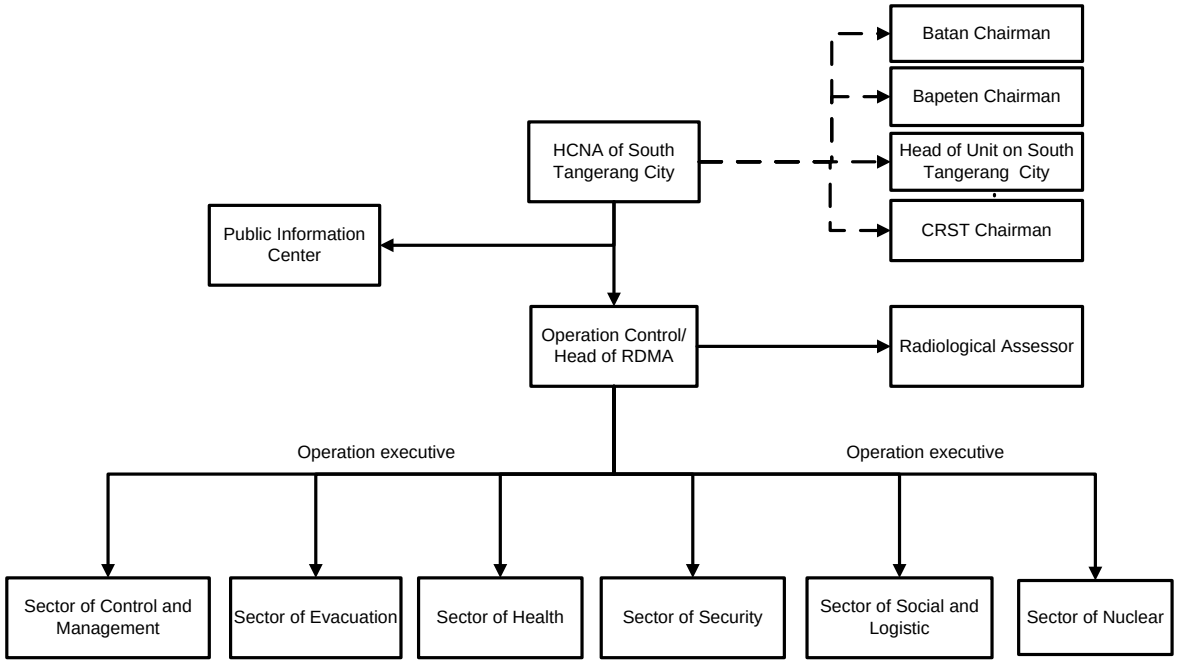


Figure 3.4-2 Regional Nuclear Emergency Response Organization of South Tangerang City

3.5. Concept of Operation

In the case of nuclear emergency that will involve nuclear emergency organization occurs, the activation of nuclear emergency organization of South Tangerang City would be conducted if the accident in facility extend out site SNA and where the licencee and SNA controller are not able to handle emergency which would rise impact furtherly to environment and public. In this emergency, SNA controller will give notification immediately to CRST area controller and to the Major of South Tangerang as HNCA of territory, and furtherly report to BAPETEN and Batan chairmans. Based on impact analysis that occurred and will occur, radiological assessor could give recomendation to activate region nuclear emergency response organization of South Tangerang. The Major of South Tangerang as HNCA leads and coordinates each operation response step from the begining until recovery.

In case of nuclear emergency caused by nuclear accident, nuclear emergency organization of South Tangerang City is operated in mechanism as follow:

1. Nuclear emergency escalates, then licencee can not handle emergency occured in facility and the escalation of emergency causes effect that all facilities and response command station of licencee are not feasible presenting on site due to the contamination and radiation level are too high, so that licencee makes coordination with NSA controller and CRST area controller immediately to give notification to surrounding public and local government whose the territory is exposed by radiological exposure.
2. Accidents result in directly significant impacts to enviroment and public by radiation exposure level on site about 5 μSv/h for 10 minutes consecutive, then licencee coordinates to NSA controller and CRST area controller must give warning immediately to local government without waiting further excalation.
3. Base on those warning, South Tangerang City Mayor through head of RDMA of South Tangerang City activates organization of nuclear response and command post of South Tangerang to control the operation of radiologic/nuclear emergency. South Tangerang City Mayor announces immediately the possible impact and protection action to public.
4. South Tangerang City Mayor through head of RDMA of South Tangerang City in charge to decide urgent protection actions (evacuation, sheltering, Iodine prophylaxis) based on recommendation from radiological assessor, and leads all nuclear/radiologic response activities until the end.
5. If nuclear/radiological emergency in South Tangerang City can be handled, South Tangerang City Mayor declares and stops nuclear/radiological emergency response in local level. But if it can not be handled, then the Mayor requests assistance immediately to province or national levels.

3.5.1. Mitigation and Prevention

Control Command Center (CCC) of SNA gives command to licencee to conduct mitigation to reduce radiological escalation, to return facility to save and stabil condition, to reduce potential radioactive release or radiation exposure and to mitigate radioactive release or radiation exposure effect. Mitigation action is conducted following safety work procedure of installation concerned. The licencee could request technical assistance from other instalations through Head of Emergency Response (HER) of SNA.

3.5.1.1 Personnal Protection Action

In the nuclear emergency even on site, HER of SNA coordinates with all head of center in BATAN to take personnel protection actions which do not involve in nuclear response on site (personnel is not nuclear emergency response officer). These protection actions cover iodine phropylaxis, sheltering, and or evacuation. Emergency response officers conduct radiology monitoring on site and personnel decontamination as needed. Evacuation point for personnel on site is sport stadium. Evacuation pathway is decided by HER of SNA depend on field condition and recommended by radiological assessor. If nuclear emergency escalates becoming off site emergency, then personnel at sport stadium will be removed to another location recomended by head of RDMA.

Protection action to personnel in off site nuclear emergency follows the personnel protection action on site which the pathway and evacuation location decided by head of RDMA.

3.5.1.2 Urgent Protection Action

In case of the accident effect exceeds intervention level which needing urgent protection action, HER of SNA coordinates with RDMA to implement urgent protection action including :

1. Evacuation
2. Iodine phropylaxis
3. Sheltering

To ensure safety of environment and public, monitoring of environmental radiological environment emergency is conducted during emergency. This information is needed to conduct urgent protection action.

3.5.1.3 Protection for First Responder, Radiation Worker, And Vulnerable Groups

The things needed to conduct on protection action to nuclear emergency response officer are :

1. Wearing personnel protective equipment
2. Monitoring of dose acceptance
3. Limiting dose asseptance on life saving
4. Acting to over dose asseptance
5. Personnel decontamination

Protection action for vulnerable groups (BATAN employees, contractors, visitors, students, out sourcing employees) follows nuclear facility preparednes programme.

3.5.1.4 Public Action to Off Site Radioactive Release

If radioactive release even make effect to off site seriously deterministic health, public should act:

1. Keep calm and do not panic
2. Keep away and far away from incident center /reactor
3. Destination location must contra with wind direction come from incident center /reactor
4. Monitoring these even continously from Official government news
5. Wearing standard masker as needed.

3.5.2. Emergency Preparedness

In the preparednes there are several things need to be prepared before emegency condition coming. Facility and equipment of nuclear emergency response is including facility support which must be avaiable in each center accordance with kind of radiology threath category on their facility. Facility and equipment of operation executive on site and off site of SNA is completed by each teams and it must be in function and storaged at special emergency room.

In conducting function of nuclear emergency response effectively, all emergency response teams must meet procedure and work instruction.

3.5.3. Emergency Response

Nuclear emergency response is conducted by Organization of nuclear emergency response of SNA and assistanced by outside relation response Organization (Nuclear Biology and Chemical unit of Army, police, hospital, etc.), and involves RDMA of South Tangerang City if accident effect escalates out of NSA. Operational of nuclear emergency response of NSA and related emergency response organization is available under control of Control Command Center (CCC) of NSA, whereas off site emergency control conducted by off site emergency response organization accordance with off site nuclear emergency preparednes response programme.

Urgent protection action plan zone is the place to be prepared for sheltering, to conduct environment monitoring and to conduct other urgent protection actions based on monitoring result several times after release.

Plan zone radius is 0,3-2 km. In this radius the Mayor of South Tangerang City gives instruction to public to stay at home or temporary sheltering to wait further instruction.

Sheltering is strongly considered for distances less than 1 km, and is also recommended to conduct until radius of 2 km. Evacuation must be done immediately for radius under 0.3 km and need consideration based on field condition until radius of 2 km.

Monitoring Food Ingredients Zone, this zone is prepared to implement protection action to reduce stocastic efect risk as a result of consuming local food products. Protection action such as relocation, food restriction and response action to agriculture product is usually based on environment monitoring result and food sampling. Radius of monitoring Food Ingredients is 5-30 km. Monitoring Food Ingredients cover agriculture product and livestock and food consumption and drinking water. This monitoring result is evaluated by radiological assessor and the assessor then recommend prohibition of consuming foods that are potentially contaminated in a defined radius of foodstuffs monitoring zone.

Table 3.5-1. Emergency Zone and The a Defined Radius for Radiology Threath Category.

Facility	Precautionary Action Zone (PAZ)	Urgent Protective Action Planning Zone (UPZ)	Longer Term Protective Action Planning Zone (LPZ)
Reactor 10-100 MWt	minimum of the outer wall of the building	0,5–5 km	5–50 km

3.5.4. Emergency Rehabilitation and Restoration

Nuclear emergency response on SNA is done if escalation of accident is predicted reach out the on-site emergency level (on site emergency class) or off site emergency (general emergency class). Both condition emergency response operations are chaired by Head of CIUNSA as SNA manager. All infrastructures of nuclear emergency (organization, coordination, facility/equipment and procedure) and ability response function of SNA is deployed to handle emergency. Nuclear emergency response also covers out SNA if accident escalation and potential threath thranscends SNA. Nuclear emergency reponse function on SNA aims for:

1. Controlling nuclear emergency situation, that the handling of which is in accordance with the response procedure on site;
2. Keeping away and mitigating accident consequency;
3. Keeping away the deterministic effect to personnel (onsite);
4. Conducting first aid and managing handling radiation wound victim;
5. Keeping away stocastic effect to public (off site);
6. Keeping away non radiology effect to individual and population;
7. Protecting property and environtment.

3.6. Related Activities

3.6.1. Human Capacity Building (e.g. training, workshops, drills, and exercises)

Training and or drill of nuclear emergency response on site is conducted by CIUNSA at least once a year, the aim of these activities is to implement the programme, to develope personnel/teams ability in field and to try out the equipment and existing response facility. Training is conducted by involving infrastructure and existing response function.

CIUNSA conducts exercise and drilling of nuclear or radiological emergency off site at least once in two years by involving out side istitutions such as RDMA, CRST, police and or hospital. CIUNSA follows exercise and drilling of nuclear or radiological emergency in national level at least once in 4 (four) years cooperates with disaster management national agency (DMNA), Nuclear biology chemical unit of army, bomb squad, health ministry, agriculture ministry, Government of South Tangerang City, etc.

Besides drill conducted, there are some supporting training such as training for radiological assessor, first responder, fire and first aid countermeasures, radiation protection, and decision maker.

3.6.2. Communication and Public Relation (e.g. information passage, mass media, and social media

Giving information to media and or public under PR coordination. The information is given to media and or public immediatelly and efective. PR keeps maintenancing information to media and or public continously due to emergency situation development. PR arranges press conference that involves related emergency response elements such as facility in charge, radiological assessor, public in charge and RDMA.

Task and responsible of public information center are as follows:

1. Collecting data and information for handling of the disaster.

2. Making information and communication network and distribute information to mass media and public about situation and condition the prevention effort.
3. Facilitating giving information from stakeholder to mass media and public.
4. Giving information to public, mass media and related institution.
5. Coordinating with external assistance PR on giving information.

III-4. Japan

4.1. Policy

4.2. Regulatory Framework and Legislation

4.3. Emergency Classes and Condition

4.4. Participating Organizations (Enterprise, Government (central and local), Non-Government, and International Partnership)

4.5. Concept of Operation

4.5.1.. Mitigation and Prevention

4.5.2. Emergency Preparedness

4.5.3. Emergency Response

4.5.4. Emergent Rehabilitation and Restoration

4.6. Related Activities

4.6.1 Human Capacity Building (e.g. training, workshops, drills, and exercises)

4.6.2. Communication and Public Relation
(e.g. information passage , mass media, and social media)

4.7 Abbreviations

III-4. Japan

4.1. Policy

On the basis of Disaster Countermeasures Basic Act (DCBA), the definition of the nuclear emergency preparedness and response is prescribed as follows:

To prevent in advance nuclear disaster
To prevent expansion of damage caused by the nuclear disaster
To assist recovery of the affected areas

The nuclear disaster means damage caused to the lives, bodies or properties of citizens due to a nuclear emergency situation in which radioactive materials or radiation at an abnormal level has been released outside the nuclear site of a nuclear operator.

Therefore, the nuclear emergency preparedness and response means to prevent in advance damage caused to the lives, bodies or properties of citizens due to a nuclear emergency situation in which radioactive materials or radiation at an abnormal level, to prevent expansion of the damage and to assist recovery of the affected areas.

In addition, since the nuclear disaster is due to operation of a nuclear reactor of a nuclear operator, the nuclear operator has primary responsibility for contain of the accident and nuclear emergency response. The responses to be implemented are different between within and outside the nuclear facility. For this reason, within and outside the facility are distinguished and called "on-site" and "off-site", respectively as shown in Table 4.1-1.

Table 4.1-1 Distinction of on-site and off-site responses

On-site: within the grounds of a facility	Main response is to contain of the accident ・ Response for control of the accident has been continued since trouble stage ・ Operator has primary responsibility for the contain of the accident
Off-site: outside of the grounds of a facility	Main response is for residences ・ Response for residences starts from a step of notification of an event that may lead to release of radioactive materials ・ Response is carried out by government and local public organization

Ref. 1) S Sato and K Yamamoto, Basic Concept of the Nuclear Emergency Preparedness and Response in Japan after the Accident of the Fukushima Dai-ichi Nuclear Power Station - The Plain Explanation for Regional Officials and Emergency Workers -, JAEA-Review 2013-015 http://jolissrch-inter.tokai-sc.jaea.go.jp/pdfdata/JAEA-Review-2013-015.pdf

4.2. Regulatory Framework and Legislation

As Japanese laws to prescribe nuclear emergency response system has been established in a sequential order after occurrence of disasters, it is effective to understand background history of the laws. The following is historical backgrounds on the establishment of the laws.

For responses to natural disaster, there was the Disaster Relief Act established in 1947. Owing to the Ise Bay Typhoon in 1959, the Disaster Countermeasures Basic Act (DCBA) was enacted in

1961 for the purpose of unification of relevant laws to disaster and promotion of comprehensive administration for disaster prevention.

In the DCBA, the establishment of the Central Disaster Prevention Council (CDPC) was prescribed. In the enforcement ordinance of the DCBA, release of a large amount of radioactive materials became one of the disasters in the DCBA, which clarified that nuclear disaster is located under the framework of the DCBA. In 1963, the CDPC showed a foundation of disaster prevention and made the Basic Plan for Emergency Preparedness that is a basis of the operational plan for disaster prevention and the local disaster prevention plan.

As the Three Mile Island accident occurred in 1979, the CDPC determined "On the measures should be taken for disaster prevention of the nuclear power plants" and advice and dispatch by experts of nuclear power. In 1980, the Nuclear Safety Commission (NSC) established a guideline on nuclear disaster prevention entitled "Emergency Preparedness for Nuclear Facilities (Emergency Preparedness Guide)" in which Emergency Planning Zone (EPZ; areas in which arrangements for emergency preparedness and response for nuclear power plants should be intensively made) was adopted. In 1997, nuclear emergency response section was added to the Basic Disaster Prevention Plan and responses specific to nuclear disaster was incorporated.

As criticality accident at the nuclear fuel plant in JCO plant occurred in 1999, the Act on Special Measures Concerning Nuclear Emergency Preparedness was established as a special law of the DCBA, which prescribed insurance of rapid initial motion system and reinforcement of the role of government. In addition, the Emergency Preparedness Guide was revised according to the Act on Special Measures Concerning Nuclear Emergency Preparedness and its target was expanded to nuclear fuel facilities and research reactors. Also, relevant guides were established or revised.

In response to the accident at the Fukushima Daiichi Nuclear Power Stations of Tokyo Electric Power Company in 2011, the Atomic Energy Basic Law, the Act on Special Measures Concerning Nuclear Emergency Preparedness and the Basic Disaster Prevention Plan were revised when the Nuclear Regulation Authority (NRA) was established. In October 2012, the NRA established the Nuclear Emergency Preparedness Guide that was legislated according to the revision of the Act on Special Measures Concerning Nuclear Emergency Preparedness. This guide was established by revising the previous Emergency Preparedness Guide incorporating lessons learned from the accident at the Fukushima Daiichi Nuclear Power Stations of Tokyo Electric Power Company, items pointed out in the investigative reports and interim report of the Emergency Preparedness Guide. Although new concept was added to the Nuclear Emergency Preparedness Guide, specific numerical values and operational method of criteria became issues to be solved in future tasks. As the new concept was made only for the commercial nuclear power reactors, considerations for the other facilities were also issues to be solved in future tasks. This is because there is a need to rapidly establish the Nuclear Emergency Preparedness Guide to make it available for revision of regional disaster prevention plan, which is a method to establish highly prioritized items in advance.

In November 2012, study teams were established under the NRA. The Nuclear Emergency Preparedness Guide was fully revised on 27th February 2013 incorporating items completed in the study teams. There have been remaining issues to be solved in the future in the revised Nuclear Emergency Preparedness Guide. Subsequently, additional revisions were carried out twice on 5th June and 5th September 2013. Further examinations for remaining items are still continued in the

study teams.

Ref. 1) S Sato and K Yamamoto, Basic Concept of the Nuclear Emergency Preparedness and Response in Japan after the Accident of the Fukushima Dai-ichi Nuclear Power Station - The Plain Explanation for Regional Officials and Emergency Workers -, JAEA-Review 2013-015
http://jolissrch-inter.tokai-sc.jaea.go.jp/pdfdata/JAEA-Review-2013-015.pdf

4.3. Emergency Classes and Condition

In the revised Nuclear Emergency Preparedness Guide, importance is addressed in the decision making on the basis of common understanding in relation to progress of the events. The response to an emergency situation can be divided into three phases, Preparedness, Early Response, Medium-term Response and Recovery as shown in Table 4.3-1.

Table 4.3-1 Phases in an emergency situation in the Nuclear Emergency Preparedness Guide

Preparedness phase	It is necessary for nuclear operators, national government and local government to make and notify each action plan, and to evaluate, verify and improve it by training.
Early response phase	It is necessary to avoid deterministic effects due to radiation exposure even in the case that limited information is available and to implement rapid protective measures to minimize stochastic effects due to radiation exposure.
Medium-term response phase	It is required to administrate effects from radiation or radioactive material. It is also necessary to understand radiation level by environmental radiation monitoring and analysis. On the basis of these results, it is necessary to revise or cancel protective measures that were implemented in the early response phase and to examine long-term protective measures.
Recovery phase	It is necessary to support a comeback to normal social and economic activities on the basis of the long-term recovery plan made in the transition time to this phase at the affected area.

In the early response phase after an emergency (particularly, before release of radioactive material), it is significant to appropriately progress preparedness and implement of protective measures according to the situations of the nuclear facility and distance from the facility. For this reason, emergency classes are divided into three types, Alert, Site Area Emergency and General Emergency.

Measures to be implemented according to the three classes are prescribed as shown in Table 4.3-2. The three categories correspond to preparedness of response organization in the alert situation, preparedness for protective measures in the site area emergency situation and rapid implement of protective measures within the Precautionary Action Zone (PAZ) and the Urgent protective action Planning Zone (UPZ), which was given by IAEA.

Table 4.3-2 Emergency categories in the Nuclear Emergency Preparedness Guide

Category	Alert	Site Area Emergency	General Emergency
Situation	There is no radiation effects on the public or any imminent risk, but caution is required because of the possibility of an 'abnormal' event occurring.	An event occurs in a nuclear facility where a radioactive material release may threaten public safety.	An event occurs in a nuclear facility where a radioactive material release will threaten public safety.
Response	The body implementing protection measures such as a local government begins preparations which may require a comparatively long time to implement.	It is necessary for local governments to put into place the main protection measures including the evacuation of all local residents.	It is necessary for controlling organizations such as local governments to implement full emergency protection measures, to mitigate inevitable damage impact and prevent its spread following the radioactive material release.

Emergency Action Levels (EALs) are guidelines to establish whether a specific situation corresponds to one of these emergency categories, such as the status of the facility's defense-in-depth equipment, the status of radioactive material confinement functions, and whether or not any external events have also occurred. Table 4.3-3 shows emergency categories relating to commercial reactor facilities and the main details of current EALs.

Nuclear operators are required to consider establishing more detailed EALs specifically reflecting conditions at each power reactor and submit them to the NRA, which will examine them and amend recommendations if warranted.

Table 4.3-3 Emergency Categories and EALs (No 1)

Emergency Category	EAL
Alert	- If an earthquake with a magnitude of at least 6-lower on the Japanese seismic intensity scale has occurred in the prefecture in which the nuclear facilities are sited - If a major tsunami warning has been issued in the prefecture in which nuclear facilities are sited - If a Tokai Earthquake Advisory has been issued - In the event of a crucial failure of the reactor facilities that a Director-General of the NRA Secretariat or the Director of the Accident Countermeasures Office of the Nuclear Emergency Preparedness Division deems to necessitate an alert

Table 4.3-3 Emergency Categories and EALs (No 2)

Emergency Category	EAL
	- In any other case in which the Chairman of the NRA deems the establishment of an NRA Nuclear Accident Vigilance Headquarters to be necessary
Site Area Emergency	- Leakage of reactor coolant - Failure of emergency core cooling system in the high pressure coolant injection system in the event of the loss of feed water functions - Loss of all feed water functions to steam generators - Loss of residual heat removal functions in the event of the loss of residual heat removal functions from the reactor by means of the main condenser - Station blackout (continuing for at least five minutes) - If a situation in which only one power source is supplying electricity to the DC bus continues for at least five minutes, in the event that there is only one emergency DC bus - Decline of the water level within the reactor vessel while the reactor is shut down to the level at which the emergency core cooling system begins to actuate - Loss of all functions for cooling the reactor during outage - Unavailability of the reactor control room
General Emergency	- Inability to shut down the reactor, if required, by means of a conventional neutron absorber. - Loss of all functions to shut down the reactor, in such an emergency is required. - Inability to inject water into the reactor in question using any of the emergency core cooling systems - If the pressure within the containment vessel reaches the design-basis maximum allowable working pressure - Loss of pressure control functions in the containment vessel, in the event that functions for removing residual heat from the reactor have been lost - Loss of all functions for cooling the reactor - Loss of all emergency DC power supply continues for at least five minutes - Detection of radiation or temperature indicative of core meltdown - Detection of a change in the liquid level within the reactor vessel or other phenomenon indicative of exposure of the irradiated fuel assemblies within the reactor vessel - If a situation continues for at least one hour in which the water level declines to a point where residual heat removal functions are lost - Unavailability of the reactor control room - The liquid level in the irradiated fuel assembly storage tank declines to the level at which the fuel assemblies in question are exposed - If a situation in which the air radiation dose rate at the site boundary reaches 5 mSv/hour continues for at least ten minutes

Ref. 1) S Sato and K Yamamoto, Basic Concept of the Nuclear Emergency Preparedness and Response in Japan after the Accident of the Fukushima Dai-ichi Nuclear Power Station - The Plain Explanation for Regional Officials and Emergency Workers -, JAEA-Review 2013-015
http://jolissrch-inter.tokai-sc.jaea.go.jp/pdfdata/JAEA-Review-2013-015.pdf
Ref. 2) Convention on Nuclear Safety National Report of Japan for 6th Review Meeting, August 2013
http://www.nsr.go.jp/english/cooperation/conventions/data/cns_6th.pdf

4.4. Participating Organizations (Enterprise, Government (central and local), Non-Government, and International Partnership)

The government's preparedness system in the event of a nuclear disaster is prescribed in detail under the Nuclear Emergency Preparedness Act, the Basic Plan for Emergency Preparedness and the Nuclear Emergency Response Manual (NER Manual), etc.

According to the NER Manual, etc., the Nuclear Emergency Response Headquarters (NERHQ) and the Local NERHQ are the core organizations that respond to a nuclear disaster. When the prime minister issues a Nuclear Emergency Declaration, the NERHQ (for which the prime minister serves as the director-general) should be established at the Kantei and the Local NERHQ at the Off-site Center. The director-general of the Local NERHQ, to whom the director-general of the NERHQ delegates part of his/her authority, undertakes the response to the accident, including the issuance of evacuation orders, in accordance with the actual local conditions and with the support of the NERHQ and the support and cooperation of the other relevant organizations such as municipal governments.

Japan is an island nation and shares no land borders with its immediate neighbors. However, its geographical neighbors – China and South Korea – also have reactor facilities. Following the Fukushima Daiichi accident sharing information during a nuclear emergency is an important issue for all of the neighboring countries. In August 2009, senior Japanese, Chinese and South Korean regulators met and agreed to share emergency information. The three countries had earlier exchanged information as required, but Fukushima underlined the importance of closer cooperation's and talks are currently underway to achieve such an outcome.

At a Japan - China - South Korea Top Regulators' Meeting in November 2011, the three countries reached agreement on a Nuclear Safety Cooperation Initiative, which includes improving the exchange of information, cooperating in response to severe accidents, and cooperating on disaster prevention and emergency responses.

In terms of existing mechanisms for the providing information other than the aforementioned tripartite mechanism, Japan will disseminate information via the Unified System for Information Exchange in Incidents and Emergencies (USIE) web portal run by the IAEA's Incident and Emergency Centre (IEC).

To carry out the provisions of the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, Japan has designated the Ministry of Foreign Affairs as the National Warning Point (NWP) and National Competent Authority for an Emergency Abroad (NCA (A)), in the event of a nuclear accident or radiological emergency occurring outside the territory of Japan. In the event of a radiological emergency outside the territory of Japan, including in a neighboring country, the Ministry of Foreign

Affairs will receive a notification and pass on the details without delay to the National Competent Authority for a Domestic Emergency (NCA (D)) and other relevant authorities, as well as taking any the necessary action. Moreover, in relation to the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, the National Assistance Capabilities (NAC) of relevant organizations within Japan have been registered with RANET (the IAEA Response Assistance Network).

Ref. 1) National Diet of Japan, Fukushima Nuclear Accident Independent Investigation Commission, Report, 5 July 2012.

Ref. 2) Convention on Nuclear Safety National Report of Japan for 6th Review Meeting, August 2013 http://www.nsr.go.jp/english/cooperation/conventions/data/cns_6th.pdf

4.5. Concept of Operation

4.5.1 Mitigation and Prevention

Act on Special Measures Concerning Nuclear Emergency Preparedness has been established. The purpose of this Act is to strengthen nuclear disaster control measures, in cooperation with the Act on Regulation of Nuclear Source Materials, Nuclear Fuel Materials and Reactors, and the Basic Act on Disaster Control Measures and other Acts concerning nuclear disaster prevention, by providing special measures for the obligations, etc. of nuclear operators concerning nuclear disaster prevention, the issuance of a declaration of a nuclear emergency situation and the establishment, etc. of nuclear emergency response headquarters, and the implementation of emergency response measures and other matters relating to a nuclear disaster, taking into consideration the particularity of a nuclear disaster, thereby protecting the lives, bodies and properties of citizens from a nuclear disaster.

The state, local governments and nuclear operators shall cooperate with each other through the promotion of mutual coordination for the purpose of ensuring the smooth implementation of measures to prevent nuclear emergency, emergency response measures and measures for restoration from nuclear emergency.

This Act determines the responsibilities of nuclear operators, the state and local governments as follows.

4.5.1.1. Nuclear Operator

A nuclear operator shall be responsible for taking full-scale measures for prevention of occurrence of a nuclear disaster pursuant to provisions of this Act or any other relevant Act and for taking, in good faith, necessary measures with regard to the prevention of the progression (expansion) of a nuclear disaster (including the probability of the occurrence of a nuclear disaster) and nuclear disaster recovery efforts.

4.5.1.2. The State

The State shall, pursuant to the provisions of this Act or any other relevant Act, be responsible for taking full-scale measures for prevention of occurrence of a nuclear disaster by establishing nuclear emergency response headquarters, giving necessary instructions to local governments and taking other measures necessary for the implementation of emergency response measurers and those necessary for the implementation of measures to prevent nuclear emergency and measurers for restoration from nuclear emergency.

4.5.1.3. Local Government

A local government shall, pursuant to the provisions of this Act or any other relevant Act, be responsible for taking full-scale measures for prevention of occurrence of a nuclear disaster by taking measures necessary for the implementation of measures to prevent nuclear emergency, emergency response measures and measures for restoration from nuclear emergency

4.5.2 Emergency Preparedness

The State, local governments and nuclear operators are strengthening the system and working for prevention of occurrence of a nuclear disaster from normality by the respective viewpoints based on the Act on Regulation of Nuclear Source Materials, Nuclear Fuel Materials and Reactors and the Act on Special Measures Concerning Nuclear Emergency Preparedness.

4.5.2.1. Nuclear operator

A nuclear operator shall prepare a nuclear operator emergency action plan with regard to its measures to prevent nuclear emergency, emergency response measures, and measures restoration from nuclear emergency and other duties that are necessary for preventing the occurrence and progression (expansion) of a nuclear disaster and promoting nuclear disaster recovery efforts, with respect to each of its nuclear sites, and review its nuclear operator emergency action plan every year and revise it if revision is found to be necessary. When a nuclear operator intends to prepare or revise a nuclear operator emergency action plan, it confers in advance with a competent prefecture governor, the competent mayor of a municipality and the related neighboring prefecture governors. When it has prepared or revised a nuclear operator emergency action plan, a nuclear operator promptly notify the competent minister to that effect and make public the gist of the plan.

A nuclear operator shall establish an on-site organization for nuclear emergency preparedness with respect to each of its nuclear sites. An on-site organization for nuclear emergency preparedness shall, in accordance with a nuclear operator emergency action plan, perform the necessary duties for preventing the occurrence or progression (expansion) of a nuclear disaster.

A nuclear operator shall post nuclear disaster prevention staffs who are engaged in the duties for preventing the occurrence or progression (expansion) of a nuclear disaster at on-site organization for nuclear emergency preparedness.

A nuclear operator shall appoint a nuclear emergency preparedness manager with respect to each of its nuclear sites and have him/her manage the relevant on-site organization for nuclear emergency preparedness. A person who manages and administrates of the business of a nuclear site at said nuclear site shall serve as a nuclear emergency preparedness manager.

A nuclear operator shall appoint a vice-nuclear emergency preparedness manager from those in a managerial or supervisory position who are able to perform, appropriately, duties concerning the prevention of the occurrence or progression (expansion) of nuclear disaster at the relevant nuclear site, and have him/her assist a nuclear emergency preparedness manager in managing the relevant on-site organization for nuclear emergency preparedness.

A nuclear operator shall establish in its nuclear site a radiation measurement facility and maintains such facility.

A nuclear operator shall install protection apparatus for radiation hazards, emergency

communication devices and any other materials and equipment necessary for said on-site organization for nuclear emergency preparedness to perform its duties, and maintain and check them as needed, in its on-site organization for nuclear emergency preparedness.

A nuclear operator shall record the numerical values of a radiation dose detected by a radiation measurement facility and publicize such values.

Where there is a need to take emergency response measures pertaining to the nuclear site of another nuclear operator, a nuclear operator shall make efforts to dispatch nuclear disaster prevention staff, lend materials and equipment for nuclear disaster prevention and provide any other cooperation necessary for implementing said emergency response measures.

4.5.2.2. The State

The competent minister shall, with respect to each nuclear site, designate a facility that serves as the center for emergency response measures taken by a specialist or organization responsible for the implementation of emergency response measures, which is located within the area of the prefecture that includes the area where the relevant nuclear site is located ("off-site center").

Senior specialist for nuclear emergency shall be allocated to the Ministry of Education, Culture, Sport, Science and Technology and the Ministry of Economy, Trade and Industry. A senior specialist for nuclear emergency preparedness shall, in addition to giving guidance and advice concerning the preparation of nuclear operator emergency action plan, establishment of an on-site organization for nuclear emergency preparedness or other measures to prevent nuclear emergency implemented by a nuclear operator with regard to a nuclear site that has been designated by the Minister of Education, Culture, Sport, Science and Technology or the Minister of economy, Trade and Industry as nuclear site of which said senior specialist for nuclear emergency preparedness should take charge, collect information necessary for understanding the situation, give advice concerning the collection of information and emergency responses implemented by a local government and perform any other duties necessary to smoothly implement the prevention of the occurrence or progression (expansion) of a nuclear disaster in the case where there has been a notification from a nuclear emergency preparedness manager.

Disaster prevention drill shall be carried out based on a plan prepared by the competent minister.

4.5.3 Emergency Response

4.5.3.1. Nuclear operator

When an event of nuclear emergency has occurred at the nuclear site managed by a nuclear emergency preparedness manager, the nuclear emergency preparedness manager shall, pursuant to the provision of a nuclear operator emergency action plan, immediately have the on-site organization for nuclear emergency preparedness of said nuclear site implement the emergency response necessary for preventing the occurrence or progression (expansion) of a nuclear disaster. In addition, a nuclear operator shall, pursuant to the provision of its nuclear operator emergency action plan, report the outline of the measures implementation to the competent minister, the competent prefectural governor, the competent mayor of a municipality and related neighboring prefectural governors. In this case, the competent prefectural governor and the related neighboring prefectural governor shall notify the mayors of related surrounding municipalities of content of said report.

4.5.3.2. The State

The competent minister shall, when he/her finds that a nuclear emergency situation has occurred, immediately report necessary information concerning the situation to the Prime Minister and submit a draft of a public notice and a draft of an instruction. When there has been a report or submission form the competent minister, the Prime Minster shall immediately give public notice of the occurrence of a nuclear emergency situation, the area where emergency response measures should be implemented, the outline of the nuclear emergency situation and the matters which need to be known by residents, etc. in the area ("the declaration of a nuclear emergency situation").

The Prime Minister shall, when he/her has issued a declaration of a nuclear emergency situation, temporarily establish nuclear emergency response headquarters within the Cabinet Office after deliberation in a cabinet meeting in order to promote emergency response measures pertaining to said nuclear emergency situation. The nuclear emergency response headquarters shall be headed by the director-general of the nuclear emergency response headquarters, and the Prime Minister shall serve in this capacity. The competent minister shall serve as the vice director-general of the nuclear emergency response headquarter.

4.5.3.3. Local government

When a declaration of a nuclear emergency situation has been issued, prefecture governor and mayors of municipalities who have jurisdiction over the emergency response measures implementation area pertaining to said declaration of nuclear emergency situation shall establish headquarters for disaster control with regard to said nuclear emergency situation.

When a declaration of a nuclear emergency situation has issued, the local nuclear emergency response headquarters and the prefectural and municipal headquarters for disaster control which have jurisdiction over the emergency response measures implementation area pertaining to said declaration of a nuclear emergency situation shall organize a Joint Council for Nuclear Emergency Response, in order to exchange information on said nuclear emergency situation and cooperate with one another for the emergency response measures that they implement respectively.

During the period from the issuance of nuclear emergency situation to the issuance of a declaration of the cancellation of a nuclear emergency situation, the heads of designated administrative organs and the heads of designated local administrative organs, the heads of local government and other executive organs, designated public institutions and designated local public institutions, nuclear operators and other parties responsible for the implementation of emergency response measures pursuant to the provision of laws and regulations shall implement emergency response measures pursuant to the prevention of laws and regulations, a disaster prevention plan or a nuclear operator emergency action plan. A nuclear operator shall, pursuant to the provisions of laws and regulations, a disaster prevention plan or a nuclear operator emergency action plan, dispatch nuclear disaster prevention staff, lend materials and equipment for nuclear disaster prevention and take other necessary measures for the accurate and smooth implementation of emergency response measures which are implemented by the heads of designated administrative organs and the heads of designated local administrative organs, and the heads of local governments and other executive organs.

Emergency response measures shall be implemented with regard to the following matters;

(1) Declaration of a nuclear emergency situation and other matters relating to the transmission of information regarding a nuclear disaster and a recommendation for or instruction of evacuation.
(2) Measurement of a radiation dose and other matters relating to the collection o information regarding a nuclear disaster.
(3) Salvage, rescue of disaster victims and other matters relating to their protection.
(4) Matters relating to the development, check and emergency recovery of facilities and equipment.
(5) Crime prevention, traffic control and other matters relating to maintenance of the social order in the area affected by the relevant nuclear disaster.
(6) Matter relating to securing emergency transportation.
(7) Securing food, medicine and other materials, measurement of radiation exposure of residents, etc., removal of contamination by radioactive materials and other matters relating to the implementation of emergency response.
(8) Matters relating to measures to prevent the progression (expansion) of a nuclear disaster (including the probability of the occurrence of a nuclear disaster).

4.5.4 Emergent Rehabilitation and Restoration

The heads of designated administrative organs and the heads of designated local administrative organs, the heads of local governments and other executive organs, designated public institutions and designated local public institutions, nuclear operators and other parties responsible for measures for restoration from nuclear emergency pursuant to the provision of laws and regulations shall implement measures for restoration from nuclear emergency pursuant to the provision of laws and regulations, a disaster prevention plan or a nuclear operator emergency action plan. A nuclear operator shall, pursuant to the provision of laws and regulations, a disaster prevention plan or a nuclear operator emergency action plan, dispatch nuclear disaster prevention staff, lend materials and equipment for nuclear disaster prevention and take other necessary measures for the accurate and smooth implementation of measures for restoration from nuclear emergency which are implemented by the heads of designated administrative organs and the heads of designated local administrative organs, and the heads of local governments and other executive organs.

Measures for restoration from nuclear emergency shall be implemented with regard to the following matters;

(1) Investigation of the concentration or density of radioactive materials, or of the radiation dose, in the emergency response measures implementation area or other area where such investigation is required.
(2) Medical examination of and mental and physical health consultation for residents, etc. and other measure relating to medical care.
(3) Public information activities concerning the status of the emanation of radioactive materials in the emergency response measures implementation area, etc. for the purpose of preventing the stagnation of sales, etc. of goods resulting from a situation where the a status of contamination by radioactive materials remains unclear.
(4) Matters relation to measures for preventing the progression (expansion) of a nuclear

disaster (including the probability of the occurrence of a nuclear disaster) or promoting nuclear disaster recovery efforts.

4.6. Related Activities

4.6.1 Human Capacity Building (e.g. training, workshops, drills, and exercises)

At emergency situations at nuclear-related facilities, responding and recovering activities on radiation protection purposes are quite important, necessary and crucial, and they should be performed by capable and reliable experts. These experts can be obtained only by systematic and continuing trainings including workshops, drills and exercises. Human capacity building process for these emergency experts should be well planned and organized for each of their expertise.

In Japan, the emergency trainings are positively conducted by most of the organizations having nuclear facilities. For example, NEAT (Nuclear Emergency Assist and Training Center), JAEA is an actual emergency assistance organ and, in ordinary time (at non-emergency situation), it is also conducting many training programs for designated emergency experts throughout a year.

In general, radiation protection experts should have;

*Basic knowledge of properties of radiation and radioactive materials in facilities and environment

*Basic knowledge of risks of radiation exposure and methods of radiation protection

*Knowledge and skills for basic radiation measurement and monitoring

*Skills on how to use or operate many protection tools and apparatuses

Practical experiences can be cultivated by certain emergency drills and exercises conducted by assuming many types of nuclear or radiation accidents, even if they have had no experiences at actual emergency situation. Trainings for practical emergency operation should also include advance planning for emergency activities. These practical trainings should be conducted regularly so that the trainees can get exact images of their own practical activities in emergency condition.

An example of menu of typical emergency training is as follows;

(Lectures)

1) Radiation protection measures
2) Characteristics of radioactive materials and effects on human bodies
3) General evacuation measures for public in nuclear emergency condition
4) How to minimize the exposure dose to workers and public

(Exercises)

1) Radiation measurements
   : Survey meters, dosimeters, contamination monitors, whole-body counters, monitoring activities etc.
2) Evaluation of air and surface contamination

: Sampling of airborne materials, sampling of surface contamination, how to measure contamination samples and evaluate the radioactivity contamination level

3) How to prevent from internal exposures
: Routes of intake of radioactive materials, how to use masks or protecting wears, how to evaluate internal doses, etc.

4) How to use or operate many types of protection tools
: Air-cleaning pump, filtration devices, respiration-assisting tools, etc.

5) Emergency drills
: Precaution measure, stand-by alert, evacuation drills, decontamination, etc.

The main targets of these trainings are responsible emergency experts, such as personnel of local government including police and fire department, leaders of local communities and medical professionals as well as workers of nuclear or radiation facilities.

Since 2006, JAEA's Nuclear Human Resource Development Center (NuHRDeC) started to promote training programs on emergency preparedness for Asian countries under sponsoring of Japanese Government: Ministry of Education, Culture, Sports, Science and Technology (MEXT). The program is divided into two types of training events, international training course (called Instructor Training Course; 6weeks) in Japan and national training courses held in Asian countries. National training courses held in each country (1 or 2 weeks) are sometimes called Follow-up Training Course, since some Japanese experts visit their countries and support them.

4.6.2 Communication and Public Relation (e.g. information passage , mass media, and social media)

Even in the normal conditions or non-emergency situations, the general public has negative images and idea on nuclear-related facilities (represented by nuclear power plants) and radiation/radioactive materials, and feels anxiety and mistrusts that any small radiation exposure may generate fatal and genetic damages.

Therefore, public relations activities are quite important for promotion of understanding of the general public on the expectations of nuclear-related technologies for its contribution to human society and on the accurate knowledge of their potential risks and the biological effects of radiation exposure that may be caused by accidents at nuclear facilities.

Public relations activities on nuclear facilities have two types. The first one is to promote understanding and acceptance of accurate knowledge and information regarding the normal operation of nuclear facilities - - - as public communication. The second is to provide the public with accurate information as promptly as possible at emergency situations - - - public relations as one of important objectives for crisis-management. The mass media and social media are very important tools and methods for this purpose.

Japan has learned much through the accident at TEPCO's Fukushima Daiichi Nuclear Power Plant

occurred in March, 2011. The lessons learned by this event shall be analyzed and reflected in future public relations activities in both ordinary and emergency situations.

◆ **Abbreviations:**

Page	Abbreviation	Formal Term
27, 28	DCBA	Disaster Countermeasures Basic Act
28	CDPC	Central Disaster Prevention Council
28	NSC	Nuclear Safety Commission
28	EPZ	Emergency Planning Zone
28, 30 .31	NRA	Nuclear Regulation Authority
23, 29	PAZ	Precautionary Action Zone
23, 29	UPZ	Urgent protective action Planning Zone
30, 31	EALs	Emergency Action Levels
32	NER Manual	Nuclear Emergency Response Manual
32	NERHQ	Nuclear Emergency Response Headquarters
32	USIE	Unified System for Information Exchange in Incidents and Emergencies
32	IEC	Incident and Emergency Centre
32	NWP	National Warning Point
32	NCA (A)	National Competent Authority for an Emergency Abroad
33	NCA (D)	National Competent Authority for a Domestic Emergency
33	NAC	National Assistance Capabilities
33	RANET	IAEA Response Assistance Network
38	NEAT	Nuclear Emergency Assist and Training Center
38, 39	JAEA	Japan Atomic Energy Agency
39	NuHRDeC	Nuclear Human Resource Development Center
39	MEXT	Ministry of Education, Culture, Sports, Science and Technology, Japan
39	TEPCO	Tokyo Electric Power Company

III-5. Kazakhstan

5.1. Policy

5.2. Regulatory Framework and Legislation

5.3. Emergency Classes and Condition

5.4. Participating Organizations (Enterprise, Government (central and local), Non-Government, and International Partnership)

5.5. Concept of Operation

- 5.5.1. Mitigation and Prevention
- 5.5.2. Emergency Preparedness
- 5.5.3. Emergency Response
- 5.5.4. Emergency Rehabilitation and Restoration

5.6. Related Activities

- 5.6.1 Human Capacity Building (e.g. training, workshops, drills, and exercises)
- 5.6.2. Communication and Public Relation
  (e.g. information passage , mass media, and social media)

III-5. Kazakhstan

5.1. Policy

In general, the policy of the Republic of Kazakhstan in the field of emergency preparedness and response regulates social relations which arisesd for the defense of workers and population, and aims at:

- prevention and liquidation of natural and man-made emergency situations and their consequences,
- urgent medical and psychological assistance to populations in the emergency area,
- nuclear, radiological, fire and industrial safety assurance.

In part, the nuclear and radiation safety policy of Kazakhstan is based on the National plan for response to nuclear and radiological accidents, which is approved by the Government of the Republic of Kazakhstan and which is put into effect by the decision of the authorized body:

1) in case of exposure or threat of exposure of factors of nuclear or radiological accident outside site of emergency nuclear, radiation, or electrophysical facility;
2) in the event of cross-border nuclear or radiological accidents that have occurred in the territory of another country, whose exposure or threat of exposure extends to part of or the whole of the Republic of Kazakhstanterritory.

The National plan for response to nuclear and radiation accidents determines the:

1) rights and responsibilities of central and local executive bodies of the Republic of Kazakhstan, as well as economic entities in case of nuclear or radiological accidents;
2) procedures and management of activities for preparedness and response to nuclear and radiological accidents;
3) coordination of activities of enterprises and government bodies in case of nuclear or radiological accidents and liquidation of their consequences.

Upon receipt of the information about a nuclear or radiological accident, the authorized body immediately informs the competent authority in the field of civil defense to put into effect the National plan.

Operating organizations develop and approve emergency plans in accordance with the legislation of the Republic of Kazakhstan. The emergency plans include procedures and activities for liquidation of the consequences of accidents, and (or) for minimization of the potential influence on workers, public and environment in accordance with the category of radiation danger of the nuclear, radiation, or electrophysical facility.

In case of cross-border accidents or incidents in the field of nuclear energy, authorized body takes alert and response measures in accordance with international agreements in the field of nuclear energy which are ratified by the Republic of Kazakhstan.

5.2. Regulatory Framework and Legislation

Modern regulatory framework of the Republic of Kazakhstan in the field of atomic energy and radiation safety assurance is represented by a four-level structure: 1) the laws of the Republic of Kazakhstan and the Decrees of the President of the Republic of Kazakhstan; 2) the resolutions of

the Government of the Republic of Kazakhstan on the atomic energy use and radiation safety assurance; 3) the rules and regulations approved by the central government authorities; 4) standards, guidelines, typical instructions for individual sectors and enterprises.

In the field of nuclear and radiological emergency preparedness and response, this framework is based on the lessons and experience learned during the Soviet period, as well as on the recommendations of the IAEA and the experience of other countries. The framework does not remain permanent in composition and content - it is updated and improved according to new global challenges. Basic documents in this field are as follows:

- Law on Atomic Energy Use;
- Law on Radiation Safety of Population;
- Law on Civil Defense.

These documents identify the:

- basics of planning and response;
- participants of planning and response activities, and the distribution of responsibilities between these participants;
- procedures in case of nuclear and radiological emergency;
- measures for emergency preparedness and so on.

The Law «On Atomic Energy Use» (No.93-1 dated to April 14, 1997) establishes legal framework and principles for regulation of public relations in the field of atomic energy use and aims at the defence of human health and life, environmental protection, nuclear weapons non-proliferation and providing and nuclear and radiation safety assurance in atomic energy use.

The Law establishes the basic rights and independence of authorized state bodies and officials in the field of atomic energy use, as well as identifies the rights and responsibilities of citizens and public organizations in this field.

The Law «On Radiation Safety» (No. 219-1 dated to April 23, 1998) regulates public relations in the field of radiation safety assurance to protect the health of the population from the negative impact of radiation and sets the main principles of radiation safety.

The Law establishes the jurisdiction of the state bodies on radiation safety assurance, general requirements for radiation safety assessment and for radiation safety when using radiation sources.

The Law «On Civil Defense» (№ 188-V dated to April 11, 2014) defines the main tasks, the organizational and functional principles of civil defense of the Republic of Kazakhstan, formation, storage and use of national material reserves, organization and activity of emergency rescue services and units.

5.3. Emergency Classes and Condition

In order to determine the level of measures for emergency preparedness and response planning the regulatory base of Kazakhstan uses five emergency planning categories that are similar to five threat categories in the recommendations of the IAEA.

Categories I, II and III represent decreasing levels of threat at facilities and therefore correspond to decreasing stringency of requirements for emergency preparedness and response measures.

Category IV includes radiological emergencies that could occur anywhere unexpectedly and applies always in all jurisdictions, possibly together with other threat categories.

Category V applies to the off-site areas where arrangements for preparedness and response are warranted to deal with contamination resulting from a release of radioactive material from a facility in category I or II.

Republic of Kazakhstan doesn't have facilities of Category I now, but Kazakhstan has facilities of categories II and III, such as reactor facility BN-350 (presently decommissioned), three operational research reactors, nuclear fuel fabrication plant and so on.

Table 5.3-1 Emergency planning categories

Category	Description
I	Facilities, for which large releases of radioactive materials are possible that can lead to severe deterministic health effects off the site
II	Facilities, for which releases of radioactive materials are possible that can lead to considerable exposure to off-site people, but cannot lead to severe deterministic health effects (low probability)
III	Facilities, for which considerable risk of exposure to off-site people does not exist, but there are possibility of accident that can lead to deterministic health effects on the site
IV	Activities with low threat of emergency such as activities relating to dangerous sources obtained illicitly, activities involving dangerous mobile sources
V	Activities, for which yield products with a significant likelihood of becoming contaminated as a result of events at facilities of category I or II, including such facilities in other States, to levels necessitating prompt restrictions on products

For rapid and coordinated response and for determination of the level of response in the case of radiation accidents regulatory base of Kazakhstan uses almost the same classification system as the IAEA with the following classes of the accidents:

- *General accident* is global-scale or regional-scale emergency resulting in an actual or substantial risk of release of radioactive materials or radiation exposure due to a criticality or loss of shielding requiring implementation of urgent protective actions off the site. At the announcement of this accident class, urgent measures should be taken to reduce consequences of the accident and to protect the people on the site and in the area (or zone) of urgent protective actions, if necessary.
- *Local accident* is a sharp decrease in the level of protection of the personnel on the site and directly near the facility. At the announcement of this accident class, urgent measures should be taken to reduce consequences and protect the people on the site. In addition, some preparation to implement protective actions off the site should be taken, if it will be necessary.
- *Facility accident* is a sharp decrease in the level of protection of the personnel on the site only. At the announcement of this accident class, urgent measures should be taken to reduce consequences and protect the people on the site. For this class there aren't any off-site hazards.
- *Threat of accident* is a significant decrease in the level of protection of the public and on-site

personnel. At the announcement of this accident class, urgent measures should be taken to assess and mitigate the consequences, as well as increase readiness of response organizations on- and off-siteif necessary.

- *Incident* is other emergencies, such as accidents during transportation of radioactive materials, contamination because of economic activity, loss of control under radioactive source and so on.

Planning level for facilities where there is a probability of accidents with a large off-site release varies in different areas, depending on distance of these areas from the facility. For such facilities Kazakhstan regulations distinguish three emergency planning zones:

- *Preventive protective action zone* – a predefined area around the object, for which urgent protective measures are planned in advance, and where it is necessary to take urgent protective actions immediately after the declaration of General Accident. The goal is to significantly reduce the risk of severe deterministic health effects through the implementation of protective measures before release.
- *Urgent protective action zone* - a predefined area around the object, where emergency planning is previously made and where there is preparedness for urgent protective actions on the basis of the results of environmental control.
- *Long-term protective action zone* - a predefined area around the object which is remote for a considerable distance from object. In this area, preparations are made in advance for the effective implementation of protective actions to limit doses of long-term exposure to radioactive fallout and to consumption of contaminated food.

Table 5.3-2 Recommended dimensions of emergency planning zones

Category of facility	Preventive protective action zone	Urgent protective action zone	Long-term protective action zone
Category I	3-5 km	10-25 km	50-100 km
Category II (longer distances refer to more dangerous facilities)	on-site area	0.5-1 km	5-10 km
	on-site area	1.5-2 km	15-20 km
Category III	on-site area	not required	not required

5.4. Participating Organizations (Enterprise, Government (central and local), Non-Government, and International Partnership)

Close cooperation at three levels is implemented for effective response in case of emergency: 1) enterprise level; 2) territorial/local level; and 3) state/central level. The coordination of actions of central and local executive authorities carried out by the Interdepartmental State Commission on Emergency Management of the Ministry of Internal Affairs.

- **The enterprise level**

This level includes enterprises engaged in activities related to the use of nuclear energy, regardless of ownership and departmental affiliation. Such enterprises are responsible for emergency planning and response to radiation accidents on a site, namely for the:

- establishment and maintenance of reserves of material and financial resources for emergency response;
- implementation of urgent measures to localize and to reduce the consequences of accidents;
- protection of personnel and public from the consequences of accidents;
- conduction of initial radiation monitoring;
- establishment of a monitoring system, alert system, communication system and support of these systems in case of radiation accidents;
- personnel training on methods of protection and response to a radiation accident, and so on.

■ **Territorial/local level**

Local executive authorities are responsible for emergency planning and response to radiation accidents in the relevant territory, namely for:

- helping enterprises where a radiation accident has happened;
- mobilization of material and technical resources of enterprises, regardless of their ownership and departmental affiliation, during emergency response;
- participation in the forming teams of rapid response to radiation accidents;
- public protection;
- development of territorial plans of response to radiation accidents.

■ **State/central level.**

Government of the Republic of Kazakhstan and the central executive authorities are responsible for emergency planning and response to radiation emergencies at the national level, namely for:

- support of local executive authorities in case of insufficiency of forces and means at the local level;
- implementation of long-term protective measures;
- international cooperation.

Almost all ministries and state departments of the Republic of Kazakhstan are involved in the state system of response to radiation accidents. Their main responsibilities include the implementation of measures for prevention of and response to radiation accidents at their subordinate enterprises. Other important responsibilities of key ministries and departments are listed below.

Thus, the Committee for Emergency Situations of the Ministry of Internal Affairs forms a national policy in the field of management of emergency (natural and man-made), including radiation accidents. The Committee also manages services of monitoring, control and forecasting of the situation, the Republican automated information system for emergency situations, and national expertise in emergencies.

Other departments of the Ministry of Internal Affairs are responsible for the maintenance of public order, protection of material and cultural values during radiation accident, and isolation zones of radiation accidents.

The Atomic and Energy Supervision and Control Committee of the Ministry of Energy is the department carrying out the regulatory, control and realizable functions in the field of nuclear energy. The Committee provides: 1) national supervision and control over nuclear and radiation safety, and nuclear security; 2) licensing activities concerned with use of nuclear energy; 3) control of emergency planning; 4) exchange of operational reports about radiation accidents and incidents with

specialized international agencies and the supervisory authorities of other states; 5) participation in international cooperation in the field of emergency planning and response to radiation emergencies, and organizations of training of specialists in the specialized international courses.

Other departments of the Ministry of Energy also provide: 1) analysis and assessment of risks of harm to human life, human health and environment in the field of atomic energy; 2) environmental impact assessment of projects and environmental monitoring of enterprises; 3) guidance to the process of radiation accidents management; 4) implementation of operational control and precision measurements of radioactive and chemical contamination caused by accidents; control over the collection, removal and disposal of radioactive waste.

Ministry of Foreign Affairs 1) promotes the development of international cooperation in the field of emergency planning and response to radiation emergencies, mutual assistance in case of accidents, catastrophes; and provides 2) notification to foreign countries about ongoing activities on radiation emergency management in the Republic of Kazakhstan, and also about threat of transboundary impact from the territory of the Republic of Kazakhstan; and 3) assistance to rescuers in rapid obtaining entry/exit visas, assistance in delivery of humanitarian supplies into areas of radiation accident.

5.5. Concept of Operation

5.5.1 Mitigation and Prevention

Prevention of emergency situations and mitigation of their consequences at all stages of the life cycle of the radioactive/hazardous object are provided through consecutive implementation of organizational and technical measures which include:

- selection of site which is suitable for radioactive/hazardous object;
- establishment of the controlled access area around such object;
- classification of structures, systems and components of object, including software for instrumentation and control systems, based on their functions and their impact on safety;
- development of project of object based on a conservative approach using the properties of inherent safety; and based on application of systems influenced on safety which are built on the principles of reservation, independence and diversity, and single failure;
- personnel recruitment and organization of work with personnel for actions in normal and emergency conditions, forming a safety culture at the level of enterprises, managers and executives;
- support of systems which are important to safety in good condition by performing a necessary maintenance and replacement of outdated equipment;
- timely diagnosis of defects and detection of deviations from normal operation, taking measures to eliminate them;
- organization of efficient system to document the results of operation and control;
- development and implementation of measures to manage accidents and mitigate the consequences of accidents which could not be prevented;
- development and implementation of measures to protect the localizing safety systems from destruction during beyond design basis accidents and to maintain their functionality;
- development and consecutive implementation of emergency plans for protection of site personnel and public outside;

- development and consecutive implementation of quality assurance programs for all kinds of work on the stages of the life cycle.

5.5.2 Emergency Preparedness

The central and local executive authorities should develop their plans to respond to radiation emergencies taking into consideration specifics of core activities, regional and local characteristics. Enterprises engaged in the activities concerned with use of nuclear energy should prepare:

- list of potential radiological accidents with a forecast of their consequences and forecast of radiological situation, approved by authorized state body;
- criteria for operational decision-making in case of radiological accident, and the intervention levels, approved by authorized state body;
- action plan for protection of personnel and public from radiological accident and its consequences, approved by local authorities and authorized state bodies engaged in national governance, supervision and control in the field of radiation safety;
- means for warning and eliminating the consequences of the radiological accident;
- medical supplies for prophylaxis of radiation injuries and means of medical aid to victims of radiological accidents;
- rescue formations created from among staff.

5.5.3 Emergency Response

Enterprises, where radiation accidents have occurred, are responsible for taking measures to protect personnel and public, accident localization and elimination of consequences, as well as timely notification to central and local executive authorities. In the case of a radiological accident, enterprises should:

- notify to central and local executive authorities;
- take measures to provide medical assistance to victims of radiation accidents;
- take measures to localize contamination and prevent the spread of radioactive substances into environment;
- analyze and prepare a forecast of radiation accident evolution and changes in radiation situation during radiation accident;
- take measures to normalize the radiation situation on the territory of the enterprise;
- take measures to assess individual doses to workers and public.

5.5.4 Emergency Rehabilitation and Restoration

Enterprises are required to plan and carry out at its own expense all necessary set of measures to eliminate the consequences of radiological accidents. Rehabilitation and restoration measures include:

- assessment of the composition and basic forms of radionuclides in contamination;
- consideration of the properties of surfaces of areas and objects;
- assessment of supposed character of fixing of radioactive contamination on various surfaces;
- prioritization of work to clean-up contamination at various objects (sites), depending on their influence on formation of radiation situation;
- choice and implementation of the most effective and real way of clean-up of radioactive contamination of objects on the basis of available forces and means.

Methods of clean-up of radioactive contamination may be the following (alone or in combination):

- collection and localization of high-level radioactive materials;
- ploughing-up the soil;
- shielding by backfilling with sand, gravel or by concrete coating;
- binding radioactive contamination by film-forming composition;
- cutting crown with subsequent collection and disposal (for terrain covered by woods and/or bushes).

5.6. Related Activities

5.6.1 Human Capacity Building (e.g. training, workshops, drills, and exercises)

5.6.1.1 Education of public and persons involved in response

Education of public to methods of radiation protection is carried out by local executive authorities, territorial authorities of Committee for Emergency Situations and training centers of enterprises (engaged in activities related to use of atomic energy) through studies, trainings at the place of work, study and life, and special drills.

Specialized emergency teams are established at the enterprises of categories I and II. These teams may be involved in activities for prevention of radiological accidents and elimination of their effects on other objects and territories.

5.6.1.2 Organization and conducting exercises

Drills and trainings are conducted according to the plans approved by the respective heads of ministries, local executive authorities and enterprises. The three types of exercises include:

Comprehensive drills are one of the highest forms of training managers, governing bodies, specialized staff emergency services and units, personnel and public living near radiation-hazardous facilities. These exercises aimed at prevention of radiological accidents and elimination of consequences. They are held at least once every three years.

Table-top exercises are a form of joint training between management staff and commanders of specialized rescue services and units to response to radiological accident. They are organized and conducted at least once a year.

Facility trainings are carried out in enterprises engaged in activities on the use of atomic energy. These trainings provide a deep, comprehensive and differentiated preparation of these enterprises to respond to radiological emergencies. The facility trainings are conducted at least twice a year (frequency of the trainings is determined by the enterprise).

5.6.2 Communication and Public Relation (e.g. information passage, mass media, and social media)

Information about threat or occurrence of radiation accident is transmitted:

- from enterprises to territorial bodies of Committee for Emergency Situations, and to departmental territorial bodies;
- from departmental territorial bodies to the central apparatus of relevant departments;
- from territorial bodies of Committee for Emergency Situations to central apparatus of the Committee (State Institution "Center for Crisis Management"), to local executive authorities, to Atomic and Energy Supervision and Control Committee of the Ministry of Energy;

- from Atomic and Energy Supervision and Control Committee to IAEA.

Information on radiation accident should be transmitted through intercomputer communication channels, and in case of absence or failure - through telegraph, telephone, satellite, radio channels of communication.

The central and local executive authorities shall take a decision on informing public through the media or alert systems, if necessary.

III-6. Malaysia

6.1. Policy

6.2. Regulatory Framework and Legislation

6.3. Emergency Classes and Condition

6.4. Participating Organizations (Enterprise, Government (central and local), Non-Government, and International Partnership)

6.5. Concept of Operation

- 6.5.1. Mitigation and Prevention
- 6.5.2. Emergency Preparedness
- 6.5.3. Emergency Response
- 6.5.4. Emergency Rehabilitation and Restoration

6.6. Related Activities

- 6.6.1 Human Capacity Building (e.g. training, workshops, drills, and exercises)
- 6.6.2. Communication and Public Relation
  (e.g. information passage , mass media, and social media)

III-6. Malaysia

6.1. Policy

The National Security Council Directive No. 20 (Revised) - Policy and Mechanism on National Disaster and Relief Management, is the main guideline for disaster management in Malaysia. It is complemented by other legislations and guidelines that form a disaster mitigation framework. The Directive describes the management mechanisms according to the level and complexity of disaster and determines the roles and responsibilities of various agencies to ensure effective coordination and mobilization of resources when handling disasters.

The Directive No 20 (Revised) defines disaster as an event that causes disruption to the activities of public and state affairs, involving loss of life, property damage, economic losses and environmental damage that goes beyond the ability of communities to cope and require extensive mobilization of resources ;

For nuclear or radiological emergency that is not considered disaster, where the emergency is involved a small number of victims and its impact only to the victims, not patterned have a chance to spread, and usually can be controlled within a short time, the emergency will be managed by agencies concerned with using resources or facilities minimal at the local level.

6.2. Regulatory Framework and Legislation

In 2015, The Government of Malaysia had established a new agency called, National Disaster Management Agency (NADMA) to manage and coodinate all disasters in Malaysia under the Directive No. 20 (Revised 2012). A law directly related with nuclear and radiological emergency in Malaysia is the Atomic Energy Licensing Act 1984 (Act 304) which is under the purview of the Atomic Energy Licensing Board (AELB). These two basic documents are used for management of nuclear and radiological emergencies in Malaysia. NADMA which is under the Prime Minister's Department, is a main lead agency responsible for coodinating the whole operation of nuclear and radiological emergencies, if the emergency is declared as a disaster under the Directive No. 20 (Revised 2012) .

Under the Directive No. 20 (Revised 2012), the AELB is a Lead Technical Agency for nuclear and radiological emergency whereas Malaysian Nuclear Agency, which is a technical support organisation, will be called upon if there is a need for technical assistance in handling the emergency. The functions and responsibilities of other agencies involved during the emergency such as Malaysian Royal Armed Forces, Malaysia Royal Police, Fire and Rescue Department, Ministry of Health, Civil Defence Department, etc. are also clearly outlined in the Directive No. 20 (Revised 2012).

The Act 304 and regulations made under the Act stipulate responsibility for developing and maintaining emergency plans and preparedness, and taking response actions in a nuclear or radiological emergency in Malaysia. According to the Act, the operator or licensee is responsible for developing and maintaining the emergency plan and preparedness at their premises.

At the international level, Malaysia is a signatory of the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in Case of a Nuclear Accident or Radiological

Emergency.

6.3. Emergency Classes and Condition

In order to manage disaster more effectively the Disaster Management Committee is established at Federal, State and District levels as below:

- Federal Disaster Management Committee (FDMC);
- State Disaster Management Committee (SDMC); and
- District Disaster Management Committee (DDMC)

Members of the committee are from various agencies, including AELB, if the disaster is related to nuclear or radiological accidents. Each agency has responsibilities for different aspects while maintaining their core responsibilities.

Disaster management should be handled according to the three levels as follows:

(i) Disaster Management Level I (District Level)

It is a management and control of disaster events that occur in an area and it can be dealt with effectively by the agencies involved in the management of disasters at district level either without external assistance or with limited external assistance.

Disaster Management Level 1 is a local incident in specific district which is controllable and has no potential to spread beyond the district area. Therefore, the DDMC Level 1 is headed by Malaysian Civil Defence Force. District committee ensures coordinated actions, including provision of available assets and human resources. The State provides assistance to the District such as financial aid, additional assets and human resources as needed. DDMC Chairman together with the Disaster Operations Commander responsible for making judgments about the disasters that occurred to determine the location and capacity of disaster management agencies at district level in handling the disaster. After the initial assessment made and actions taken but it appears that disaster events cannot be handled at the district level, DDMC Chairman shall inform the SDMC to get help immediately. Disaster management machinery at the district level should continue operate even after receiving help from the State and Federal level.

(ii) Disaster Management Level 2 (State Level)

It is a management and control of disaster events that occurs at more than one district in the same State which requires mobilization of resources at the State level with the limited assistance of the Federal level. Disaster Management Level 2 is a more serious incident covering a wider area with the potential of spreading out. In Disaster Management Level 2, State Disaster Management Committee (SDMC) uses and mobilizing resources under its control to help disaster management at district level or take over the overall disaster management at district level.

The State Police Chief and State Fire and Rescue Director is responsible as Commander and Deputy Commander of Operations Disaster respectively when disaster control was taken over as a whole by the State Level. The Malaysian Civil Defence Force, as the Chairman of SDMC, is responsible to move machinery in the state-level disaster management to ensure that all actions are carried out in orderly, efficient and coordinated. Chairman of SDMC, on the advice of the Disaster Operations

Commander, responsible for determining the ability of agencies in handling the disaster and if help is needed, SDMC shall be informed immediately by the Chairman SDMC.

(iii) Disaster Management Level 3 (Federal Level)

It is a management and control of disaster that occurs at more than one state or complex in nature and affecting a wide area which requires coordination and mobilization of resources at the Federal level or with foreign assistance. In Disaster Management Level 3, FDMC will utilize and mobilize resources under its control to help disaster management incident at State and District or to take the overall disaster management at state level.

The Director of the Internal Security and Public Order, Royal Malaysia Police (RMP) and Deputy Director of Operations, Fire and Rescue Department responsible as Commander and Deputy Commander of Disaster Operation respectively when overall disaster management is taken over by Federal Level. NADMA is responsible to ensure that implementation of all policies on disaster management, search and rescue operation, and relief to victims are in a coordinated, efficient and effective. After assessment and found that the management of disasters in the state does not have adequate capacity or specific expertise to handle an event of such disasters, FDMC through NADMA can coordinate the application or accept the assistance offered from foreign countries or international organizations.

When any disaster happens, the committee will be called upon and whether it needs federal, state or district level of intervention depends on the conditions of the disaster. The NADMA is a secretariat to the Disaster Operation Control Centre (DOCC), the police force will be an 'On-scene Commander' whiles the Fire and Rescue Department will be a Deputy 'On Scene Commander'. AELB acts as a lead technical agency for nuclear and radiological incident and Malaysian Nuclear Agency as a technical support organisation will help the authorities in terms of technical expertise if needed. Figure 7.3-1 shows the national disaster management structure, including nuclear and radiological emergency, as stipulated in the Directive No. 20 (Revised)

The level of disaster management is dependent on the assessment of Disaster Management Committee at the District, State or Federal level. The assessment shall be based on the following elements:

- complexity and magnitude;
- destruction and damage;
- ability of financial resources , manpower and equipment;
- expertise;
- assistance; and
- response time period.

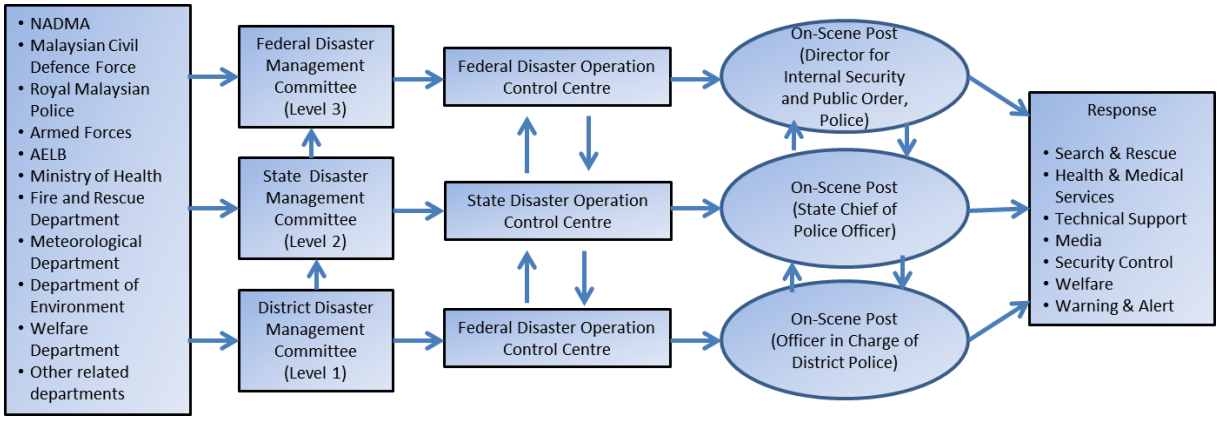


Figure 6.3-1: National disaster management structure, including nuclear and radiological emergency, as stipulated in the Directive No. 20 (Revised)

6.4. Participating Organizations (Enterprise, Government (central and local), Non-Government, and International Partnership)

In case of nuclear or radiological emergency, the authority and responsibility for taking decisions to apply intervention measures and for mitigating the event consequences within the facility site or on-site are fully given to the operator or licensee. The operator shall ensure that there are clear allocations of responsibilities, authorities and arrangements for coordination in all phases of the response. These arrangements include ensuring that the radiation protection officer has the authority and responsibility to direct the entire on-site response, to notify the appropriate emergency organisations, to take immediate on-site mitigation actions and to re-establish the site's normal operation.

Off-site nuclear or radiological emergency will be managed by the Atomic Energy Licensing Board if the incident is not classified as disaster. If the nuclear or radiological emergency is declared as disaster, the NADMA will take over the management and the action to be taken is as explain in Paragraph 7.3.

6.5. Concept of Operation

6.5.1. Mitigation and Prevention

All government agencies, statutory bodies, private parties and volunteer involved in disaster management should, in alone or in cooperation -

- preparing and updating policies, action plans and guidelines respectively to prevent and reduce the risk of disasters;
- implement development programs for the prevention or reduce the risk of disasters;
- designing and implementing measures to reduce disaster risk including efforts on research and development in the management of disasters;
- to enforce the laws and regulations of each of relevant agencies and effective governance practices;
- share information on the disaster mitigation and prevention, and
- carry out such other efforts on mitigation and prevention from time to time.

6.5.2. Emergency Preparedness

The goal of emergency preparedness is to ensure that an adequate capability is in place within the operating organization and at local, regional and national levels and, where appropriate, at the international level, for an effective response in a nuclear or radiological emergency. This capability relates to an integrated set of infrastructural elements that include, but are not limited to: authority and responsibilities; organization and staffing; coordination; plans and procedures; tools, equipment and facilities; training, drills and exercises; and a management system.

Under the Subsidiary Regulation of the Act 304, the Atomic Energy Licensing (Basic Safety Radiation Protection) Regulations 2010, it is a requirement for the Licensee of the facility to have an Emergency Plan for radiological or nuclear emergency. This plan shall be submitted and approved by the AELB. It is also stated that this emergency plan shall be tested yearly and once in every five years with the attendance of the regulator.

On the National level AELB is responsible in developing a National Radiological Emergency Plan which is currently under the process of adoption by the National Disaster Management Agency (NADMA). This plan includes roles and responsibility of every related agencies and departments.

In strengthening the capability of managing any nuclear or radiological emergency, the AELB have built a National Radiological Emergency Centre (NREC) which can be reached on emergency Hotline at 1-800-88-7999. It is operated 24 hours per day and seven (7) days per week. The AELB has also a Mobile Operation Unit (specially modified double deck bus) which has a function as a Mobile Off-site Centre in case of radiological or nuclear emergency happen. Beside that the AELB is also equipped with a Mobile Radiation Monitoring Laboratory for environment radiation monitoring.

Nuclear or radiological emergency drill and exercise are held yearly to strengthen emergency preparedness on the national level with cooperation of other agencies such as HAZMAT (Fire and Rescue Department), Malaysian Royal Armed Forces, Malaysian Royal Police, NADMA, Ministry of Health etc.

Proper resource allocation is very important so that the emergency plan can be implemented effectively. The necessary resources include the following:

- Budget - it is important to ensure that the proper equipment and necessary infrastructure are made available to deal with an emergency;
- Staffing - response teams should always have and maintain the adequate ‘strength’, especially in the ‘key’ positions in the event of an emergency and
- Documentation - well-documented, proper and a continuously updated emergency plans and procedures for anticipated accidents that might occur at the site are ready and easily available.

6.5.3. Emergency Response

During an emergency National Radiological Emergency Centre (NREC) AELB will be activated and operates 24 hours. This centre will become a coordination and communication centre and any mitigation decision will be analysed here. Besides that AELB has also developed a Nuclear Emergency Team (NET) which will respond to any nuclear or radiological emergency. This team is operated 24 hours and can be contacted anytime. Figure 7.5-1 shows the response mechanism of Nuclear Emergency Team (NET) of AELB.

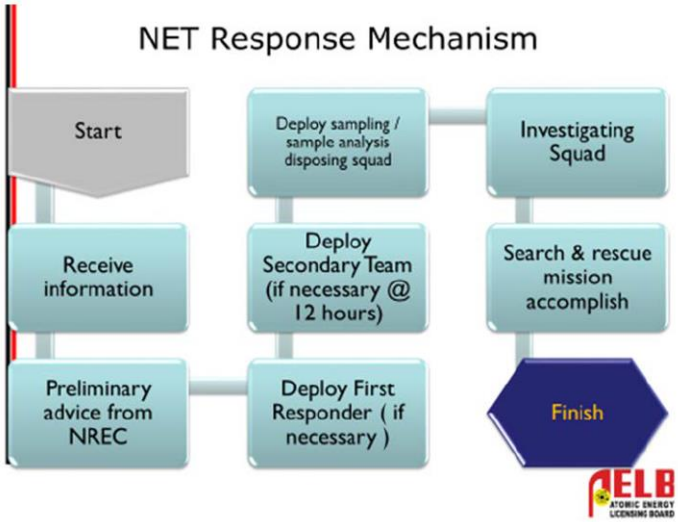


Figure 6.5-1: Nuclear Emergency Team (NET) response mechanism

If the emergency becomes disaster, the action should be taken as stated in Para 7-3.

6.5.4. Emergency Rehabilitation and Restoration

There is no nuclear power plant in Malaysia. However, Malaysia has a 2 MW research reactor named Reaktor TRIGA PUSPATI which is situated at Malaysian Nuclear Agency. Therefore, in term of hazard assessment, in case of nuclear or radiological emergency, Malaysian only involves in Category III, IV and V which do not involves rehabilitation and restoration (see Figure 7.5-2).

Category	Criteria
1	Reactor with power levels equal to or greater than 100MW
2	Reactor with power levels equal to or greater than 2MW and less than 100MW
3	Reactor with power levels of less or equal to 2MW Irradiation Facility
4	Mobile sources like NDT sources Satellite with dangerous sources Scrap metal processing facilities National border crossing Facilities with fixed gauges with dangerous sources
5	Products with a significant likelihood of becoming contaminated as a result of events at facilities in Hazard Category 1 or 2

Figure 6.5.-2 Category of nuclear and radiological Emergency

However, In case of disaster, rehabilitation and restoration should be implemented immediately after the event occurred. Each Government agencies, statutory bodies, private and voluntary bodies involved, responsible for implementing damage assessment and restoration and reconstruction of public infrastructure under their respective jurisdiction

6.6. Related Activities

6.6.1. Human Capacity Building (e.g. training, workshops, drills, and exercises)

Training for personnel who are involved with radiological emergency or accident is essential and should be done regularly. Therefore, in Malaysia any person who deals with radioactive or nuclear materials or with irradiation apparatus shall undergo a radiation protection training course which includes handling of radiological accidents or emergencies. Beside this training course, all radiation workers shall also attend training course before can be approved as radiation workers.

Training courses and workshops for first responder agencies such as police and fire brigade personnel are also conducted regularly. Besides local training courses, the government also sends personnel to attend workshops which are conducted by the International Atomic Energy Agency and Asian Nuclear Safety Network (ANSN). The training course is also conducted through bilateral arrangement within the Government of Malaysia and other countries such as the United of America and Australia.

Exercises are essential. At national-level, the exercises are conducted by AELB and NADMA which include field exercise on research reactors, transport accident exercises, Malaysia railway service exercise for dirty bombs, missing source exercise, contamination emergency exercise, etc. Drills and exercises cover a full range of response actions, and involve the AELB and NADMA teams and participants from states and local governments, other federal agencies and foreign organisations, where appropriate.

The lessons learned from these exercises help the agency to focus its mission and objectives, to streamline its radiological emergency response programme, to modify operational procedures and to rectify response weaknesses

6.6.2. Communication and Public Relation (e.g. information passage , mass media, and social media)

The arrangement of public communication and relation during the emergency depends on situation whether the incident happen on-site or off-site. In case of on-site incident, the communication is only within the licensee premises and the Atomic Energy Licensing Board.

However, if the incident happens off-site the premises and it is not classified as a disaster, then the regulatory body, i.e. AELB will take necessary action to manage the incident. In this case, during an emergency, if public communication is needed, it will be coordinated between Multimedia and Communication Section of AELB and Corporate Communication Unit of Ministry of Science Technology and Innovation (MOSTI). AELB will mainly be responsible of feeding the technical information needed and any press conference or press release will be given by the Minister of MOSTI through the local television/radio station and newspaper. Moreover, the public is also can communicate with AELB through official website www.aelb.gov.my where any questions or report about misuse of radioactive or nuclear material can be made. AELB can also be contacted through social media such as Facebook and Instagram.

In case of nuclear or radiological that is considered disaster; early warnings are disseminated through sirens, short messaging systems, telephone, telefax, webpage, mass media broadcasting system and public announcements. Malaysia uses Information and Communication Technology (ICT) to promote awareness and disseminate early warnings to the public. A separate system

known as the Government Integrated Radio Network (GIRN) provides radio communication between responders during emergencies or disasters. Disaster Reporting is very efficient via the Malaysia Emergency Response System (MERS) hotline, "999". The potential of using mass media as an effective platform to disseminate disaster preparedness information is fully capitalised by the Department of Information, which is under the Ministry of Communication and Multimedia.

In the event of disaster emergency the Media Management Centre will be established immediately and operated by the Department of Information and placed in the specified zone. The Media Management Centre is a place where the officers and staff of the mass media can carry out related tasks to coverage of disasters that occur. It shall be equipped with briefing room, media conference room, television and radio. Officials from the Department should also coordinate all coverage and broadcasting of news about the disaster that happened to people. Disaster Operation Commander shall ensure that the representatives of the mass media are in the specified zone only. Only essential facts can be announced to the public through the media to avoid unwanted confusion. Only the Chairman of Disaster Management Committee, Lead Agencies, Disaster Operations Commander or an officer authorized by the Chairman of the Disaster Management Committee can issue a statement to the media if necessary.

6.7. References

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III-7. Mongolia

7.1. Policy

7.2. Regulatory Framework and Legislation

7.3. Emergency Classes and Condition

7.4. Participating Organizations (Enterprise, Government (central and local), Non-Government, and International Partnership)

7.5. Concept of Operation

- 7.5.1. Mitigation and Prevention
- 7.5.2. Emergency Preparedness
- 7.5.3. Emergency Response
- 7.5.4. Emergency Rehabilitation and Restoration

7.6. Related Activities

- 7.6.1 Human Capacity Building (e.g. training, workshops, drills, and exercises)
- 7.6.2. Communication and Public Relation
  (e.g. information passage , mass media, and social media)

III-7. Mongolia

7.1. Policy

State Policy of Mongolia on the Exploitation of Radioactive Minerals and Nuclear Energy has been approved by the Parliament Resolution No.45dated 25 June 2009. Relevant paragraphs related to the emergency preparedness and response are as follows:

> *5.6.To develop and implement national emergency response program for possible nuclear and radiation accidents.*

Action plan for Implementation of the State Policy had been approved by the Government resolution no.222 dated 22 July, 2009 and the relevant paragraphs are:

7.4. Develop a national plan for potential nuclear and radiation emergencies and provide professional bodies with radiation control devices

7.5. Improve the inspection of the illegal transport of nuclear materials and radiation generators across the national border.

In February 2016, Mongolian parliament approved **"Mongolian Sustainable development concept 2030"** (Parliament Resolution no.19, 02 February 2016) and according to this document following strategic objectives were stated in the field of uses of nuclear energy:

- *Phase 1. (2016-2020): to increase renewable energies to 20% of total energy, providing preparation work of using nuclear energy.*
- *Phase 2. (2021-2025): to increase renewable energies to 25% of total energy, complete preparation work of using nuclear energy.*
- *Phase 3. (2025-2030) to increase renewable energies to 30% of total energy, start using nuclear energy.*

Currently, Mongolia has no nuclear facilities and the Nuclear energy law requires a facility level emergency response plan from the licensee as a part of application documents for license.

7.2. Regulatory Framework and Legislation

Mongolia's International legal instruments related to the EPR are follows:

- Agreement between IAEA and Government of Mongolia on Methods under the Treaty on the Non-proliferation of Nuclear Weapons /its Protocol, 1972
- Additional Protocol to Agreement between IAEA and Government of Mongolia on Methods under the Treaty on the Non-proliferation of Nuclear Weapons, 2003
- Convention on the Physical Protection of Nuclear Material, 1985
- Convention on Early Notification of a Nuclear Accident, 1987
- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, 1987.

Mongolia has joined to IAEA Incident and traffic database in 2015 and approved IAEA Integrated Nuclear Security Support Plan, 2015.

<u>Relevant national legislation are:</u>

- Law on nuclear energy, 2008
- Law on nuclear weapon free status, 2000

- Law on disaster protection, 2003

Relevant provisions of Nuclear Energy law, 2009 are as follows:

Article 45. Prevention from nuclear and radiation accident

- *45.1. The license holder shall have the program for emergency prevention, mitigation & response plan for nuclear/radiation accident, and it is responsible for all the recovery expenses in the case of nuclear/radiological accident.*
- *45.2. It shall be organize activities of investigation and identification of accident causes, recovery activities in cooperation with the responsible government authorities under supervision of the State Emergency Commission.*
- *45.3. The Government shall be responsible for expenses related to elimination of harms of nuclear and radiation accident affecting broad masses.*

Article 46. Compensation of damage caused by nuclear and radiation accident

Law on disaster protection:

Article 17. Disaster Response Team (DRT)

Designate non stuffing teams responsible for prevention, rescue and recovery of different disasters shall be leaded by related governmental authorities (13 teams)

- *17.1.8. State emergency response team for nuclear/radiological accident*

Government Decision 81, 2015 updated the list of DRT. Leading Agency for State emergency response team for Nuclear & radiological accident (NEA) has been replaced by GASI (2015, March 09).

National regulations and standards:

- Radiation Safety Standard (2015) based on IAEA GS-R Part 3
- Basic Regulation on Radiation Protection and Safety based on IAEA GSR Part 3 (2016)
- Transport Regulation for Radioactive Sources (1987)
- Set of Radiation Protection National Standards, 2006
- Basic Radiation Safety Standard, July 28, 2015
- Regulation on Security of Radiation Sources, Nov 4, 2015
- Regulation on Radioactive Waste Management from Mining and Milling of ore, Nov 4, 2015
- Radiation Safety Procedures for Uranium Exploration, Nov 4, 2015
- Rule for Radiation Control Unit within the Radiation User Organizations, July 28, 2015
- Technical regulation for acid in situ leach uranium mining (2015)
- Mongolian Integrated nuclear security support plan (2015)

Development of new safety requirements and regulatory guidance documents are follows:

- Drafted in 2016: Radiation safety regulation for uranium mining and milling (in assistance of EU)
- Drafted in 2016: Guidance document for EPR for uranium mining and milling (under the EU project)
- Drafted in 2016: Regulation for the Safe Transport of Radioactive Material based on IAEA SSR-6, 2012

Regulatory body

Government of Mongolia restructured the Nuclear Energy Commission (NEC) replaced on the Nuclear Energy Agency by the Law amendment and the Government decision 2015. According to the amendment of the law and Government decision, the Regulatory body has been restructured and transferred from NEA into the General Agency for Specialized Inspection /GASI/ as Nuclear and Radiation Inspection Department.

Following the Amendment of the Nuclear Energy Law (February 13, 2015) and the Government Decision:

- **Executive Office** of the **NEC** has been established.
- **Regulatory Department** of NEA has been restructured under the **GASI** (Independent Inspection Agency)
- **Mining Licensing Unit** of the NEA has been restructured under the **Mineral Resources Authority** of the Ministry of Mining.

NEC is responsible for the coordination of peaceful uses of radioactive minerals and nuclear energy, research and development of nuclear technology and nuclear and radiation safety. It was established in 1962. The Chairman of the Nuclear Energy Commission of Mongolia is The Prime Minister.

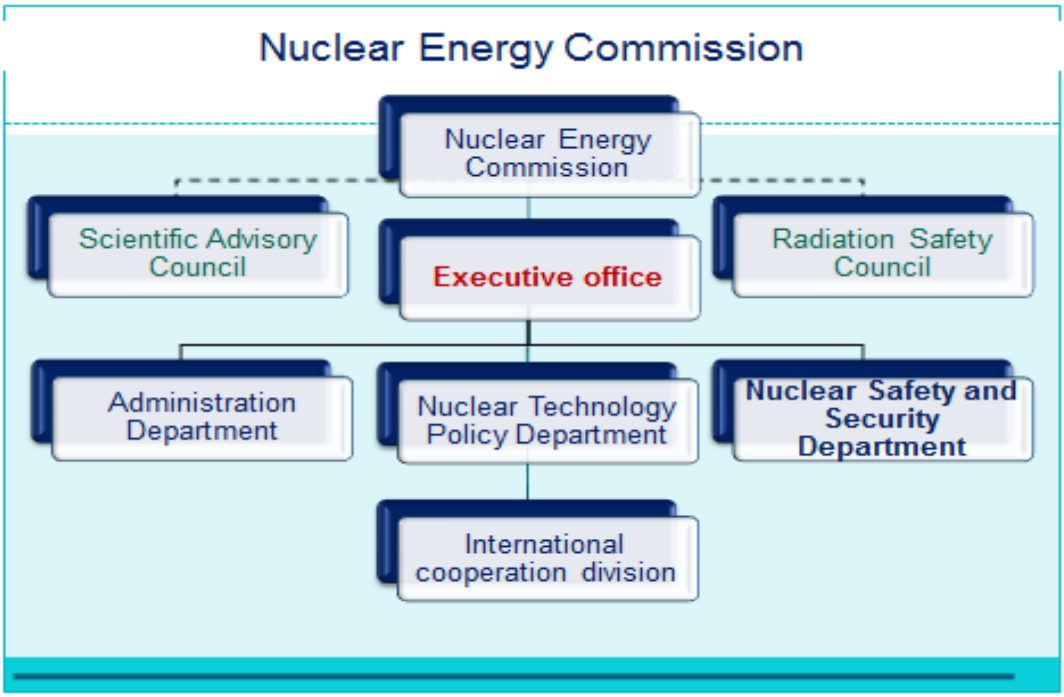
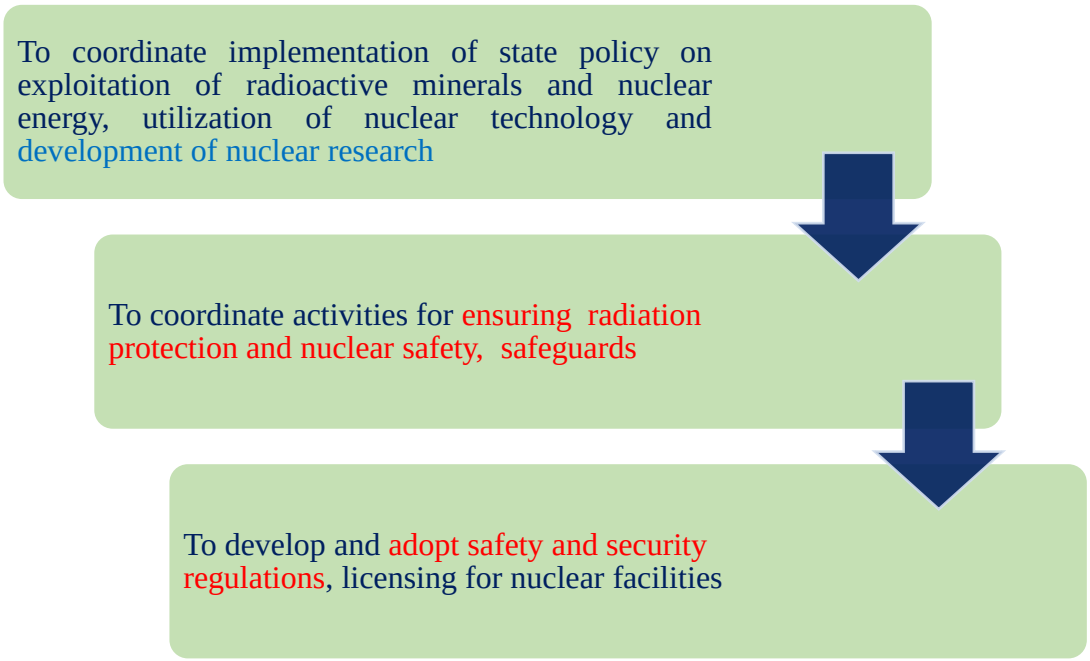


Figure 7.2-1: Organizational chart of the Nuclear Energy Commission.

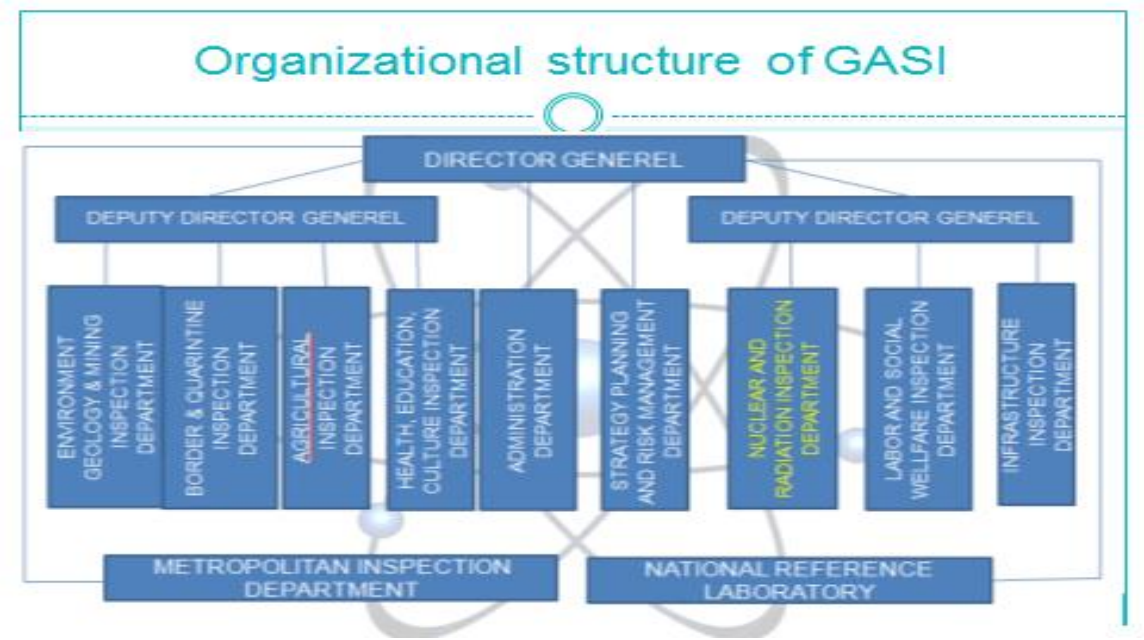
Main duties of the NEC as follows:



General Agency for Specialized Inspection (GASI) is independent inspection agency under Deputy Prime Minister and it has 7 inspection departments and National Reference Laboratory as follows:

- Infrastructure inspection department
- Social and labor welfare inspection department
- Health, education, culture and science inspection department
- Environment, tourism, geology and mining inspection department
- Food, agriculture, industry and public service inspection department
- **Nuclear and Radiation Inspection Department (10 inspectors)**
- Border quarantine inspection department
- National reference laboratory for food safety /includes **radiation control laboratory (9 staff)**
- Administration department

GASI has 21 branches in the Provinces but there is no radiation inspectors in the local branches except Metropolitan branch. The Metropolitan Inspection Branch has **Nuclear and Radiation Inspection Division** (8 inspectors).



Environmental monitoring

Environmental monitoring is coordinated by the Metropolitan Specialized Inspection Department and carried out by the environmental monitoring network of Ministry of Environment and Green Development of Mongolia.

Air fallout samples for gross beta measurement are collected in 24 local stations and 34 meteorological stations, ambient gamma dose rates are measured twice a day using portable dose rate meters. The data of the measurement transmitted to the meteorological center in Ulaanbaatar twice a week. In the case of nuclear accident from outside the ambient gamma dose rate measurement frequency changed as hourly.

It has great importance to develop online environmental monitoring network for Mongolia considering its geographical locations between 2 nuclear countries for emergency response purposes. Former NEA has developed a Project Proposal on Establishment of an internationally compatible environmental radiation network for contribution of international activities in analyzing and managing the global impact of environmental radiation. Submitted the proposal to the Government for Approval.

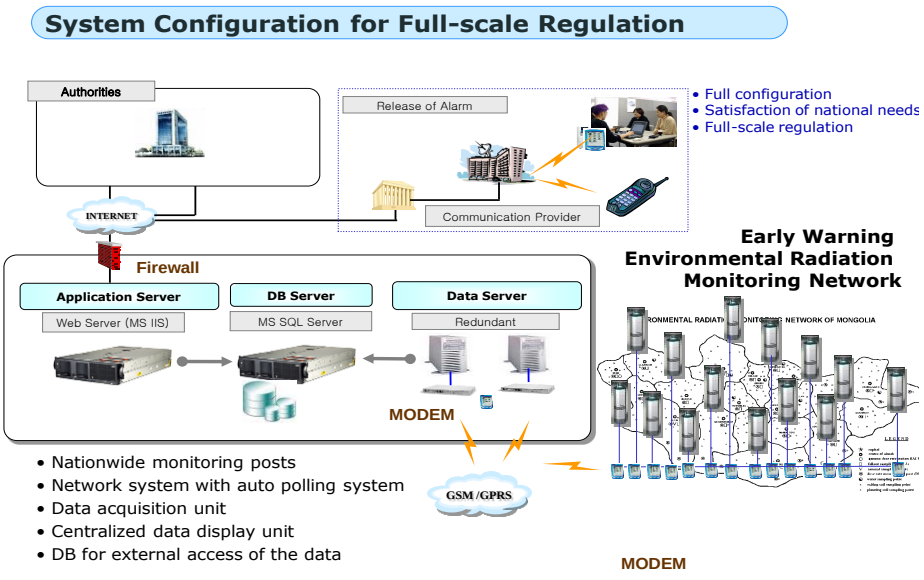


Figure 7.2-2: Early warning system which proposed under the project

Border control

Since 2008, Mongolia has started to install and operate radiation portal monitoring equipment supported by USA under the project UNSCR 1540 on strengthening of technical capabilities for export and import controls over nuclear and radioactive material. There are 80 radiation portal monitors were installed at 15 border crossing ports as of 2017.

Cooperation with US-DOE Global Threat Reduction Initiative (GTRI)

Mongolia received technical assistance from **US-DOE Global Threat Reduction Initiative (GTRI)** project for upgrading of Physical Protection of Radiation Sources stored at Isotope Center and other potential source users like Radiotherapy hospital and Nuclear Research Centre.

7.3. Emergency Classes and Condition

Currently, there is no specific document related to an Emergency Classes and Condition in Mongolia. Threat categorization system is not in place, however actions are under way to make improvements.

7.4. Participating Organizations (Enterprise, Government (central and local), Non-Government, and International Partnership)

Based on the law of Mongolia on Disaster Protection, which was passed in June 2003, the National Emergency Management Agency (NEMA) was established with the duty to conduct nationwide activities for disaster protection. All the 21 provinces and the capital city have a NEMA emergency management divisions and departments.

Safety and response procedures for first responders from NEMA for radiological accident has been approved by NEMA Director General's Decision A/853, dated 26 November 2013.

Participating organizations at national level and their main responsibilities are:

- NEMA (Emergency management and Rescue)
- GASI (Investigation & Technical Advisor)
- NEC (Coordination & Technical advisor)
- National Security Authority (Investigation)
- Police Department (Investigation & Protective Measures)
- Hospital /Ambulance (Medical assistance)
- Isotope Centre of NEC (Storage, transport and securing of RAM)
- Other government institutions (technical assistance)

Needs to close cooperation of above organizations and their branches in provinces at three levels for implementation of effective response in case of emergency:

1. Facility level;
2. Local level
3. State level.

The coordination of activities of central and local executive authorities carried out by the Interdepartmental Commission on Emergency Management according to the Law on Disaster Protection.

NEC is responsible for coordination of the international assistance, if required in the case of nuclear/radiological accident.

7.5. Concept of Operation

7.5.1. Mitigation and Prevention

There are not arrangements to initiate a prompt search and to issue a warning to the public in the event of a dangerous source being lost or illicitly removed and possibly being in the public domain, however actions are under way to make improvements, however this topic has been consider under the national Plan.

The National plan consider the arrangements for mitigatory actions, however there is not a system in place.

The facility level emergency plans, procedures and guidance for the operator on mitigatory actions designed for the facility shall be revised by the regulatory body before granting a license according to the legal requirements.

7.5.2. Emergency Preparedness

All hazard disaster or emergency responses in Mongolia are coordinated by the National Emergency Management Agency /NEMA/. NEMA has contact point operating 24hours a day and 7 days/week.

Executive office of the Nuclear Energy Commission and General Agency for Specialized Inspection (GASI) play a role within a multiagency response and providing technical adviser in the case of nuclear and radiological emergency.

NEMA and NEC has memorandum understanding of cooperation on the emergency preparedness and response.

National Plan for Radiological Emergency Response which had been developed by NEMA needs for updating regarding to restructuring of the Government bodies.

The Executive office of NEC had been designated as a leading authority for developing of National Emergency Management Plan for Nuclear/Radiological emergency in cooperation with other Governmental organizations including NEMA, GASI etc. according to the Decision of State Emergency Commission's (Chaired by Deputy Prime Minister) Session dated 15 November 2016. The new National Plan should be submitted to the Government for approval in 2017/2018.

7.5.3. Emergency Response

According with the Mongolian structure upon the level of the accident, the NEC, under the supervision of the State Emergency Commission (SEC) chaired by the Deputy Prime Minister, in collaboration with NEMA or other respective professional agencies, shall make the arrangements to co-ordinate the state level of emergency response of nuclear/radiological accident.

The country does not adopt national intervention levels for taking urgent protective actions in accordance with international standard, however actions are under way to make improvements.

There is not in place arrangements for effectively making and implementing decisions on urgent protective actions to be taken off the site within the emergency zone, however actions are under way to make improvements.

7.5.4. Emergency Rehabilitation and Restoration

The License holder is responsible for all the recovery expenses in the case of nuclear/radiological

accident. The Government shall be responsible for expenses related to elimination of harms of nuclear and radiation accident affecting broad masses according to the Nuclear Energy Law.

Orphan or abandoned radiation sources should be secured and stored at Isotope office without any charge by the Law on Nuclear Energy (2008). Requirements on reporting loss of control and to encourage awareness of, and monitoring to detect, orphan sources has been described in the Nuclear Energy Law and regulations.

7.6. Related Activities

7.6.1. Human Capacity Building (e.g. training, workshops, drills, and exercises)

Training opportunities for regulatory and government staff related to the emergency response are follows:

- IAEA training program
- National training courses
- International organizations
- Bilateral cooperation with other countries
- Technical Assistance Projects

NEMA and operators are responsible for conducting a facility level emergency exercise and drills according to the Law on Disaster Protection.

Onsite emergency exercises for the organizations where potential sources used or stored have been done in Erdenet mining company, Isotope centre and Radiotherapy hospital in cooperation with NEMA and the regulatory body.

Non governmental organizations which approved by the regulatory body has providing an radiation protection training for operators and also for first responders for radiological emergency.

The regulatory and competent authorities had been organized several training event for the first responders under the above mentioned training programs during last 4 years. For example:

- Radiological Security Incident Response Training, Mongolia, June 17-21, 2013. Attended: *(31 participants from 10 organizations)*
- Mongolia participated in the Instructor Training Program on Nuclear/Radiological Emergency Preparedness and Response which held by JAEA. There are 6 instructors were trained in 2014-2016 and 3 follow up training courses were organized in Mongolia in 2014-2016.

Mongolia needs to arrange training and exercises on EPR for radioactive contamination from NPPs of other countries considering its geographical location and country specific needs.

7.6.2. Communication and Public Relation

(e.g. information passage , mass media, and social media)

There is not arrangement yet to provide warning and instructions to the different groups, however this is the authority's main duties, according with the National Emergency Plan.

There is an urgent need to strengthening of national infrastructure for emergency preparedness and response for Mongolia. Establishment of national program for emergency preparedness/response, identification of gaps and updating of national nuclear/radiological emergency response plan are the main goal for the near future.

III-8. Thailand

8.1. Policy

8.2. Regulatory Framework and Legislation

8.3. Emergency Classes and Condition

8.4. Participating Organizations (Enterprise, Government (central and local), Non-Government, and International Partnership)

8.5. Concept of Operation

- 8.5.1. Mitigation and Prevention
- 8.5.2. Emergency Preparedness
- 8.5.3. Emergency Response
- 8.5.4. Emergency Rehabilitation and Restoration

8.6. Related Activities

- 8.6.1 Human Capacity Building (e.g. training, workshops, drills, and exercises)
- 8.6.2. Communication and Public Relation
  (e.g. information passage , mass media, and social media)

III-8. Thailand

8.1. Policy

The National Nuclear and Radiological Emergency Plan is a practical infrastructure on nuclear and radiation in consistent with the National Preparedness Policy, the National Disaster Prevention and Mitigation Plan, the National Defence Plan and the National Policy on Prevention and Suppression on Terrorism. It is intended for use in the preparedness and cooperation in domestic and international levels on nuclear and radiological emergency. Being construed as a strategic plan in pursuant to roles of each relevant agency, the Plan is served as guidelines in accordance with the National Preparedness Policy.

■ **National Policy on Nuclear/Radiological Emergency Preparedness and Response**

i. All relevant parties shall undertake necessary measure to prepare for prevention, mitigation, suppression and rehabilitation of disasters, security threats and emergencies
ii. Government agencies, state enterprise, private sector organizations and the general public shall participate and cooperate in the implementations of the National Disaster Prevention and Mitigation Plan and Military Defence Plan.
iii. Relevant agencies shall develop their respective implementing plans concerning prevention, mitigation, suppression and rehabilitation of disaster, security threats and emergencies to be in accordance with and systemically linked to the National Preparedness Policy.
iv. Crisis management system shall be administered in comprehensive, unified, effective and timely manners for all circumstances.

Relevant policies and national plans

- National Preparedness Policy
- National Disaster Prevention and Mitigation Plan

8.2. Regulatory Framework and Legislation

Main laws, ministerial regulations and relevant regulations are as follows;

- The Atomic Energy for Peace Act B.E. 2504 (1961), MOST
- The Atomic Energy for Peace Act B.E. 2508 (1965) (2nd Edition), MOST
- The National Disaster Prevention and Mitigation Act B.E. 2550 (2007), Ministry of Interior
- The Labor Protection Act, B.E. 2541 (1998)
- The Public Health Act, B.E. 2535 (2002)
- The Arms Control Act, B.E. 2530 (1997), Defence Industry Department
- The Enhancement and Conservation of the National Environment Quality Act, B.E. 2535 (2002)
- The Airport Authority of Thailand Act, B.E. 2522 (1989)
- The Factory Act, B.E. 2535 (2002)
- The Hazardous Material Act, B.E.2551 (2008), Department of Industrial Works
- Other relevant legislations

8.3. Emergency Classes and Condition

The response to an emergency should begin without delay and be fully coordinated from the start. To facilitate this, a common emergency classification system should be adopted by all response organizations. The requirements suggest the following classes for facility emergencies (items 1-4) and for radiological emergencies (item 5);

8.3.1. Nuclear and radiological emergency class 1

Nuclear and radiological emergency class 1 are general emergencies at facilities in threat category I or II involving an actual, or substantial risk of, release of radioactive material or radiation exposure that warrants taking urgent protective action off the site. Upon declaration of this class of emergency, action shall be promptly taken to mitigate the consequences of the event and to protect people on the site and within the precautionary action zone (PAZ) and the urgent protective action planning zone (UPZ) as appropriate.

8.3.2. Nuclear and radiological emergency class 2

Nuclear and radiological emergency class 2 are site area emergencies at facilities in threat category I or II involving a major decrease in the level of protection for those on the site and near the facility. Upon declaration of this class of emergency, action shall be promptly taken to mitigate the consequences of the event and to protect people on the site and to make preparation to take protective action off the site if this becomes necessary.

8.3.3. Nuclear and radiological emergency class 3

Nuclear and radiological emergency class 3 are facility emergencies at facilities in threat category I,II, or III involving a major decrease in the level of protection for people on the site. Upon declaration of this class of emergency, action shall be promptly taken to mitigate the consequences of the event and to protect people on the site. Emergencies in this class can never give rise to an offsite threat (e.g. site area or general emergency).

8.3.4. Nuclear and radiological emergency class 4

Nuclear and radiological emergency class 4 are emergency alerts at facilities in category I, II or III involving an uncertain or significant decrease in the level of protection for the public or for people on the site. Upon declaration of this class of emergency, action shall be promptly taken to assess and mitigate the consequences of the event and to increase the readiness of the on-site and off-site response organization as appropriate. Alerts include events that could evolve into facility, site area or emergencies.

8.3.5. Nuclear and radiological emergency class 5

Nuclear and radiological emergency class 5 are other emergencies such as uncontrolled source emergencies involving loss, theft or loss of control of dangerous sources, including terrorist threats involving radioactive material and re-entry of a satellite containing such a source. This emergency classification is intentionally used for communications among the involving agencies in respect to suppress and alleviate of the disaster, enabling prompt and appropriate actions. Typically, the operator declares a class of emergency on the basis of predetermined emergency action levels (EALs). The emergency classification should not be confused with the International Nuclear Events Scale (INES).

Nuclear and radiological threats can be classified into 5 categories according to Table 10.3-1.

Threat categories I through III represent decreasing levels of threats at facilities and therefore decreasing emergency preparedness and response requirements. Threat category IV applies to threats and practices that can exist virtually anywhere and thus is the minimum level of threat assumed to exist everywhere. Threat category IV always applies to all jurisdictions, possibly along with other categories. Threat category V applies to the off-site areas where emergency preparations are warranted to address contamination resulting from a release from a facility in threat category I and II.

Table 8.3-1 Suggested Emergency Threat Categories for Planning (No.1)

Category	Definitions and potential nuclear and radiological threats
I	Emergencies have been postulated that could result in severe deterministic health effects off site of the facilities, to including: - reactors with power levels greater than 100 MW(th) e.g. power reactors, nuclear ship and research reactors; - spent fuel pools that may contain some recently discharged fuel and a total of more than about 0.1 EBq (E=exa=1018) of Cs-137 equivalent to the inventory in a 3000 MW(th) reactor core; - facilities with inventories of dispersible radioactive materials sufficient to result in severe deterministic effects offsite of such facilities. **Probability of threats in Thailand and potential affected areas** - Currently, there are no nuclear power plants and nuclear facility of such magnitude.
II	Emergencies have been postulated that could result in doses warranting taking urgent protective action off site of the facilities, to including: - reactors with power levels greater than 2 MW(th) and less than 100 MW(th), e.g. power reactors, nuclear ship and research reactors;
Category	**Definitions and potential nuclear and radiological threats**
	- spent fuel pools containing fuel requiring active cooling; - facilities with potential for an uncontrolled criticality within 0.5 km of the off-site boundary; - facilities with inventories of dispersible radioactive sufficient to result in doses warranting taking urgent protective action off site[1]; **Probability of threats in Thailand and potential affected areas** - Currently, there are no nuclear power plants but potential threats occur if a nuclear ship is in our territory. The affected sites depend on the climate.

Table 8.3-1 Suggested Emergency Threat Categories for Planning (No.2)

Category	Definitions and potential nuclear and radiological threats
III	Emergencies have been postulated that could result in doses warranting taking urgent protective action on site of the facilities, including: - facilities with potential, if shielding is lost, of direct external (shine) dose rates of more than 100 mGy/h at 1 m; - facilities with potential for an uncontrolled criticality more than 0.5 km from the off-site boundary; - reactors with power levels of less than or equal to 2 MW(th); - facilities with inventories of radioactive sufficient to result in doses warranting taking urgent protective action on the site[2] **Probability of threats in Thailand and potential affected areas** - A researchreactor is located at 16. Vibhavadi Rangsit Road, Chatuchak District, Bangkok. The potentially affected sites could be the nearby area.
IV	Operatorsof mobile danqerous sources. including: 1. a mobile source with potential, if shielding is lost. of direct external (shine) dose rates of more than 10 mGy/h at 1 m 2. satellites with dangerous sources; 3. transport of quantities of radioactive material that would be dangerous if not controlled;
Category	**Definitions and potential nuclear and radiological threats**
	4. facilities/locations with a significant probability of encountering an uncontrolled dangerous source such as: 4.1 large scrap metal processing facilities; 4.2 national border crossings; 4.3 facilities with fixed gauges with dangerous sources. **Probability of threats in Thailand and potential affected areas** - Radioactive materials are used nationwide so threat could have possibly occurred at any of the sites. The affected area is the incident site.
V	Products with a significant likelihood of becoming contaminated as a result of events at facilities in threat categories I or II of neighboring countries, to levels necessitating prompt restrictions on products in accordance with international standards. **Probability of threats in Thailand and potential affected areas** - The affected sites depend on the climate.
[1] 10 times the AID value calculated in Appendix 3 provides an estimate of this inventory if 10% of the inventory is assumed to be released to the atmosphere.	
[2] 0.01 times the AID value calculated in Appendix 3 provides an estimate of this inventory if 10% of the inventory is assumed to be released into room and the people are evacuated within a few minutes	

8.4. Participating Organizations (Enterprise, Government (central and local), Non-Government, and International Partnership)

8.4.1. The Prime Minister's Office

8.4.1.1. Office of the National Security Council shall have powers and responsibilities as follows:

(1) Follow the national security and other relevant laws.
(2) Propose recommendations to the National Security Council or the Cabinet to formulate the policies and strategies or activity plan in connection with the national security both internal and international affairs, border affairs and national defence and other national security-related affairs.
(3) Facilitate and coordinate with government agencies, private sectors, academic institutions and educational institutions on implementations and activities according to the National Security Policies and Strategies so that they are consistent and integrated.
(4) Organize and research, develop and oversee changing security circumstances, including evaluate and develop policies and strategies in pursuant to all national security-related matters and peaceful strategies.
(5) Recommend and formulate policies, facilitate, improve, cooperate and follow up the assessments of intelligence, counterintelligence, national security, as well as, propose guidelines on development of intelligence policy, intelligence organization, and counterintelligence.
(6) Recommend and formulate policies, facilitate, coordinate, follow up, evaluate, and develop national security policies in pursuant with the resolutions against the international terrorism. International crime, security crisis management, national preparedness, and policy on prevention and resolutions of other new security threats.
(7) Perform other duties as required by laws by virtue of the Office of National Security Councilor as required by the Prime Minister or the Cabinet.

8.4.1.2. Government Public Relations Department shall have powers and responsibilities as follows:

(1) Publicize to create moral and psychological supports among people, government officials in unified efforts, to provide cooperation and support the operations.
(2) Coordinate with the regulatory government agencies relating to control information, release of information, prevention disclosure of government confidentiality and news broadcasting which may be threat to security.
(3) Support communication equipment and materials in terms of public relations to provide security information services, as well as, specialized personnel to support the operations.

8.4.2. Ministry of Interior shall have powers and responsibilities as follows:

(1) Facilitate, oversee, and provide sufficient consumer products, temporary shelters, and other remuneration package to the victims radically and expeditiously.
(2) Control and maintain peaceful to normal state, provide protection and mitigate the people's dispirited during the disastrous event.

8.4.2.1. Department of Disaster Prevention and Migration shall have powers and responsibilities as follows:

The Department of Disaster Prevention and Mitigation is served as a central government

agency in implementing the national disaster prevention and mitigation and shall have powers and duties as follows:

(1) Establish the National Disaster Prevention and Mitigation Plan, propose to the National Disaster Prevention and Mitigation Committee (NDPMC) and seek for approval by the Cabinet.
(2) Organize researches on procedures and measures to prevent and mitigate all impacts of disasters effectively.
(3) Operate, cooperate, support and assist government agencies, local administrations and relevant private sectors on disaster prevention and mitigation, as well as, provide initial aids to the affected people, victims or casualties.
(4) Guide and provide consultancy, and train other government agencies, local administrations and other private sectors on disaster prevention and mitigation aspect.
(5) Follow-up, assess and evaluate all activities related to disaster prevention and mitigation at all level.
(6) Perform other duties in accordance to this and other laws or as may required by Commander in Chief, Prime Minister, NDPMC, or the Cabinet.

8.4.3. Ministry of Defence shall have powers and responsibilities as follows:

(1) Establish measures on prevention and mitigation of nuclear and radiological disaster, which has impacts on individuals, facilities, premises and military properties, including, plan on evacuation of military affairs and families, and coordinate with the Department of Disaster Prevention and Mitigation.
(2) Facilitate, coordinate, command, and oversee the operations of the Ministry of Defence on providing aids to those affected by nuclear and radiological disaster, including solving unexpected problems, rehabilitation of both central and provincial casualties in prompt, unified, effective and timely manners.
(3) Facilitate and organize public relations by utilizing tools and equipment of the Ministry of Defence, or through other media channels to warn and report updated events in all circumstances, including provide recommendations on procedures to be followed to those affected by nuclear and radiological disaster.
(4) Cooperate/exercise on operations, support and facilitate the civil prevention in the areas.

8.4.3.1. Defence Mobilisation Department shall have powers and responsibilities as follows:

(1) Coordinate with the Disaster Mitigation Centre, Ministry of Defence on providing aids to those affected by nuclear and radiological disaster
(2) Provide support on resources information of military forces, military arms, devices, equipment, and communication tools for nuclear and radiological disaster prevention, mitigation, suppression and rehabilitation according to the Disaster Mitigation Plan, Ministry of Defence, when requested.

8.4.3.2. Directorate of Civil Affairs shall have powers and responsibilities as follows:

(1) Propose the policy and implementation plan, including guidelines on prevention and resolution of nuclear and radiological disaster, as well as, develop Aide Plan by the Royal Thai Armed Forces Headquarter for those affected by nuclear and radiological disaster.
(2) Facilitate, coordinate, command and supervise the operational sectors of the Royal Thai

Armed Forces Headquarter in providing aids to those affected by nuclear and radiological disaster.

(3) Served as coordinating centers among military agencies of the Royal Thai Armed Forces Headquarter, civil affairs and private sector, to facilitate the operational aid to those affected by nuclear and radiological disaster.

(4) Publicize, announce information regarding nuclear and radiological disaster, aide to the people, as well as, provide recommendations on implementations of nuclear and radiological disaster prevention to the public.

8.4.3.3. Royal Thai Army Chemical Department shall have powers and responsibilities as follows:

(1) Procure forces, equipment and tools to assist on emergency operations to prevent, mitigate, and suppress nuclear and radiological threats as requested by other government agencies via the Royal Thai Army.

8.4.3.4. The Naval Science Department shall have powers and responsibilities as follows:

(1) Procure forces, equipment and tools in relating to preliminary nuclear and radiological public disaster mitigation to provide aid to the victims as commanded by the Royal Thai Navy.

8.4.3.5. Research and Development Centre for Space and Aeronautical Science and Technology, Royal Thai Air Force, shall have powers and responsibilities as follows:

(1) Provide the Nuclear-Biological-Chemical (NBC) Team to join the operation as requested.

8.4.4. Ministry of Science and Technology shall have powers and responsibilities as follows:

(1) Support on technology services and knowledge of Ministerial agencies concerning nuclear and radiological response in emergency.

(2) Promote and assist the research, development and innovation which support the implementation and operation to mitigate nuclear and radiological disaster.

8.4.4.1. The Office of Atoms for Peace (OAP) shall have powers and responsibilities as follows:

(1) Be responsible for preliminary assessing situations for mitigating nuclear and radiological accidents and emergencies so that such events shall be resolved in the right directions in accordance with the nuclear and radiation protection to limit the expansion of such event which could be detrimental to the public and environment.

(2) Receive notification and report nuclear and radiological incident(s) and accident(s).

(3) Coordinate with the Nuclear and Radiological Suppression Forces Operations and other local and international relevant agencies, e.g. Disaster Mitigation Agencies, Royal Thai Police, Army Forces, International Atomic Energy Agency, etc.

(4) Follow up and collect information on nuclear and radiological accident to plan, manage, operate and prepare efforts for the suppression of nuclear and radiological emergency situations both in and out of the Bangkok Metropolitan.

(5) Manage database and statistics concerning officials, agencies, etc. in connection with the

suppression of nuclear and radiological emergencies for development and improvement of coordination to achieve the highest level of

(6) Cooperate trainings on nuclear and radiological emergencies to raise safety awareness in preparedness and operations during nuclear and radiological emergency circumstances.

8.4.4.2. Thailand Institute of Nuclear Technology (TINT) shall have powers and responsibilities as follows:

(1) Support response activities of nuclear and radiological emergency, when requested.

(2) Provide consultancy, propose recommendations on formulating nuclear and radiological emergency plan to other agencies.

8.4.5. Ministry of Public Health shall have powers and responsibilities as follows:

(1) Support the formulation of National Nuclear and Radiological Emergency Plan and situation correction.

(2) Collaborate with other relevant agencies to identify roles and responsibilities of key agencies to formulate Capability Building Implementation Plan as well as provide necessary resources as follows:

(2.1) Survey and supply collected medical and public health resources, as well as, set up medical and radiological

(2.2) Establish Emergency Medical Services (Ambulance System) to be available and assist the injured at the site, including establish public health network system to support its nationwide operation.

(2.3) Provide medical care, sanitation and disease prevention to the victims.

(2.4) Provide trainings to medical professions on treatment of patients exposed to radiation and nuclear.

(2.5) Establish system and procedures on safety maintenance of radiological equipments and materials used in the public health facilities.

(2.6) Manage data and report effectively.

(2.7) Provide knowledge on primary care, sanitation and environmental health to the public so that they can help themselves and others during the crisis.

8.4.6. Ministry of Natural Resources and Environment shall have powers and responsibilities as follows:

(1) Provide recommendations and propose guidelines on the formulation of Chemical Substances and Hazardous Materials Emergency Plan in the risk areas.

(2) Coordinate with relevant agencies according to the Disaster Prevention and Mitigation Plan on planning to control the prevention of explosion, fire, and chemical and hazardous material leaks to the public and environment.

(3) Follow up, oversee, and assess the effects of hazardous residuals on the environment, as well as, plan on the rehabilitation and preservation of the environment to achieve the balancing state which is appropriate to the livings.

(4) Plan and develop permanent and sustainable natural resources and environment to be able to endure other threats.

8.4.6.1.Pollution Control Department shall have powers and responsibilities as follows:

(1) Provide consultancy and recommendations on guidelines of the National Nuclear and

Radiological Emergency Plan in collaboration with relevant agencies.

(2) Coordinate with relevant agencies as defined in the National Nuclear and Radiological Emergency Plan to control, prevent and remedy potential hazards, caused by nuclear and radiological emergency, to the public and environment.

(3) Support and provide recommendations on guidelines to rehabilitate and remedy damages to the environment caused by nuclear and radiological emergency, in collaboration with other relevant agencies.

8.4.7. Ministry of Industry shall have powers and responsibilities as follows:

(1) Regulate, oversee and support operational activities of industrial business, as well as, promote safety, environment and hygiene at the manufacturing facilities.

(2) Control and oversee security system to prevent disaster caused by hazardous materials in industrial factories.

8.4.7.1. Department of Industrial Works shall have powers and responsibilities as follows:

(1) Administrate industrial business, including hazardous materials in terms of manufacturing, environment, safety to be consistent with laws and. international agreements.

(2) Support information and knowledge of machines, manufacturing, environment, hazardous materials and energy for utilization in the industrial business development.

(3) Provide services on conversion of assets, machineries, into fund.

8.4.8. Ministry of Transport shall have powers and responsibilities as follows:

(1) Support transportation vehicles, drivers, and transportation equipment as well as supply fuel.

(2) Prepare back-up routes or temporary traffic arrangement, fix or modify transportation, particularly roads, rails, or damaged bridges to be in services.

8.4.8.1. Department of Land Transport shall have powers and responsibilities as follows:

(1) Support information of vehicle registration and drivers, collaborate, coordinate and facilitate on vehicle procurement in the transportation as appropriate.

8.4.9. Ministry of Foreign Affairs shall have powers and responsibilities as follows:

(1) Coordinate with agencies, international organizations to request supporting of civil defence.

(2) Request of aids from abroad.

8.4.10. Ministry of Finance shall have powers and responsibilities as follows:

(1) Allocate budget as needed and in urgent circumstances

(2) Provide consultancy on allocation and integrated utilization of budget.

8.4.11. Ministry of Information and Communication Technology shall have powers and responsibilities as follows:

(1) Support communication resources and provide necessary communication system services as contingency plan and remedy nuclear and radiological emergency.

(2) Coordinate on information and relevant communicative infrastructure for disaster warning, aide, and suppression of nuclear and radiological emergency.

(3) Provide weather forecast information to support 24-hours operation.

8.4.11.1. National Disaster Warning Centre shall have powers and responsibilities as follows:

(1) Study each type of disaster by simulating different scenarios of disasters and develop anticipated basic information used to make informed, comprehensive, accurate, quick and standardized decision.

(2) Exchange of disaster information at domestic and international levels for analyzing the level of disaster severity and assess casualties caused by the disaster.

(3) Warn and broadcast the severity of the disaster and its ending via the Television Pool of Thailand, radio, telephone, and other government and private medias that wish to broadcast news, warning towers, including provide suggestion to minimize loss, evacuate, avoid and mitigate the disaster to staff and relevant agencies in order to provide aids to the public and countries bound by the warning system agreement.

(4) Announce fact sheets to stop disaster rumor through the Television Pool of Thailand, radio in order that panic, confusion, anxiety of the public can be eradicated.

(5) Monitor disaster situations closely to learn about casualties of both lives and assets, and support necessary rescue equipment, as well as, coordinate and provide information to the Disaster Mitigation officer so that the mitigation activities can be performed effectively.

(6) Guide and cooperate trainings to the officials and public to have knowledge on guidelines and means of minimizing losses, evacuation, avoidance, and mitigation of the disaster.

(7) Perform other duties as assigned.

8.4.12. The Royal Thai Police shall have powers and responsibilities as follows:

(1) Control and maintain peaceful state, safety of lives and properties of the people and provide social services.

(2) Evaluate the situation, plan the operation, and deploy operational forces. Facilitate and support, exchange information among operational units, as well as, publicize disaster warning to the civil sector.

(3) Organize traffic systems in case the transportation routes are in detour or barred, support the operational activities of other units, and provide aide to mitigate the disaster.

(4) Set up Frontline Operational Center to be Joint Operation Center of the Royal Thai Police, control, oversee, facilitate and collaborate on the operational activities until the situation turns to its normal state.

(5) Organize Mobile Medical Team with medical supplies to provide medical services to the people and staff affected during the crisis.

8.4.13. Bangkok Metropolitan Administration shall have powers and responsibilities as follows:

(1) Direct, control, oversee, and recommend on the operational activities of disaster prevention and mitigation in the Bangkok Metropolitan areas.

(2) Support the operational activities of District Disaster Prevention and Mitigation Operation Division or other regions when requested for suppression, mitigation and rehabilitation.

(3) Coordinate with government sectors and relevant agencies in the Bangkok Metropolitan areas, including collaborate with the private sectors in all operational activities to prevent and mitigate disaster.

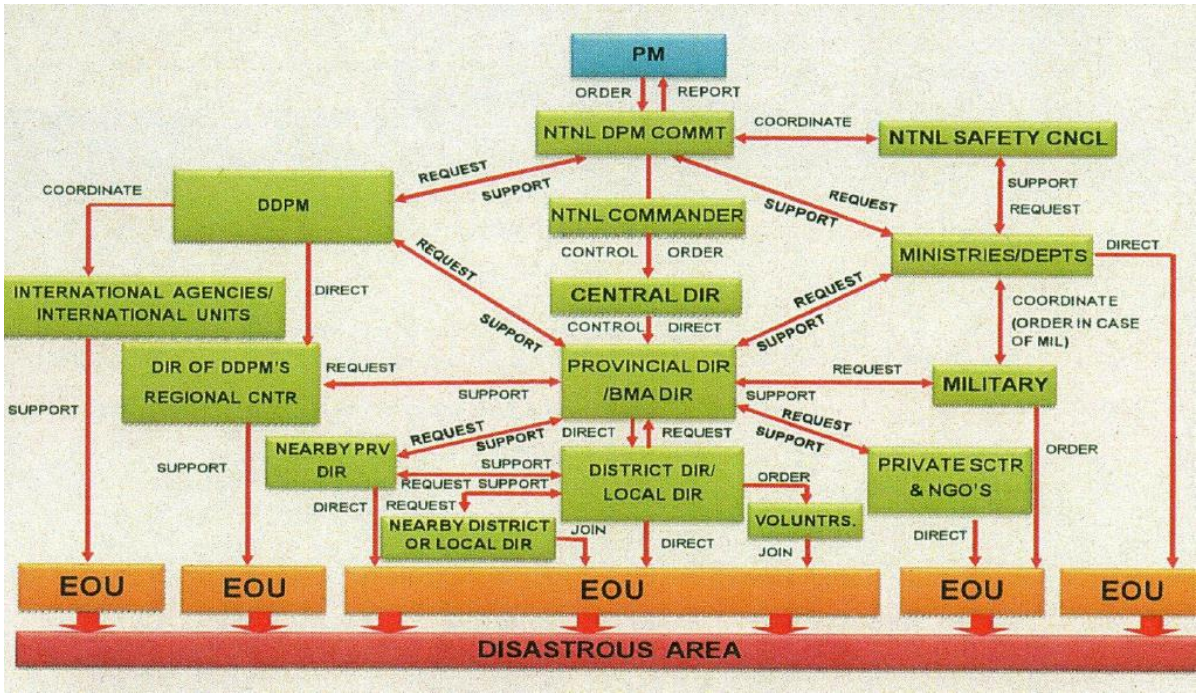


Figure 8.4-1 Organization structure of DM in Thailand

8.5. Concept of Operation

a. Mitigation and Prevention

b. Emergency Preparedness

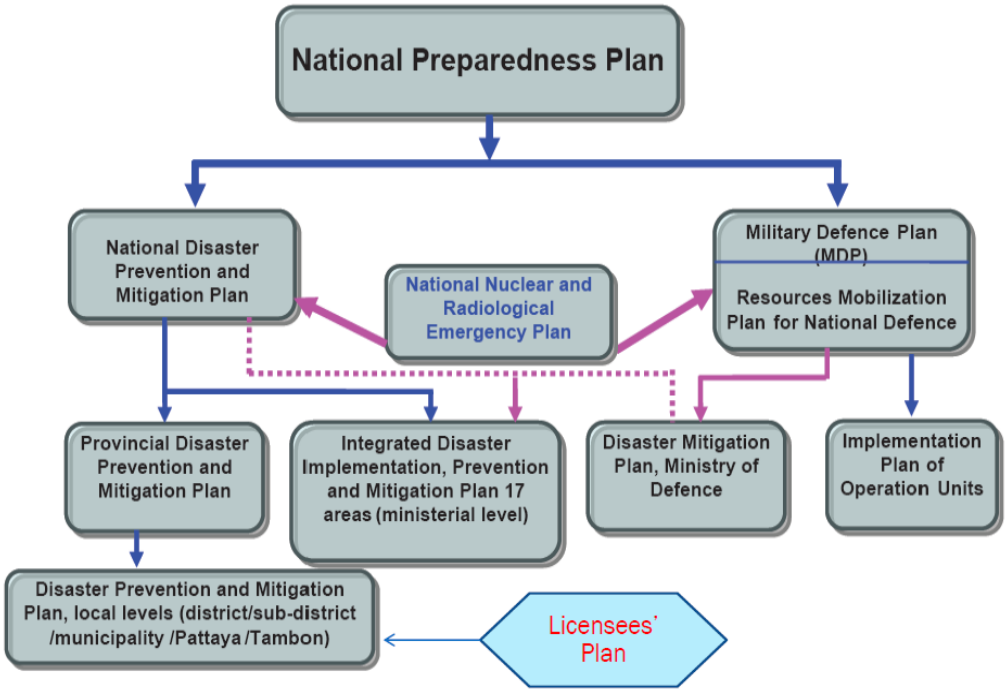


Figure 8.5-1 Structure of National Preparedness Plan

c. Emergency Response

Table 8.5-1 Guidance on Operational intervention levels (OILs) for Public (OAP, 2014)

Major Exposure Condition	OIL	Recommended Actions
External radiation from a point source	100 µSv/h	- Isolate the area - Recommended isolation area of cordoned area - Control access and egress
External radiation from ground contamination over a small area or in the case of not very disruptive evacuation	100 µSv/h	- Isolate the area - Recommended isolation area of cordoned area - Control access and egress
External radiation from ground contamination over a wide area or in the case of very disruptive evacuation	1 mSv/h	- Recommended evacuation or substantial shelter
External radiation from air contamination with an unknown radionuclide(s)	1 µSv/h	- Isolate the area (if possible) - Recommended isolation area of cordoned area or downwind in open area

d. Emergency Rehabilitation and Restoration

8.6. Related Activities

8.6.1. Human Capacity Building (e.g. training, workshops, drills, and exercises)

OAP has conducted training programs for first responders, police, military, Emergency Medical Service, frontline officer, scrap metal dealer, rescuer, ets.

Figure 8.6-1 National emergency exercise

Figure 8.6-2 Training for Frontline Officers

8.6.2. Communication and Public Relation (e.g. information passage , mass media, and social media)

Communication and coordination with relevant agencies when a nuclear and radiological emergency occurs is a significant task. When a disaster or security event occurs, the involving agencies must be notified of the event to take appropriate actions for mitigation, including collaboration and cooperation, commanding, reporting the activities and facilitating all related matters for prompt response and smooth operation during both crisis and normal operation.

Procedures

1. Be ready and prepared at all times even in a normal state. A number of communication systems and back-up tools should be available for accurate, reliable and prompt action.
2. Test the communication system annually to check its function and assess the problems and obstacles which could have occurred during nuclear and radiological emergency or during normal operation.
3. List the main relevant organizations. Internal communication and coordination among inside and outside relevant organizations can take place at any time.

III-9. Vietnam

9.1. Policy

9.2. Regulatory Framework and Legislation

9.3. Emergency Classes and Condition

9.4. Participating Organizations (Enterprise, Government (central and local), Non-Government, and International Partnership)

9.5. Concept of Operation

9.5.1. Mitigation and Prevention

9.5.2. Emergency Preparedness

9.5.3. Emergency Response

9.5.4. Emergency Rehabilitation and Restoration

9.6. Related Activities

III-9. Vietnam

General

Now in Vietnam, radiation and radioisotopes have been applied in health care, agriculture, industry, geology, mining, meteorology, hydrology, transport, construction, oil and gas industry, etc.

There is only one nuclear installation in the country is the Dalat nuclear research reactor with capacity of 500 kW.

In order to meet the energy demand in the future, the first nuclear power plant (NPP) will be put in operation in 2020 with capacity of 2000 MW and the second NPP with capacity of 2000 MW will be put in operation in 2021.

Atomic Energy Law had been approved at the twelfth National Assembly Session 3 on 3rd June 2008 and come to enforce on 1st January 2009. The Atomic Energy Law includes 11 Chapters with 93 Articles.

9.1. Policy

To establish the basic requirements for adequate level of Nuclear & Radiological Emergency Preparedness & Response;

To implement the requirements to minimise consequences during all types of nuclear and radiological Emergency;

To complement standards already developed for large & complex radiation sources, including nuclear reactors and radioactive waste management facilities.

9.2. Regulatory Framework and Legislation

9.2.1. Legislative framework and policy

According to articles 91, 103 of Statute of the Socialist Republic of Vietnam, the order of legislative framework is as following:

- Laws will be enacted by the National Assembly of the Socialist Republic of Vietnam.
- Ordinances will be enacted by the Standing Committee of the National Assembly.
- Decrees will be enacted by the Prime Minister of the Socialist Republic of Vietnam.;
- Circulars, Guidance, Codes of practices will be enacted by the Minister or some Ministers.
- Atomic Energy Law, Article 6, Principles for activities and the assurance of safety and security in the field of atomic energy.
- Any activities in area of atomic energy shall ensure that public health, human life, environment and social security are protected. State management on safety and security shall be independent and scientifically based.

9.2.2. National System on Nuclear/Radiological Emergency Preparedness and Response

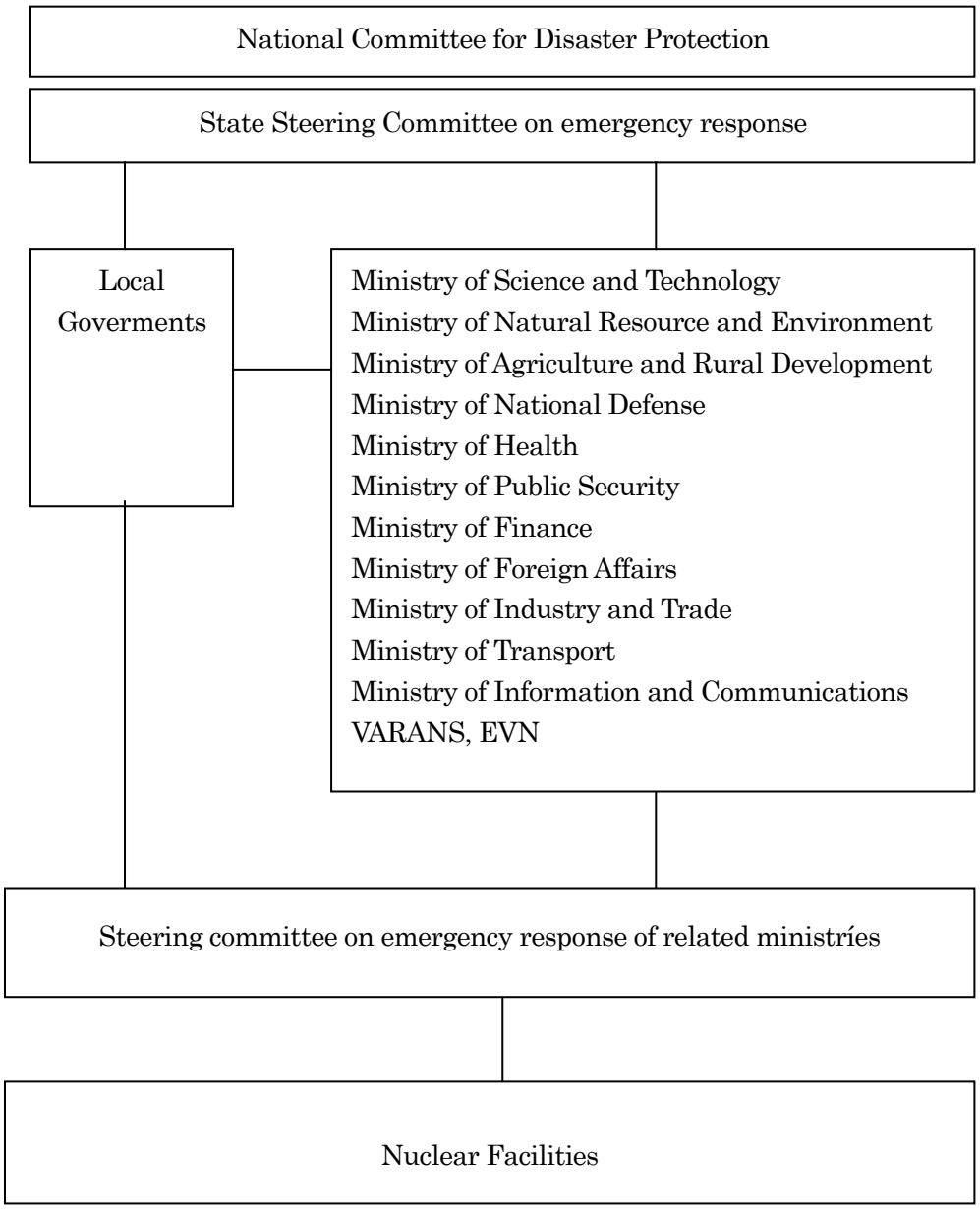


Figure 9.2-1 Flow chart of National System on Nuclear/Radiological Emergency Preparedness and Response

9.2.3. Legislation Documents on Nuclear/Radiological Emergency Preparedness and Response

- **Atomic Energy Law**

The Law has became effective as from 1 Jannuary 2009, stipulating Emergency preparedness and response for radiation and nuclear incidents and accidents including the following:

- Classification of Emergency circumstances for the purpose of working out appropriate response plans:

Group 1 - Circumstances of unserious incidents,
Group 2 - Circumstances of less serious incidents,
Group 3 - Circumstances of serious incidents,
Group 4 - Circumstances of very serious incidents,
Group 5 - Circumstances of particularly serious incidents.

- Stipulating the plan for emergency preparedness and response in detail:
  Plans on response to facility –level incidents are applied when incidents of group 1, 2 or 3,
  Plans on response to provincial-level incidents are applied when incidents of group 4,
  Plans on response to national-level incidents are applied when incidents of group

➢ **Secondary documents to enforce the Law on Nuclear/Radiological Emergency Preparedness and Response**

Decree 70/2010/ND-CP by The Government dated detailing and guiding number of articles of The Law on Atomic Energy regarding nuclear power plants stipulating the action in response to NPP accidents.

➢ **The content of Emergency and Response Plan**

- Organizations, individuals conducting radiation activities shall develop their plans for radiation and nuclear incident response
- Provincial People's Committee shall develop provincial plans for radiation and nuclear incidents response; the MOST shall provide guidance on planning and approving the provincial plans for radiation and nuclear incidents response.
- The MOST shall collaborate with the Ministry of Industry, Ministry of Health, Ministry of Defense, Ministry of Public Security, Provincial People's Committees in which radiation facilities, nuclear facilities are operating and related organizations and individuals to develop national's plans for radiation and nuclear incident response to submit to the Prime Minister for approval.

➢ **National Emergency Response Plan**

MOST shall assume the prime responsibility for, coordinate with concerned agencies, organizations and individuals is developing response plans to National level- emergencies.

VARANS have been also assigned to develop National Nuclear and Radiological Emergency Response plan. The Draft of the plan is available and is reviewing by related organizations. It will be submited for Prime Minister Approval in 2017.

PM will decides responsibility of agencies implementing of Convention on Notification and Convention on Assistance in case of Radiological Emergency & Nuclear Accident.

➢ **Provincial Emergency Response Plan**

Provincial People's Committees shall develop provincial plan for radiation and nuclear incidents response

Emergency response plans at provincial level have been prepared in some big cities: Hanoi, Ho Chi Minh City, Da Nang and Binh Duong, Lang Son, Hai Phong, Khanh Hoa and BaRia-Vung Tau.

➢ **Facility Emergency Response Plan**

Organizations, individuals conducting radiation practices shall develop their plans for radiological and nuclear incidents response.

These plans will submitted to the VARANS for reviewing when licensees apply for license.

9.3. Emergency Classes and Condition

Class 1. Facility Emergency Response Plan

Content of the Facility Emergency Response Plan includes the estimated incident situations that may occur; manpower plans, means to implement the initial response measures, to held emergency victims, limiting the incident spread, limiting the consequences, isolating hazardous area, and safety and security issues; organizing emergency response exercises annually.

Condition:

Apply for accidents that belong to Group 1, 2, 3 as described in Atomic Energy Law above.

Class 2. Provincial Emergency Response Plan

Content of the Provincial Emergency Response Plan includes the estimated incident situations that may occur; manpower plans, means to implement the initial response measures, to held emergency victims, limiting the incident spread, limiting the consequences, isolating hazardous area, and safety and security issues; organizing emergency response exercises annually

Condition:

Apply for accidents that belong to Group 1, 2, 3 but the accidents are beyond the response capacity of the facilities and Group 4, as described in Atomic Energy Law.

Class 3. National Emergency Response Plan

Content of the National Emergency Response Plan includes organizing system, includes the estimated incident situations that may occur; Emergency Response Scenarios; organizing emergency response exercises every two years.

Condition:

Apply for accidents that belong to Group 4 but the accidents are beyond the response capacity of the Province and Group 5 as described in Atomic Energy Law above.

9.4. Participating Organizations (Enterprise, Government (central and local), Non-Government, and International Partnership)

➢ **National Committee for Disaster Protection**

In coordination with the State Steering Committee on emergency response to coordinate human resources to cope with the emergency situation, to support local governments and facilities, to perform assigned tasks in incident response plan.

➢ **State Steering Committee on emergency response**

- Directing ministries and branches to prepare human resources and equipments and technical means, and incident response process;
- Advising the Government to build offsite-centre;
- Organizing exercise of the Emergency Response Plans;
- Taking charge of the action of emergency preparedness and response;

- Performing assigned tasks in the emergency response plans approved by the Prime Minister;
- Advising the National Committee for Disaster Protection to implement emergency measures.

➢ **Ministry of Science and Technology**

- Monitoring the response activities within the nuclear facility;
- Advising the State Steering Committee on emergency response to implement emergency measures;
- Supporting technical to assess radiation background, to analyze radioactive isotope in environmental samples and foodstuffs, to assess radioactive spread and radiation doses;
- Monitoring radiological environment and evaluating radiation in normal conditions and in incidents;
- Supporting local governments and facilities;
- Advising radiation protection measures and evaluation of occupational radiation doses of personnel involved in responding to incidents;

➢ **Ministry of Natural Resource and Environment**

- Building resources, prepare technical facilities to ensure the control of radioactive pollution;
- Supporting the Ministry of Science and Technology to monitoring radiological environment in the initiate period of the response;
- Conducting pollution control and environmental impact assessment of the incident.

➢ **Ministry of National Defense**

- Providing professional human resources in incident response, radiation recording devices, equipment and instruments for professional use;
- Supporting the radiation monitoring, decontamination, analysis of environmental samples;
- Supporting local governments to evacuate the people.

➢ **Ministry of Health**

- Chaired implement measures to protect health care for those affected by the incident;
- Building health systems of health care for victims of radiation exposure, especially in the local where nuclear power plant located;
- Coordinating with the Ministry of Agriculture and Rural Development to inspect the production, processing and storage of food for humans and animals;
- Organizing epidemiological investigation;
- Controlling and studying the radiation exposure population.

9.5. Concept of Operation

9.5.1. Mitigation and Prevention

Mitigation provides a critical foundation for emergency management. The ultimate purpose of emergency management is to save lives, preserve the environment and protect property and the economy. Emergency management is comprised of four interdependent risk-based functions: prevention/mitigation, preparedness, response and recovery.

9.5.2. Emergency Preparedness

Emergency Preparedness is the discipline of dealing with nuclear accidents. It involves mitigation, preparedness, response and recovery in order to lessen the impact of accident. Emergency management requires a partnership among all levels of government (nuclear facility,

local, State). Successful preparedness requires detailed planning and cooperation among each sector.

The following principles illustrate the emergency preparedness concept: Emergency preparedness at all levels considers and takes into account all accident, all phases, all stakeholders and all impacts relevant to accident. Anticipation of future accident and preventive and preparatory measures build accident-resistant and accident-resilient communities. Sound risk management principles (accident identification, risk analysis, and impact analysis) are used in assigning priorities and resources. Unity of effort among all levels of government and all elements of a community are integrated. Broad and sincere relationships among individuals and organizations are incorporated to encourage trust, advocate a team atmosphere, build consensus, and facilitate communication. Activities of all relevant stakeholders are synchronized to achieve a common purpose. Creative and innovative approaches are used to overcome disaster challenges. Emergency preparedness uses a science and knowledge-based approach; based on training, experience, ethical practice, public stewardship and continuous improvement.

Management consists of four phases: Mitigation, Preparedness, Response, and recovery.

9.5.3. Emergency Response

Emergency response consists of actions taken to prevent death and further damage during an emergency situation. The response phase is putting the preparedness phase into action. Examples of response include evacuating an accident area, seeking shelter, etc. Response activities take place during an emergency.

9.5.4. Emergency Rehabilitation and Restoration

This is the ability to return to a state of normal function with minimal suffering and disruption of services following a accident. Accident and financial assistance are examples of recovery that aids individuals and communities. Recovery assistance can be provided at local, state. The recovery phase takes place following an accident.

9.6. Related Activities

9.6.1. Human Capacity Building (e.g. training, workshops, drills, and exercises)

Training for personnel who are involved with radiological emergency or accident is essential and should be done regularly. Therefore, in Vietnam any person who deals with radioactive or nuclear materials or with irradiation apparatus shall undergo a radiation protection training course which includes handling of radiological accidents or emergencies. Beside this training course, all radiation workers shall also attend training course before can be approved as radiation workers.

Exercises are essential. At local-level, the exercises are conducted by Steering committee on emergency response of local government and VARANS which include field exercise on research reactors, transport accident exercises, missing source exercise, contamination emergency exercise, etc.

Drills and exercises cover a full range of response actions, and involve the Steering committee on emergency response of local government and VARANS teams and participants from local governments, other federal agencies, where appropriate.

The lessons learned from these exercises help the agency to focus its mission and objectives, to

streamline its radiological emergency response programme, to modify operational procedures and to rectify response weaknesses.

9.6.2. Communication and Public Relation (e.g. information passage , mass media, and social media)

Some important activities like organizing training courses, emergency related poster, announcement and passage of information in the website are in place to alert public for the hazard of radiation sources and emergency related issues etc. A complete information system is in the process of development to inform the public about the regulated practices in the emergency related aspects.

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Appendix A Past Emergency Experience

◆ Reactor Accident and Emergency

Year/Month		Country	Emergency Experience
1957	Oct.	UK	Windscale NPP (Graphite reactor) Carbon fire, fuel meltdown
1961	Jan.	US	SL-1 reactor (LWR) Reactor excursion
1975	May	US	Browns Ferry-1 NPP (BWR) Fire
1975	Dec.	East Germany	Greifswald-1 NPP (VVER) Fire
1977	Feb.	Czechoslovakia	Bohunice A1 NPP (Gas cooled reactor) Fuel meltdown
1977	Sep.	US	Davis Besse NPP (PWR) Loss of Coolant
1979	Mar.	US	TMI-2 NPP (PWR) Loss of Coolant, core meltdown
1980	May	France	Saint Laurrent-2 NPP (Gas cooled reactor) Fuel melt down
1980	Jun.	US	Browns Ferry-3 NPP (BWR) Scram failure
1986	Apr.	USSR*	Chernobyl-4 NPP (RBMK) Reactor excursion, meltdown
1986	Dec.	US	Surry-2 NPP (PWR) Pipe rupture
1989	Oct.	Spain	Vandellos-1 NPP (Gas cooled reactor) Fire
1991	Nov.	US	Salen-2 NPP (PWR) Turbine missile. fire
1992	Jul.	Sweden	Barsebaeck-2 NPP (BWR) ECCS failure
1993	May	India	Narora-1 NPP (CANDU) Fire, electric break
2002	May	US	Davis Besse NPP (PWR) Pressure vessel cover injury
2011	Mar.	Japan	Fukushima Daiich NPP (BWR) Core melt down

*USSR: Union of Soviet Socialist Republics.

◆ Nuclear Accident and Emergency

1. Criticality Accident

Year/Month		Country	Emergency Experience
1957	Apr.	USSR*	Mayak complex, Criticality, 1death+ 5 serious
1958	Jan.	USSR*	Mayak complex, Criticality, 3 deaths
1958	Jun.	US	Oak Ridge, Y-12 chemical factory, criticality, 8 exposed
1958	Dec.	US	Los Alamos, Reprocessing plant, criticality, 1death, 2 exposed
1964	Jul.	US	Wood River Junction, criticality, 1 death, 2 exposed
1999	Sep.	Japan	JCO conversion factory, Criticality, 2 deaths, 1 serious, 57 exposed

*USSR: Union of Soviet Socialist Republics.

2. Explosion and Release of Radioactivity

Year/Month		Country	Emergency Experience
1953	Jan.	US	Savannah River reprocessing plant, Chemical explosion, 2 workers damaged
1957	Sep.	USSR*	Kyshtym reprocessing plant, Explosion, Release, Level 6
1973	Sep.	UK	Windscale reprocessing plant, Release, Level 4
1975	Feb.	US	Savannah River reprocessing plant, Explosion, fire, 2 workers damaged
1976	Aug.	US	Hanford reprocessing plant, Explosion, 9 workers exposure
1977	Jul.	France	Pierrelatte Conversion factory, UF6 release
1981	Jan.	France	La Hague reprocessing plant, Fire in the storage, 5 workers exposure
1986	Jan.	US	Sequoyah conversion factory, UF6 release, 1 death

1987	Jan.	UK	Sellafield reprocessing plant, Pu intake, 12 contamination
1987	Feb.	Germany	Hanau fuel fabrication plant, Pu intake, 14 contamination
1990	Dec.	Germany	Hanau fuel fabrication plant, Explosion, 2 damaged.
1991	Jun.	Germany	Hanau fuel fabrication plant, Pu intake 3 workers
1993	Apr.	USSR*	Tomsk-7 Reprocessing plant, Explosion, Release
1994	Dec.	Japan	PNC-Tokai reprocessing plant. Pu intake, 4 workers
1997	May	Japan	PNC-Tokai Reprocessing plant, Explosion

*USSR: Union of Soviet Socialist Republics.

3. Radiological Accident and Emergency

Year	Country	Emergency Experience
1963	China	Irradiation facility, 2 deaths
1975	Italia, Brescia	Irradiation facility, 1 death
1981	US, Oklahoma	Radiography, 1 death
1982	Norway	Sterilization irradiation, 1 death
1989	EL Salvador, San Salvador	Industrial irradiation facility, 1 death
1990	Israel, Soreq	Industrial irradiation facility, 1 death+ 6 serious damage
1991	Belarus, Nesvizh	Industrial irradiation facility, 1 death
1996	Casta Rica, San Jose	Medical facility, 3 deaths (patients)
2001	Panama	Medical facility, 14 deaths (patents)

4. Theft or Loss of Radiation Source

Year	Country	Emergency Experience
1962	Mexico, Mexico city	Loss of radiation source, 4 deaths
1978	Algeria	Loss of radiation source, 1 death
1984	Morocco	Loss of radiation source, 8 deaths
1987	Brazil, Goiania	Theft of radiation source, 4 deaths+ 249 contamination
1992	China, Xinshou	Loss of radiation source, 2 deaths+5 serious damage
1994	Estonia, Tammiku	Theft of radiation source, 1 death
2000	Thailand, Samut Prakarn	Theft of radiation source, 3 deaths+7 serious damage
2000	Egypt, Meet Halfa	Loss of radiation source, 2 deaths+ 5 serious damage

Appendix B FNCA RS&RWM Workshop (2014-2016)

✧ **FNCA RS&RWM Workshop 2016**

- Date: October 4-6, 2016
- Venue: Almaty, Kazakhstan
- Topics: Progress, improvement and future plan over the prior year on 1) nuclear and radiological emergency preparedness and response; 2) status, plans and challenges of low/Intermediate level waste disposal facilities/long term storage facilities.

✧ **FNCA RS&RWM Workshop 2015**

- Date: November 17-19, 2015
- Venue: Serpong, Indonesia
- Topics: 1) nuclear and radiological emergency preparedness and response; 2) status, plans and challenges of low/Intermediate level waste disposal facilities/long term storage facilities

✧ **FNCA RS&RWM Workshop 2014**

- Date: September 9-12, 2014
- Venue: Astana, Kazakhstan
- Topics: Challenges faced by FNCA participating countries in the area of RS&RWM such as 1)radiation safety issues in uranium mining; 2)challenges in RS&RWM in RI facilities/nuclear power plant; 3)plans for NPP introduction, and 4)status and plans for low level waste disposal facilities/long term storage facilities.

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