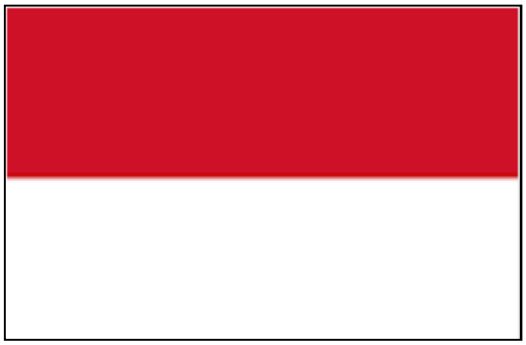
FINAL EPREV REPORT

IAEA

Emergency Preparedness Review

EPREV

PEER APPRAISAL OF THE ARRANGEMENTS IN INDONESIA REGARDING THE PREPAREDNESS FOR RESPONDING TO A NUCLEAR AND RADIOLOGICAL EMERGENCY



2016-09-19 to 2016-09-28

International Atomic Energy Agency

FOREWORD

Within the United Nations system, the International Atomic Energy Agency (IAEA) has the statutory functions of establishing standards of safety for the protection of health against exposure to ionizing radiation, and of providing for the application of these standards. In addition, under the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Assistance Convention) the IAEA has a function, if requested, to assist Member States in preparing emergency arrangements for responding to nuclear accidents and radiological emergencies.

In response to a request from the Government of Indonesia, the IAEA fielded an Emergency Preparedness Review (EPREV) mission to conduct, in accordance with Article III of the IAEA Statute, a peer review of Indonesia's radiation emergency preparedness and response arrangements vis-à-vis the relevant IAEA standards.

The number of recommendations, suggestions and good practices is in no way a measure of the status of the emergency preparedness and response system. Comparisons of such numbers between EPREV reports from different countries should not be attempted.

Contents

EXECUTIVE SUMMARY

This report provides the results of the Emergency Preparedness Review (EPREV) mission to the Republic of Indonesia on 19–28 September 2016. The mission was undertaken by the IAEA in response to a request from the Indonesian Government. EPREV missions are designed to provide an independent peer review of emergency preparedness and response (EPR) arrangements in a country on the basis of the IAEA Safety Standards. The EPREV team consisted of international EPR experts from IAEA Member States and a team coordinator from the IAEA Secretariat. This report includes recommendations for improvements based on IAEA safety requirements, suggestions for consideration based on IAEA safety requirements and safety guides, and good practices that are considered as models for other Member States.

It is important to recall that Indonesia has a notable history regarding the IAEA EPREV missions, as the country hosted the very first and second missions in 1999 and 2004, respectively. Today, Indonesia invited an EPREV mission against the recently published Safety Standards Series No. GSR Part 7, Preparedness and Response for a Nuclear or Radiological Emergency.

The findings of this report are based on the results of the self-assessment completed by Indonesia prior to the EPREV mission, as well as interviews with counterparts and site visits conducted during the EPREV mission. The self-assessment completed by Indonesia was thorough and objective. Throughout the preparation and the mission, EPREV experts noted the openness and transparency of the counterparts and their willingness to share and discuss EPR arrangements in great detail.

The mission took place at counterpart organizations in and around Jakarta, Cikarang, Sentul, Depok, Tangerang Selatan and Serpong. Being a full-scope EPREV mission, interviews—and, in many cases, site visits—were conducted with a broad range of relevant national, provincial and local government departments. These included: the National Disaster Management Agency (BNPB), the Nuclear Energy Regulatory Agency (BAPETEN), the Ministry of Health (MoH), the CBRE[1] Police (POLRI), the Army NBC[2] (NUBIKA) Detachment, the Local Disaster Management Agency (BPBD), the G.A. Siwabessy Multi-Purpose Research Reactor and Radioactive Waste Management Facility of the National Nuclear Energy Agency (BATAN), the Fatmawati and MRCCC Siloam hospitals, the Dharmais National Cancer Hospital, the PT. Rel-ion Irradiation Facility and the Sucofindo Industrial Radiography facility.

There is a well-developed regulatory framework for nuclear and radiological emergencies in Indonesia. However, the self-assessment and information gathered during the mission indicated that a comprehensive national hazard assessment should be performed to provide a basis for a graded approach in preparedness for and response to nuclear and radiological emergencies.

[1] Chemical, biological, radiological and explosive.
[2] Nuclear, biological and chemical (NUBIKA).

The EPREV team considers it a priority for Indonesia to establish a nuclear and radiological emergency management system, at the national level, and to set it up in a way that is integrated into the national all-hazards emergency management system. It was also found by the EPREV experts that many roles and responsibilities for emergency preparedness and response are shared among many organizations, and there are informal cooperation arrangements that need to be formalized.

Other areas for improvement included: finalizing and implementing the national nuclear emergency response plan, establishing emergency action levels, communicating with the public throughout an emergency and introducing systematic training.

The EPREV team also recommended that the arrangements that are in place for emergency planning category III and IV facilities and activities required improvement with regard to supporting off-site response organizations.

In the context of financial resources, it was found that BNPB should consider that additional resourcing may be required for the local disaster management agencies.

For operating and response organizations, the review team found that additional improvements were required for analysis after an emergency, and that programmes ensuring the availability and reliability of resources necessary for an effective response should be adopted.

The EPREV team also noted a number of good practices in Indonesia's EPR arrangements that other Member States may consider. Indonesia demonstrates a significant commitment to nuclear and radiological emergency preparedness and response by regularly conducting large scale field exercises. Similarly, innovative communications strategy with helpers has been stablished, which will support involvement of helpers for coordinated response during a nuclear or radiological emergency; and a system has been created to classify and notify about emergencies at the hospital level.

In some cases, improvements in line with the detailed findings are already being undertaken by BAPETEN and relevant organizations. In other cases, the Government of Indonesia will need to adopt an action plan to address the recommendations and suggestions.

This report serves as the final record of the EPREV mission. The IAEA will continue to work with Indonesia through existing projects to assist in further improving the country's EPR arrangements. It is expected that the Government of Indonesia will invite the IAEA for an EPREV follow-up mission to review the implementation of the recommendations and suggestions.

1. INTRODUCTION

1.1. Objective and Scope

The purpose of this EPREV mission was to conduct a review of the Indonesian emergency preparedness and response (EPR) arrangements and capabilities. This EPREV reviewed all hazards applicable for EPR arrangements in the country, and it can be considered a full-scope mission. The review was carried out by a comparison of Indonesia's existing arrangements against the IAEA safety standards on EPR.

It is expected that this EPREV mission will facilitate further improvements in Indonesia's EPR arrangements and those of other Member States through the knowledge gained and experiences shared between Indonesia and the EPREV team; through the evaluation of the effectiveness of Indonesia's arrangements and capabilities; and through its good practices.

The key objectives of this mission were to further enhance Indonesia's radiation emergency preparedness and response:

- Providing Indonesia with an opportunity for self-assessment of its activities against IAEA safety standards on EPR;
- Providing Indonesia with a review of its EPR arrangements;
- Providing Indonesia with an objective evaluation of its EPR arrangements with respect to IAEA safety standards and guidelines on EPR;
- Contributing to the harmonization of emergency prepradeness and response approaches among IAEA Member States;
- Promoting the sharing of experience and the exchange of lessons learned;
- Providing reviewers from IAEA Member States and the IAEA staff with opportunities to broaden their experience and knowledge of EPR;
- Providing key Indonesian staff with an opportunity to discuss their practices with reviewers who have experience with different practices in the same field;
- Providing Indonesia with recommendations and suggestions for improvement; and
- Providing other States with information regarding good practices identified in the course of the review.

1.2. Preparatory work and review team

At the request of the Government of Indonesia, a preparatory meeting for an EPREV mission was conducted from 5 to 6 April 2016. The preparatory meeting was carried out by the appointed team leader Mr Toshimitsu Homma, and the IAEA EPREV team Representative, Mr Peter Zombori.

The EPREV preparatory team held discussions regarding EPR (and policy issues) with the Indonesian Liasion Officer, Mr Abdul Qohhar, and key organizations in the host country. These discussions resulted in agreement on the scope of the forthcoming EPREV mission.

Mr Qohhar made presentations on the national context, the current status of EPR in Indonesia and the self-assessment results to date.

IAEA staff presented the EPREV principles, process and methodology. This was followed by a discussion on the tentative work plan for the implementation of the EPREV mission in Indonesia scheduled for September 2016.

The composition of the proposed EPREV review team (experts from Member States to be involved in the review) was discussed, and the size of the team was tentatively confirmed. Logistics, including meeting and work space; identification of the counterparts and the Liaison Officer; proposed site visits; and lodging and transportation arrangements were also addressed. All relevant aspects were included in the agreed Terms of Reference (TOR).

The Liaison Officer for the EPREV mission was Mr Mohammad Ridwan. The IAEA team coordinator of the EPREV mission was Mr Rodrigo Salinas.

At the end of July 2016, Indonesia provided the IAEA (and the review team) with the advance reference material (ARM) for the review, including the self-assessment results submitted on the IAEA's Emergency Preparedness and Response Information Management System (EPRIMS). In preparation of the mission, the IAEA review team members conducted a review of the ARM and provided their initial comments to the IAEA team coordinator prior to the commencement of the EPREV mission.

1.3 Reference for the Review

IAEA Safety Standards Series Nos. GSR Part 7 (Preparedness and Response for a Nuclear or Radiological Emergency) [1] (hereinafter referred to as GSR Part 7); GSG-2 (Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency) [2]; and GS-G-2.1 (Arrangements for Preparedness for a Nuclear or Radiological Emergency) [3] were used as review references.

The terms used in this report are consistent with those found in the IAEA Safety Standards referred to in the above paragraph.

2. DETAILED FINDINGS ON GENERAL REQUIREMENTS

2.1. Emergency management system

The emergency management system of Indonesia is set out in a number of documents, including:

- Act No. 24 of 2007 on Disaster Management;
- Act. No. 10 of 1997 on Nuclear Energy;
- Government Regulations (GR) No. 33 of 2007 on Safety of Ionizing Radiation and Security of Radioactive Sources;
- GR No. 21 of 2008 on Disaster Management;
- GR No. 54 of 2012 on the Safety and Security of Nuclear Installations;
- GR No. 58 of 2015 on Radiation Safety and Security in Transportation of Radioactive Source; and
- Nuclear Energy Regulatory Agency of Indonesia (BAPETEN) Chairman's Regulation (BCR) No. 1 of 2010 on Nuclear Emergency Preparedness and Response.

While the Act No. 24 implicitly acknowledges nuclear and radiological emergencies under the section for technology failure, a nuclear emergency management system has not explicitly been defined, developed and integrated into the all-hazards emergency management system of the Badan Nasional Penanggulangan Bencana (National Disaster Management Agency — BNPB).

Recommendation 1
Observation: An emergency management system for nuclear and radiological emergency preparedness and response has not been fully established.
Basis for recommendation: GSR Part 7, para. 4.1, states: "The government shall ensure that an emergency management system is established and maintained on the territories of and within the jurisdiction of the State for the purposes of emergency response to protect human life, health, property and the environment in the event of a nuclear or radiological emergency."
Recommendation: The Government should complete the establishment of a national emergency management system for nuclear and radiological emergency preparedness and response.

BAPETEN pro-actively drafted a National Nuclear Emergency Response Plan (NNERP), which establishes the National Nuclear Emergency Response Organization (NNERO) for response to nuclear and radiological emergencies. The draft plan has been exercised over a number of years with the involvement of multiple response organizations, including organizations with a key role in nuclear

and radiological emergencies, such as BNPB and the BATAN. Furthermore, throughout the review, many operating organizations and response organizations made reference to the draft NNERP. This indicated to the reviewers that there is a general acceptance of the draft plan.

In finalizing the draft NNERP, an integrated approach should be followed which will be consistent with an all-hazards approach. In order to give effect to the finalized plan, a mechanism for its endorsement, coordinated by BNPB and supported by all response organizations, should be established.

Recommendation 2
Observation: The Government has not finalized and given legislative and operational effect to the draft NNERP.
Basis for recommendation: GSR Part 7, para. 4.3, states: "The emergency management system shall be integrated, to the extent practicable, into an all-hazards emergency management system …."
Recommendation: Recognizing the national coordinating role of BNPB, and in cooperation with BAPETEN and other relevant organizations, the Government should, as a matter of priority, finalize the draft NNERP, using an integrated all-hazard approach, and ensure its implementation.

BNPB has a funding scheme for the preparedness, response and recovery phases of an emergency. However, the EPREV team identified that there is a significant lack of financial resources for the Badan Penanggulangan Bencana Daerah (Local Disaster Management Agency — BPBD) within the South Tangerang precinct, which assumes critical first response roles if a nuclear and radiological emergency should occur at Serpong (refer to 2.3).

Suggestion 1
Observation: There is lack of financial resources for local authorities for the preparation of nuclear emergency arrangements.
Basis for suggestion: GSR Part 7, para. 4.8, states: "The government shall ensure that response organizations, operating organizations and the regulatory body have the necessary human, financial and other resources, in view of their expected roles and responsibilities and the assessed hazards, to prepare for and to deal with both radiological and non-radiological consequences of a nuclear or radiological emergency, whether the emergency occurs within or beyond national borders."
Suggestion: BNPB should consider providing the necessary financial support for local response organizations to establish nuclear or radiological emergency arrangements.

2.2. Roles and responsibilities

According to the Act No. 24, BNPB has been established to coordinate the planning and implementation of disaster management activities in an integrated manner and to implement disaster management for all defined phases of an emergency, including disaster prevention, preparedness, emergency response and recovery. GR No. 54 requires that a nuclear emergency plan at the national level be drafted by BNPB, in cooperation with BAPETEN and other ministries. At the local level, each BPBD is

established and is requested to draft a provincial nuclear emergency plan in cooperation with the respective licensee, BAPETEN and other institutions. At the installation level, the licensees are requested to develop an emergency plan.

BAPETEN is the sole regulatory body in Indonesia with regard to nuclear and radiological facilities and activities. BCR No. 1 of 2010 provides further details about the obligation of licensees. During the emergency response, BAPETEN assumes a role in recommending protective actions and other response actions to the local and national governments. BAPETEN may be involved in the implementation of response measures in exceptional cases such as unknown sources or transboundary effects.

In 2015, BAPETEN prepared the draft NNERP, which describes the roles, responsibilities and operations of the off-site response organizations.

Recommendation 3
Observation: BNPB has not established and maintained a national nuclear and radiological emergency plan that clearly defines all roles and responsibilities.
Basis for recommendation: GSR Part 7, para. 4.9, states: "The government shall ensure that operating organizations, response organizations and the regulatory body establish, maintain and demonstrate leadership in relation to preparedness and response for a nuclear or radiological emergency."
Recommendation: BNPB should demonstrate leadership and coordinate with the licensee, BAPETEN and other organizations the implementation of a national nuclear and radiological emergency plan that clearly defines all roles and responsibilities.

2.3. Hazard assessment

BAPETEN has performed a hazard assessment, taking into account only the inventory of the facilities and significant sources used within Indonesia. For nuclear installations, this activity was performed during the safety analysis report (SAR) as part of the licencing process. Identification of initiating events — such as accidents, natural hazards and deliberate attacks — has been considered through the review of the original design basis analysis and the design basis threat, respectively. Moreover, BATAN conducts topographical and demographical reviews of the area surrounding the Serpong site every five years.

Facilities in Emergency Preparedness Category (EPC) I do not exist in Indonesia. (EPCs are defined in table 1 of GSR Part 7). There is one facility in EPC II, the 30 MW research reactor, at the Serpong site. The site includes a radioactive waste management facility and a spent fuel storage facility, which makes it a multi-facility site. The site is operated by BATAN. There are other numerous facilities and activities located throughout the country in EPCs III and IV. There are no facilities in neighbouring countries that result in hazards from EPC V.

The ARM provided to the EPREV team prior to the mission acknowledged that a comprehensive national hazard assessment had not yet been conducted by Indonesia.

Recommendation 4
Observation: While individual facilities have conducted hazard assessments, a comprehensive hazard assessment has not been conducted at the national level for nuclear and radiological emergencies.
Basis for recommendation: GSR Part 7, para. 4.20, states: "The government shall ensure that for facilities and activities, a hazard assessment on the basis of a graded approach is performed. The hazard assessment shall include consideration of: (a) Events that could affect the facility or activity, including events of very low probability and events not considered in the design; (b) Events involving a combination of a nuclear or radiological emergency with a conventional emergency such as an emergency following an earthquake, a volcanic eruption, a tropical cyclone, severe weather, a tsunami, an aircraft crash or civil disturbances that could affect wide areas and/or could impair capabilities to provide support in the emergency response; (c) Events that could affect several facilities and activities concurrently, as well as consideration of the interactions between the facilities and activities affected; (d) Events at facilities in other States or events involving activities in other States."
Recommendation: The Government should conduct a comprehensive national hazard assessment for all facilities and activities.

2.4. Protection strategy for an emergency

BAPETEN has developed regulatory guidance on the use of operational interventional levels (OILs) generally based on GSG-2 [2]. Current BAPETEN guidance also refers to response time objectives (RTOs), consistent with IAEA Safety Guide GS-G-2.1 [3].

Based on the dose rates, in GR No. 54 of 2012, the declaration of provincial and national emergencies is defined for a detection of 5 and 500 μSv/h, respectively, at the site boundary, occurring for a continuous duration of 10 minutes. This suggests that the execution of the protection strategy, specifically the initiation of urgent protective actions and other response actions, may be delayed.

For BATAN EPC II and III facilities, a range of plant parameters and conditions is monitored within the research reactor control room and the waste management facility control room. Moreover, a range of observables is continuously monitored from the command centre. However, these parameters are not used to establish emergency action levels (EALs), as BATAN only follows the GR No. 54 requirement of 5 and 500 μSv/h for emergency declarations.

Recommendation 5
Observation: EALs have not been developed and implemented by BATAN.
Basis for recommendation: GSR Part 7, para. 4.28, states: "Development of a protection strategy shall include, but shall not be

Recommendation 5
limited to, the following: **…** (4) Once the protection strategy has been justified and optimized and a set of national generic criteria has been developed, pre-established operational criteria (conditions on the site, emergency action levels (EALs) and operational intervention levels (OILs)) for initiating the different parts of an emergency plan and for taking protective actions and other response actions shall be derived from the generic criteria. Arrangements shall be established in advance to revise these operational criteria, as appropriate, in the course of a nuclear or radiological emergency, with account taken of the prevailing conditions as they evolve."
Recommendation: BAPETEN should require licensees to develop EALs to be used as an essential part of the protection strategy.

The consequence modeling presented by BATAN does not include doses due to inhalation, deposition, re-suspension, cloud shine and other exposure pathways, and the dose contributions could not be attributed to specific radionuclides. The potential impact of a release from facilities at BATAN also did not consider exposure to different population groups or their sensitivities. Without detailed consequence assessments, the developed protection strategies may not be appropriate.

Suggestion 2
Observation: Consequence assessments which identify dose pathways, specific radionuclides contributions and different exposure groups and their sensitivities did not form part of the basis to justify and optimize protection strategies by BATAN.
Basis for suggestion: GSR Part 7, para. 4.27, states: “The government shall ensure that, on the basis of the hazards identified and the potential consequences of a nuclear or radiological emergency, protection strategies are developed, justified and optimized at the preparedness stage for taking protective actions and other response actions effectively in a nuclear or radiological emergency to achieve the goals of emergency response.”
Suggestion: BATAN should consider reassessing the potential consequences of nuclear and radiological emergencies at all its facilities by using comprehensive analysis tools to ensure that the protection strategy is justified and optimized.

3. DETAILED FINDINGS ON FUNCTIONAL REQUIREMENTS

3.1. Managing emergency response operations

For conventional emergencies, an integrated command system is currently being implemented, and 6 out of 34 provincial disaster management organizations have been completed. An indication that implementation is progressing well is the integration with nuclear security that was observed through joint training and exercises. Similarly, operational command and the transfer of command have been demonstrated during exercises and real world events and are codified in plans.

The response to radiological emergencies is informally managed in line with responses to conventional emergencies, with the additional involvement of specialized agencies such as BAPETEN. The police are in charge at the scene, with support from fire fighters and paramedics, as with a conventional emergency. Specialized radiological support is provided by the Army NBC Detachment (NUBIKA) and the Police CBRE (POLRI) units.

At the Serpong nuclear site, EPR arrangements are in place for each individual facility. There is also a centralized command centre for the entire site, which coordinates response on-site, as well as with off-site authorities. On-site and off-site responsibilities for response are clearly delineated and understood.

However, for nuclear and radiological emergencies, the response is based on informal arrangements with BAPETEN and BATAN, which is to improve in the future by the intended implementation of the common command and control system.

Recommendation 6
Observation: Emergency response operations for all types of emergencies are not managed by a unified command and control system at all levels.
Basis for recommendation: GSR Part 7, para. 5.7, states: “Arrangements shall be made for the establishment and use of a clearly specified and unified command and control system for emergency response under the all-hazards approach as part of the emergency management system ….”
Recommendation: BNPB should implement a unified command and control system for nuclear and radiological emergencies, preferably as part of the system for all types of emergencies.

3.2. Identifying, notifying and activating

There is no universal emergency phone number for the public in Indonesia. Each responding authority uses its own numbers: police 110 and 112 (SMS 1717), ambulance and rescue 118, fire 113 and medical emergencies 119. Personnel at call centres are not trained to identify information on a radiological emergency, nor are they aware of notification procedures in such a case.

Regulations from BAPETEN require immediate notification of a nuclear or radiological emergency. Although not yet formally approved, the NNERP describes comprehensive notification and activation arrangements for an emergency. At

BATAN, an emergency classification system has been established. There are three levels of emergency conditions, namely: Alert, Site Area and General. Currently, BATAN relies solely on the detection of 5 and 500 μSv/h for 10 minutes for the identification and notification of site area and general emergency, respectively. Triggers for alert levels are not clear (refer to Recommendation 5).

For emergencies at activities and locations in EPC IV, identification will be determined by response teams from BAPETEN, NUBIKA and POLRI; by having trained medical professional assess radiation induced injuries; and by portal detection from border protection officers and scrap metal processing facilities.

During interviews with the staff at Siloam hospital, it was identified that a very simple yet effective emergency notification system had been employed. All staff wore a detailed and codified emergency reference card, attached to the rear of their identification card, which enabled the rapid classification and notification of an emergency, including nuclear or radiological emergencies, based on relevant observable parameters and/or features. It was explained to the reviewers that this reference card was used to advise the command centre when a range of safety, security and natural hazard emergencies had commenced.

Good practice 1
Observation: Siloam hospital has implemented an innovative approach to classify and notify the central command centre of a range of safety, security and environmental hazard emergencies, including radiological emergencies, through the use of a codified reference card attached to all staff identification cards.
Basis for good practice: GSR Part 7, para. 6.22, states: "Adequate tools, instruments, supplies, equipment, communication systems, facilities and documentation (such as documentation of procedures, checklists, manuals, telephone numbers and email addresses) shall be provided for performing the functions specified …. These items and facilities shall be selected or designed to be operational under the conditions (such as radiological conditions, working conditions and environmental conditions) that could be encountered in the emergency response, and to be compatible with other procedures and equipment for the response (e.g. compatible with the communication frequencies used by other response organizations), as appropriate. These support items shall be located or provided in a manner that allows their effective use under the emergency conditions postulated."
Good practice: Siloam hospital has implemented an innovative system for the classification and notification of emergencies, including radiological emergencies.

3.3. Taking mitigatory actions

The BATAN Serpong facility has equipment and personnel on-site in order to conduct mitigatory actions to prevent the escalation of an emergency, return the facility to a safe and stable state and minimize the potential for radioactive releases into the environment. This includes on-site fire services, on-site pumps and industrial sized

hoses and alternate sources of water supplies. Plant equipment includes heavy lifting machinery and apparatuses and other supporting equipment to for carrying out mitigatory actions.

Off-site, the BPBD presented a range of firefighting vehicles and additional water collection, pumping, storing and delivery systems.

BATAN has arrangements in place and has gained experience through exercises that have tested how its radiation protection teams provide technical assistance to supporting off-site organizations. On-site, integrated safety and security systems ensure the prompt access to the facility grounds, and radiation experts provide radiation protection measures. It is possible that additional capabilities may be needed, given the postulated initiating events at BATAN; this may include, for example, damage control capabilities from military construction engineers or additional water storage facilities.

BAPETEN has established a 24/7 on-call assessment and advice capability to advise first responders on radiation protection and mitigatory actions in the event of a dangerous source that has been discovered, lost or stolen. BAPETEN's capabilities can also be escalated to a deployable mobile emergency search team.

3.4. Taking urgent protective actions and other response actions

Article 38, BCR No. 1 of 2010, obliges licensees to take urgent protective actions for workers and the public, including evacuation, sheltering and iodine thyroid blocking.

Similarly, Article 7, BCR No. 1 of 2010, obliges licensees under EPC II to develop emergency planning zones and submit them for approval. These zones are usually specified in legislation or in a national plan. Once this has been achieved, appropriate arrangements, such as ensuring the triggering of alarms, providing instructions to the public and informing people in advance (by a leaflet, for example), can be implemented.

The emergency planning zones for the Serpong site include a precautionary action zone (PAZ), an urgent protective action planning zone (UPZ) and a food restriction planning zone. However, the emergency planning zones were reported inconsistently to the EPREV team (BATAN: UPZ=2km, BAPETEN: UPZ=3km).

Recommendation 7
Observation: The explanation of emergency planning zones between BATAN and BAPETEN differed.
Basis for recommendation: GSR Part 7, para. 5.38, states: "For facilities in category I or II, arrangements shall be made for effectively making decisions on and taking urgent protective actions, early protective actions and other response actions off the site in order to achieve the goals of emergency response, on the basis of a graded approach and in accordance with the protection strategy. The arrangements shall be made with account taken of the uncertainties in and limitations of the information available when protective actions and other response actions have to be taken to be effective, and shall

Recommendation 7
include the following: (a) The specification of off-site emergency planning zones and emergency planning distances for which arrangements shall be made at the preparedness stage for taking protective actions and other response actions effectively …"
Recommendation: The Government should ensure that emergency planning zones are clearly defined and established.

BAPETEN responds to emergencies related to orphan sources and emergencies related to contamination resulting from unknown sources. POLRI units respond to emergencies triggered by malicious/security events within national borders, while NUBIKA is responsible for such events originated in other countries which may affect Indonesia. NUBIKA has developed a range of capabilities in order to take response actions. POLRI and NUBIKA also have very well established informal cooperation arrangements. The detection, monitoring and radiological knowledge of POLRI are not adequate for the purposes of response actions during nuclear or radiological emergency (Recommendation 8).

Although organizations expressed an awareness of existing transient and special population groups within the current emergency planning zones and emergency planning distances, further work is required to incorporate these locations into the EPR arrangements to ensure that appropriate protective actions and other response actions can be effectively implemented.

Additionally, the current geospatial consequence models from BATAN did not highlight any non-radiological hazards arising from an emergency.

3.5. Providing instructions, warnings and relevant information to the public

Local authorities at the Serpong site provide information to the public about EPR on a regular basis by conducting outreach activities such as visiting schools.

At the Serpong site, the operator can trigger a siren alarm that covers the site and also the emergency planning zone. However, no arrangements are in place for providing instructions to the public. Some 75 000 people live in the emergency planning zone. Limited arrangements are in place in Indonesia for warning and providing instructions to the public in conventional emergencies. For certain natural disasters, e.g. flooding or tsunamis, notifications are issued by the meteorological service. The intention is to develop a 'multi warning system' to alert the public of all types of emergencies.

Suggestion 3
Observation: There are limited arrangements in place for providing instructions to the public during an emergency.
Basis for suggestion: GSR Part 7, Requirement 10, states: "The government shall ensure that arrangements are in place to provide the public who are affected or are potentially affected by a nuclear or radiological emergency with information that is necessary for their protection, to warn them promptly and to instruct them on actions to be taken."

Suggestion 3
Suggestion: The Government should ensure that arrangements are in place for providing instructions to the public during a nuclear or radiological emergency.

3.6. Protecting emergency workers and helpers in an emergency

While the regulation includes provisions for protecting emergency workers (e.g. Article 42, BCR No. 1 of 2010) it was found that dosimetry and personal protective equipment is only available for emergency workers who are employees of the licensee. For example, at Serpong and PT. Rel-ion, there are no arrangements for providing dosimetry services or detection equipment to responders such as fire fighters entering the site from off-site.

Recommendation 8
Observation: There are no arrangements for protecting off-site emergency workers and helpers.
Basis for recommendation: GSR Part 7, Requirement 11, states: “The government shall ensure that arrangements are in place to protect emergency workers and to protect helpers in a nuclear or radiological emergency.”
Recommendation: BNPB, in collaboration with BAPETEN, should establish appropriate arrangements for protecting emergency workers and helpers.

3.7. Medical response

Recommendation 9
Observation: There is limited awareness among general medical personnel and emergency medical staff of radiation clinical symptoms.
Basis for recommendation: GSR Part 7, para. 5.63, states: “Arrangements shall be made for medical personnel, both general practitioners and emergency medical staff, to be made aware of the clinical symptoms of radiation exposure, and of the appropriate notification procedures and other emergency response actions to be taken if a nuclear or radiological emergency arises or is suspected."
Recommendation: The Ministry of Health (MoH) should make arrangements, such as the introduction of an outreach programme, to ensure that general medical personnel and emergency medical staff are aware of radiation clinical symptoms.

BCR No. 1 of 2010, Article 46, obliges licensees to provide first aid, dose estimation, transport services and medical treatment to workers and the public.

At the national level, MoH is responsible for the establishment of emergency medical response in radiation emergencies. Regulations on nuclear or radiological emergencies have not yet been established. However, MoH has designated three hospitals — Hasan Sadikin Hospital in Bandung, Dr. Sardjito Hospital, Yogyakarta in Yogyakarta and Fatmawati Hospital in Jakarta, all of which are close to a research reactor — for the treatment of contaminated or overexposed persons.

Fatmawati Hospital in Jakarta has the dedicated capability to receive contaminated and overexposed patients through a separate entrance. The hospital has limited equipment for initial reception and actions, including personal protective equipment, survey meters, personal dosimeters and decontamination capabilities with water. There are three beds in the decontamination area. Based on the postulated events in the hazard assessment, this facility cannot currently treat the number of patients which may present with injuries.

Long term follow-up of the radiation victims for identification of radiation induced health effects has not been established.

Recommendation 10
Observation: The arrangements to provide initial treatment of radiation injuries, or a contaminated patient, are limited.
Basis for recommendation: GSR Part 7, para. 5.67, states: "Arrangements shall be made to identify individuals with possible contamination and individuals who have possibly been sufficiently exposed for radiation induced health effects to result, and to provide them with appropriate medical attention, including longer term medical follow-up. …"
Recommendation: MoH should ensure that the designated hospitals for radiation emergencies have arrangements in place to be able to provide initial treatment to patients who are contaminated or have been overexposed to radiation.

3.8. Communicating with the public throughout an emergency

BCR No 1 of 2010 requires licensees to provide information to the public. The use of a spokesperson is recommended. For the Serpong site, public communication is handled by the common command centre for all facilities on site. BNPB has no dedicated arrangements in place for public communication during an emergency. No arrangements are in place for common communication for the off-site authorities in case of a nuclear or radiological emergency. BAPETEN has developed public communication guidelines, which are a good example of supporting documentation on the issue. However, no further practical arrangements or coordination exist.

Recommendation 11
Observation: Off-site authorities have no practical arrangements for communication with the public. There is no coordination between BNPB and BAPETEN in this regard.
Basis for recommendation: GSR Part 7, para. 5.69, states: "Arrangements shall be made for providing useful, timely, true, clear and appropriate information to the public in a nuclear or radiological emergency, with account taken of the possibility that the usual means of communication might be damaged in the emergency or by its initiating event (e.g. by an earthquake or by flooding) or overburdened by demand for its use. These arrangements shall also include arrangements for keeping the international community informed, as appropriate. These arrangements shall take into account the need to protect sensitive

Recommendation 11
information in circumstances where a nuclear or radiological emergency is initiated by a nuclear security event. Communication with the public in a nuclear or radiological emergency shall be carried out on the basis of a strategy to be developed at the preparedness stage as part of the protection strategy. Arrangements shall be made to adjust this strategy in the emergency response on the basis of prevailing conditions."
Recommendation: BNPB should develop, together with BAPETEN, a strategy for communicating with the public during a nuclear or radiological emergency, to be further elaborated in practical arrangements.

3.9. Taking early protective actions

It was observed that the criteria and the responsibilities for conducting restrictions on food, water and commodities were not established. It was also observed that the practical arrangements in place only considered off-site monitoring to be performed by the operator.

Recommendation 12
Observation: The full range of requirements for conducting early protective actions have not been developed or implemented.
Basis for recommendation: GSR Part 7, Requirement 14, states: "The government shall ensure that arrangements are in place to take early protective actions and other response actions effectively in a nuclear or radiological emergency."
Recommendation: The Government should make appropriate arrangements to ensure that effective early protective actions (in particular, restrictions on water, food and commodities) are implemented in an emergency.

3.10. Managing radioactive waste in an emergency

Act No.10 designates BATAN to perform national radioactive waste management. However, the act does not address waste arising from nuclear or radiological emergencies.

BATAN has an infrastructure with significant capacity for handling solid and liquid waste. However, there are no national arrangements at BATAN for handling waste that may be generated during a nuclear or radiological emergency.

Recommendation 13
Observation: There are no legislative provisions, and there are no arrangements in place, for managing radioactive waste arising from nuclear or radiological emergencies.
Basis for recommendation: GSR Part 7, Requirement 17, states: "The government shall ensure that adequate arrangements are in place to benefit from, and to contribute to the provision of, international assistance for preparedness and response for a nuclear or radiological emergency."
Recommendation: The Government should adopt a national policy on

Recommendation 13
managing radioactive waste arising from nuclear or radiological emergencies, to be implemented through appropriate arrangements.

3.11. Mitigating non-radiological consequences

Article 53 of GR No. 21 addresses the protection of vulnerable groups through rescue, health care and psychosocial services. Article 54 addresses the immediate recovery of essential facilities and infrastructure. BNPB has a broad range of capabilities which address many of the requirements for non-radiological consequences arising from conventional emergencies. These include psychological and social support, economic and welfare arrangements and cultural and infrastructure recovery capabilities, which could be considered in the development of the protection strategy.

3.12. Requesting, providing and receiving international assistance

Indonesia is party to the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency. BAPETEN has the role of National Competent Authority both for domestic emergencies and emergencies abroad; it also assumes the role of national warning point.

While BAPETEN's responsibilities in this regard are explicitly identified, the national arrangements to request international assistance during emergencies are not clearly defined.

Suggestion 4
Observation: Current national arrangements to request assistance are not integrated into the national emergency management system.
Basis for suggestion: GSR Part 7, para 5.94, states: "Arrangements shall be put in place and maintained for requesting and obtaining international assistance from States or international organizations and for providing assistance to States (either directly or through the IAEA) in preparedness and response for a nuclear or radiological emergency, on the basis of international instruments (e.g. the Assistance Convention …), bilateral agreements or other mechanisms. These arrangements shall take due account of compatibility requirements for the capabilities to be obtained from and to be rendered to different States so as to ensure the usefulness of these capabilities."
Suggestion: BAPETEN should consider integrating into the national emergency management system the arrangements to request, as required,international assistance in case of nuclear or radiological emergencies.

Indonesian authorities are currently considering the option to register national capabilities into the IAEA's Response and Assistance Network (RANET). This will allow Indonesia to be able to provide assistance to other countries if requested, should local conditions allow for this assistance to be provided.

3.13. Terminating an emergency

Regulations for the post-disaster period of conventional emergencies have been established in GR No. 21 of 2008 concerning disaster management by BNPB. BCR No. 1 of 2010 requires procedures to be developed by the licensee, including the provision of statements about when an emergency has ended.

There are no specific arrangements for terminating a nuclear or radiological emergency that includes criteria and guidelines, consultation with stakeholders, a public communication strategy or considerations of non-radiological aspects in the regulation.

Recommendation 14
Observation: There are no specific arrangements in place for terminating a nuclear or radiological emergency.
Basis for recommendation: GSR Part 7, para. 5.100, states: "The government shall ensure that, as part of its emergency preparedness, arrangements are in place for the termination of a nuclear or radiological emergency. The arrangements shall take into account that the termination of an emergency might be at different times in different geographical areas. The planning process shall include as appropriate: (a) The roles and functions of organizations; (b) Methods of transferring information; (c) Means for assessing radiological consequences and non-radiological consequences; (d) Conditions, criteria and objectives to be met for enabling the termination of a nuclear or radiological emergency …; (e) A review of the hazard assessment and of the emergency arrangements; (f) Establishment of national guidelines for the termination of an emergency; (g) Arrangements for continued communication with the public, and for monitoring of public opinion and the reaction in the news media; (h) Arrangements for consultation of interested parties."
Recommendation: The Government should ensure that arrangements are in place and are implemented for the termination of a nuclear or radiological emergency, with account taken of the need for the resumption of normal social and economic activity.

3.14. Analysing the emergency and emergency response

Regarding the analysis of the emergency and emergency response to avoid other emergencies and to improve emergency response arrangements, BCR No. 1 of 2010 only requires procedures to be developed by the licensee, including the evaluation and analysis of the emergency causes.

There is no documented process for post-emergency investigation and reporting on lessons learned. For purposes of continuous improvement, the ability to record and document key decisions would greatly assist the ability of Indonesia to analyse the nuclear or radiological emergency and the response that was undertaken.

Recommendation 15
Observation: There are no arrangements in place to analyse the nuclear

Recommendation 15
or radiological emergency and the emergency response.
Basis for recommendation: GSR Part 7, para. 5.102, states: "Arrangements shall be made to document, protect and preserve, in an emergency response, to the extent practicable, data and information important for an analysis of the nuclear or radiological emergency and the emergency response. Arrangements shall be made to undertake a timely and comprehensive analysis of the nuclear or radiological emergency and the emergency response with the involvement of interested parties. These arrangements shall give due consideration to the need for making contributions to relevant internationally coordinated analyses and for sharing the findings of the analysis with relevant response organizations. The analysis shall give due consideration to: (a) The reconstruction of the circumstances of the emergency; (b) The root causes of the emergency; (c) Regulatory controls including regulations and regulatory oversight; (d) General implications for safety, including the possible involvement of other sources or devices (including those in other States); (e) General implications for nuclear security, as appropriate; (f) Necessary improvements to emergency arrangements; (g) Necessary improvements to regulatory control."
Recommendation: The Government should develop capabilities to analyse the nuclear or radiological emergency and key emergency response decisions for the purposes of continuous improvement of national EPR arrangements.

4. DETAILED FINDINGS ON REQUIREMENTS FOR INFRASTRUCTURE

4.1. Authorities for emergency preparedness and response

BAPETEN has full authority in regulating the EPR arrangements of licensees. Submission of an emergency plan by the applicant is a requirement in the licensing process. GR No. 54 and BCR No. 1 of 2010 define authorities and responsibilities for EPR arrangements at local, provincial and national levels.

The assignment of authorities regarding the relevant responsibilities and functions in EPR is discussed in Section 2.2 and Section 3 where relevant.

4.2. Organization and staffing for emergency preparedness and response

Overall, the organization of EPR is specified in the draft NNERP. However, the NNERO established by the NNERP is missing some key functions (for example, public information). Furthermore, NNERO is composed of leading officials of major responding organizations and does not have specific assignments of individuals to particular positions. The BAPETEN emergency team does not have defined positions either. However, the team maintains a 24/7 on-call duty officer.

At the Serpong site, there are defined positions within emergency teams for individual facilities and the command centre but no lists of staff members who would fill the positions. However, the PT. Rel-ion irradiation facility has appropriate arrangements for staffing.

Recommendation 16
Observation: Many response organizations do not have positions defined for their emergency teams or do not have assigned personnel to specific positions where positions exist.
Basis for recommendation: GSR Part 7, para. 6.8, states: "The positions responsible within each operating organization and response organization for performance of the response functions … shall be assigned in the emergency plans and procedures. The positions responsible in each operating organization, in each response organization and in the regulatory body for the performance of activities at the preparedness stage, in accordance with these requirements, shall be assigned as part of the routine organizational structures and shall be specified, as appropriate, in the emergency plans and procedures."
Recommendation: All response organizations should develop position based emergency teams, including the assignment of adequate numbers of personnel to positions.

4.3. Coordination of emergency preparedness and response

The NNERP provides details for the coordination of organizations at the local, provincial and national levels. This has translated into the coordinated conduct of exercises which has involved a range of organizations across Indonesia and abroad. At the Serpong site, there is coordination between on-site and off-site response organizations which includes both, safety and security. Evidence has shown that this coordination was supported by multiple exercises conducted involving off-site

response organizations, including POLRI, NUBIKA and BPBD. Relevant radiological survey data, plant conditions and advice are also shared with BAPETEN and BPBD, as appropriate.

For EPC III facilities and activities in EPC IV, significant gaps exist in the coordination of arrangements and the periodic exercising with off-site response organizations.

Recommendation 17
Observation: Several EPC III facilities and EPC IV licensees have not established coordination arrangements with off-site response organizations.
Basis for recommendation: GSR Part 7, para. 6.12, states: "Arrangements shall be developed, as appropriate, for the coordination of emergency preparedness and response and of protocols for operational interfaces between operating organizations and authorities at the local, regional and national levels, including those organizations and authorities responsible for the response to conventional emergencies and to nuclear security events …. The arrangements shall be clearly documented and the documentation shall be made available to all relevant parties. Arrangements shall be put in place to ensure effective working relationships among these organizations, both at the preparedness stage and in an emergency."
Recommendation: BAPETEN should ensure that all EPC III facilities and EPC IV licensees coordinate their emergency preparedness arrangements with off-site response organizations, where appropriate.

4.4. Plans and procedures for emergency response

For licensees, appropriate requirements and regulations for the development, endorsement and review of plans and procedures have been issued by BAPETEN. Guidance is also provided by BAPETEN in a standardized format for plans and arrangements. Furthermore, in regulatory guide Pedoman Penganggulangan Kedaruatan Radiologi Untuk Pelaksana Tannagp Darurat, a detailed Concept of Operations (CONOPS) is also provided to assist response organizations dealing with radioactive materials out of regulatory control. BAPETEN maintains its own set of emergency procedures for the activation and recall of emergency response staff, but not for its activities as the designated radiation protection and nuclear safety advisor within the NNERP.

BATAN provided comprehensive plans and procedures for emergency response concerning a range of activities to be performed at the facility level, on-site, command centres and off-site.

A range of EPC III and IV operating organizations were visited by the review team. In general, plans and procedures for emergency response focused upon internal arrangements for managing an emergency. Many of the operating organizations relied upon off-site response organizations to perform emergency tasks. The plans were not integrated or coordinated with supporting off-site response organizations.

Recommendation 18
Observation: Emergency plans for many EPC III and IV operating

Recommendation 18
organizations were not integrated or coordinated with supporting off-site response organizations.
Basis for recommendation: GSR Part 7, para. 6.17, states: “Each response organization shall prepare an emergency plan or plans for coordinating and performing their assigned functions as specified … and in accordance with the hazard assessment and the protection strategy.”
Recommendation: BAPETEN should ensure that for EPC III and IV operating organizations, emergency plans are integrated and coordinated with off-site response organizations, where appropriate.

When reviewing the infrastructure at all operating organizations, the reviewers observed common vulnerabilities regarding the physical security systems and their interfaces, which may inhibit or impair the onset of an emergency response. Without entering into details that could be considered as restricted information, evidences were found about the existence of vulnerabilities dealing with in some aspects that could be detrimental for emergency response.. Moreover, the arrangements for emergencies would often create security vulnerabilities when implemented. This suggested that emergency plans and security plans had not been implemented in a way that avoided conflict.

Recommendation 19
Observation: Many EPC III facilities and EPC IV licensees showed significant vulnerabilities regarding the physical protection of dangerous radioactive materials, which may inhibit or impair the onset of an emergency response. Some emergency arrangements would also create security vulnerabilities when implemented.
Basis for recommendation: GSR Part 7, para. 6.17, states “Each response organization shall prepare an emergency plan or plans for coordinating and performing their assigned functions as specified … and in accordance with the hazard assessment and the protection strategy. An emergency plan shall be developed at the national level that integrates all relevant plans for emergency response in a coordinated manner and consistently with an all-hazards approach. Emergency plans shall specify how responsibilities for managing operations in an emergency response are to be discharged on the site, off the site and across national borders, as appropriate. The emergency plans shall be coordinated with other plans and procedures that may be implemented in a nuclear or radiological emergency, to ensure that the simultaneous implementation of the plans would not reduce their effectiveness or cause conflicts. Such other plans and procedures include: (a) Emergency plans for facilities in category I and for areas in category V; (b) Security plans and contingency plans (c) Procedures for the investigation of a nuclear security event, including identification, collection, packaging and transport of evidence contaminated with radionuclides, nuclear forensics and related activities; (d) Evacuation plans; (e) Plans for firefighting”
Recommendation: BAPETEN should ensure that all EPC III facilities and EPC IV licensees address the physical security vulnerabilities of

Recommendation 19
dangerous radioactive materials that may be detrimental for EPR and make arrangements for security and emergency plans in a way that avoids such conflict.

4.5. Logistical support and facilities

With respect to EPC II and III hazards located at BATAN, the reviewers visited a number of on-site and off-site response organizations and facilities which could provide support in an emergency. In many cases, the supporting response organizations and facilities were adequate to ensure that an effective response could be performed during a nuclear or radiological emergency. Heavy plant equipment, instrumentation, protective equipment, manuals, contact lists, fire-fighting vehicles, pumps, hoses, water receptacles and additional diesel generator equipment was available on-site. Internal contamination assessment capabilities and medical health screening services were also available on-site, including advanced decontamination and waste collection and management capabilities.

Off-site fire-fighting vehicles, additional pumps, hoses, water receptacles and diesel generators were also available. Moreover, when reviewing the specific capabilities available at the BPBD, it was identified that large quantities of shelter and food supplies were also available. Additional psychological support services and other conventional capabilities, such as logistics and communications, were identified at the BNPB, although arrangements had not been made to enable these services for use in nuclear or radiological emergencies.

With respect to command centre infrastructure, it was noted that response organizations maintained limited systems of communication, which are vulnerable to overload during an emergency. It was recognized that both organizations may benefit from the use of other technologies — such as satellite communications — which should also be configured to be compatible with each other for use in an emergency.

Suggestion 5
Observation: Response organizations utilize limited modes of communication between their respective operations centres that are vulnerable to overload and failure during an emergency.
Basis for suggestion: GSR Part 7, para. 6.22, states: "Adequate tools, instruments, supplies, equipment, communication systems, facilities and documentation (such as documentation of procedures, checklists, manuals, telephone numbers and email addresses) shall be provided for performing the functions specified …. These items and facilities shall be selected or designed to be operational under the conditions (such as radiological conditions, working conditions and environmental conditions) that could be encountered in the emergency response, and to be compatible with other procedures and equipment for the response (e.g. compatible with the communication frequencies used by other response organizations), as appropriate. These support items shall be located or provided in a manner that allows their effective use under the emergency conditions postulated."
Suggestion: Response organizations should consider the diversification of their communications systems to ensure that immediate, reliable and

compatible means of communication are available during an emergency.

Off-site coordination by BPBD and local helpers during an emergency is maintained through an innovative practice which uses an access controlled social media service. The BPBD can rapidly issue general instructions and information about an emergency to helpers.

Good practice 2
Observation: The BPBD has implemented an innovative social media application in order to rapidly communicate with local helpers within the South Tangerang precinct. This social media application allows for the immediate issue of general instructions and information about any emergency, including a nuclear or radiological emergency.
Basis for good practice: GSR Part 7, para. 6.22, states: "Adequate tools, instruments, supplies, equipment, communication systems, facilities and documentation (such as documentation of procedures, checklists, manuals, telephone numbers and email addresses) shall be provided for performing the functions specified …."
Good practice: BPBD has implemented an innovative communications strategy with helpers that will support a coordinated response during a nuclear or radiological emergency.

4.6. Training, drills and exercises

There is a dedicated CBRN capacity building centre — the Indonesia Centre of Excellence on Nuclear Security and Emergency Preparedness (I-CoNSEP) — which, among other functions, also serves as a training facility. A number of CBRN exercises have been organized for response personnel in collaboration with Canada, the United States of America and Australia. Nuclear security officers have initial and ongoing radiation safety training and also participate in exercises.

The PT. Rel-ion irradiation facility conducts regular training, which includes responses to a radiation emergency. The Siloam hospital conducts regular training in a systematic manner. Training activities have occurred every 4 months, although do not include drills on nuclear or radiological emergency. The Dahrmais hospital conducts drills, but there is a lack of training. The Fatmawati hospital does not have systematic training.

There is a lack of training on radiological emergency response for the local authorities at the Serpong site. The same is true for the Police, who have in the past conducted several exercises but have not had any recent training on radiological emergency response. Similarly, BNPB conducts many kinds of disaster training courses in its training centre, but not for radiological emergency response. The staff only participates in exercises organized by BAPETEN and BATAN.

Recommendation 20
Observation: Training for nuclear and radiological emergencies is conducted by some response organizations; however, it is not performed systematically and not all response organizations are covered.
Basis for recommendation: GSR-Part 7, Requirement 6.28, states: "The

Recommendation 20
operating organization and response organizations shall identify the knowledge, skills and abilities necessary to perform the functions specified …. The operating organization and response organizations shall make arrangements for the selection of personnel and for training to ensure that the personnel selected have the requisite knowledge, skills and abilities to perform their assigned response functions. The arrangements shall include arrangements for continuing refresher training on an appropriate schedule and arrangements for ensuring that personnel assigned to positions with responsibilities in an emergency response undergo the specified training."
Recommendation: BNPB, in cooperation with relevant organizations, should systematically provide training on nuclear and radiological emergency response to all responding organizations.

BAPETEN has conducted large scale national exercises based on security events: an RDD[3] exercise in 2005, a radioactive material sabotage exercise in 2010 and nuclear material sabotage exercise in 2013.

Indonesia has an extensive exercise regime covering a range of safety and security aspects of EPR. The frequency of exercises is well defined in the regulations, covering provincial, local and national levels. The exercise regime includes numerous large scale exercises with a large number of players in the field.

Good practice 3
Observation: Indonesia has an extensive exercise regime for large scale field exercises at local, provincial and national levels.
Basis for good practice: GSR Part 7, para. 6.30, states: "Exercise programmes shall be developed and implemented to ensure that all specified functions required to be performed for emergency response, all organizational interfaces for facilities in category I, II or III, and the national level programmes for category IV or V are tested at suitable intervals. These programmes shall include the participation in some exercises of, as appropriate and feasible, all the organizations concerned, people who are potentially affected, and representatives of news media. The exercises shall be systematically evaluated … and some exercises shall be evaluated by the regulatory body. Programmes shall be subject to review and revision in the light of experience gained…."
Good practice: Indonesia is demonstrating commitment to nuclear and radiological emergency preparedness and response by regularly conducting large scale field exercises.

However, most of the exercises are field exercises that do not have concrete objectives or clearly defined injects and expected performance of the players.

BAPETEN maintains an annual training plan for EPR. However, it is limited to exercises, which are conducted three times per year. There is no systematic approach to training.

[3] Radiological dispersal device ('dirty bomb').

4.7. Quality management

There is a quality management system in place at the facilities of BATAN, which is required by regulations. The Siloam and Dahrmais hospitals both have mature quality management systems in place. The PT. Rel-ion irradiation facility has an ISO 9001 certified quality managements system, but EPR is not part of it. Similarly, the industrial radiography facility has a quality management system in place, but emergency preparedness is not covered.

BAPETEN has not implemented a quality management system for EPR. A limited number of standard operating procedures exists for the BAPETEN emergency response team. However, there is no programme in place to systematically check for availability and reliability of all supplies, equipment, communication systems and facilities, plans, procedures and other arrangements. The NNERO procedures observed at its emergency centre at the BAPETEN premises were also not identified as controlled copies.

BNPB does not have any quality management in place. It has maintenance programmes, but EPR is not necessarily integral part of them. The same is the case for the POLRI.

Recommendation 21
Observation: BAPETEN, BNPB and some other response organizations do not have a programme to ensure the availability and reliability of all equipment, procedures and other arrangements necessary for effective response in a nuclear or radiological emergency.
Basis for recommendation: GSR Part 7, Requirement 26, states: “The government shall ensure that a programme is established within an integrated management system to ensure the availability and reliability of all supplies, equipment, communication systems and facilities, plans, procedures and other arrangements necessary for effective response in a nuclear or radiological emergency.”
Recommendation: The Government should ensure that all responding organizations establish a programme to ensure the availability and reliability of all supplies, equipment, communication systems and facilities, plans, procedures and other arrangements to perform the necessary functions in a nuclear or radiological emergency.

APPENDIX I: MISSION TEAM COMPOSITION

No.	Name and LAST NAME	Position	Country/Organization
1.	Toshimitsu Homma	EPREV team leader	Japan
2.	Genaro Rodrigo Salinas Mariaca	EPREV team coordinator	IAEA
3.	Loch Castle	EPREV team member	Australia
4.	Bushra Nasim	EPREV team member	Pakistan
5.	Marjan Tkavc	EPREV team member	Slovenia

APPENDIX II: MISSION SCHEDULE

DETAILED AGENDA FOR THE EPREV MISSION
19 – 28 September 2016

Team A: National EPR arrangements

Team B: Local EPR arrangements

Time	Agenda	Location
Sunday, 18 Sept.	Review team internal meeting: briefing, review of mission plan, review of preliminary findings and assignment of priorities.	Hotel
Monday, 19 Sept.		
09.00 – 09.20	Courtesy call to BAPETEN Chairman	BAPETEN, Building A
09.20 – 09.30	Safety induction	BAPETEN, Building B, 8th floor
09.30 – 09.40	Welcome address by BAPETEN Chairman	
09.40 – 09.50	Opening remarks by IAEA Coordinator	
09.50 – 10.10	Self-introduction of participants	
10.10 – 10.25	Photo Session and coffee break	
10.25 – 10.55	Presentation by Director of Technical Support and Emergency Preparedness on overall national framework of emergency preparedness and response	
10.55 – 11.25	Presentation by IAEA of EPREV objectives and processes	
11.25 – 13.00	Lunch break	
13.00 – 15.00	Discussion with BAPETEN officials	
15.00 – 16.00	Visit to BAPETEN's Emergency Preparedness and Response Headquarter	
Tuesday, 20 Sept.		
09.00 – 12.00	Visit to National Disaster Management Agency (BNPB) – Team A	Sentul
13.00 – 16.00	Visit to NBC Detachment (Police) – Team A	Depok
09.00 – 12.00	Visit to Multi Purpose Reactor, Radioactive Waste Management Facility and other facilities managed by BATAN – Team B	Serpong
13.00 – 16.00	Visit to Tangerang Selatan Fire Brigade, Tangerang Selatan, and Local Disaster Management Agency (BPBD) – Team B	Tangerang Selatan

Wednesday, 21 Sept.		
09.00 – 12.00	Visit to Crisis Center (Ministry of Health) – Team A	Jakarta
13.00 – 16.00	Presentation by Forensic Laboratory (Police) – Team A	BAPETEN, Building C
09.00 – 12.00	Visit to PT. Rel-ion (irradiation facility) – Team B	Cikarang
13.00 – 16.00	Visit to another EPC IV facility – Team B	Cikarang
Thursday, 22 Sept.		
09.00 – 12.00	Presentation by NBC Detachment (Army) – Team A	BAPETEN, Building C
13.00 – 16.00	Visit to Fatmawati Hospital (referral hospital, candidate) – Team A	Jakarta
09.00 – 12.00	Visit to Siloam Hospital – Team B	Jakarta
13.00 – 16.00	Visit to Dharmais National Cancer Hospital – Team B	Jakarta
Friday, 23 Sept.		
09.00 – 12.00	Discussion with BAPETEN counterparts	BAPETEN
12.00 – 13.30	Lunch break	
13.30 – 16.00	Continued activities	
Saturday, 24 Sept.		
09.00 – 12.00	Report writing by EPREV team	BAPETEN
14.00 – 16.00	Report review and discussions	
Sunday, 25 Sept.		
09.00 – 12.00	Report writing by EPREV team	Hotel
13.00 – 16.00	Social activity	TBD
Monday, 26 Sept.	• Continued report drafting • Draft report submitted to counterpart (no later than 09:00) • Unified Comment submitted to EPREV team (not later than 17.00)	Hotel (Rooms)
Tuesday, 27 Sept.		
09.00 – 12.00	• Meeting with Host Country representatives to discuss comments • Report finalization	BAPETEN
12.00 – 13.00	Lunch break	

13.00 – 14.00	Continued activities	
14.00 – 16.00	Final arangement	
Wednesday, 28 Sept.		
09.00 – 11.00	Exit meeting	BAPETEN, Building B, 8th floor
11.00 – 12.00	Press conference	BAPETEN, Building A

APPENDIX III: LIST OF ATTENDEES OF EPREV MISSION MEETINGS

No.	Name	Position	Organization
Opening meeting ***Venue:* BAPETEN** ***19 September 2016***			
1.	Prof. Jazi Eko Istiyanto	Chairman	BAPETEN
2.	Dr. Khairul Huda	Deputy Chairman	BAPETEN
3.	Hendriyanto Hadi Tjahyono	Executive Secretary	BAPETEN
4.	Dedik Eko Sumargo	Director of Technical Support and Emergency Preparedness	BAPETEN
5.	Rodrigo Salinas	Team coordinator	IAEA
6.	Toshimitsu Homma	Team leader	IAEA
7.	Bushra Nasim	Team member	IAEA
8.	Marjan Tkavc	Team member	IAEA
9.	Loch Castle	Team member	IAEA
10.	Ratih Utami		Local Disaster Management Agency of South Tangerang
11.	Bambang Hartoko		Local Disaster Management Agency of South Tangerang
12.	Sofyan Arief		NBC Detachment Police
13.	Panca		NBC Detachment Police
14.	Dr. Ira C. Tresna		Crisis Center of Ministry of Health
15.	Shinta Rahmawati		Crisis Center of Ministry of Health
16.	Budi Rohman	Director of Inspection for NIM	BAPETEN
17.	T. Handayani	Head of Legal Affairs and Organization Development Bureau	BAPETEN
18.	Farid A. Binaruno	Head of Planning Bureau	BAPETEN

No.	Name	Position	Organization
19.	Amil Marda	Head of Internal Affairs of BAPETEN	BAPETEN
20.	Lukman Hakim	Head of Education and Training Center of BAPETEN	BAPETEN
21.	Sofyan Arief		NBC Detachment Police
22.	Panca		NBC Detachment Police
23.	Tri Sajogo		Forensic Laboratory Police
24.	Robert S.		NBC Detachment Army
25.	Angga H.		NBC Detachment Army
26.	Chevy Cahyana		National Nuclear Energy Agency
27.	Untara		National Nuclear Energy Agency
28.	Dr. Eny		BNPB
29.	Andhika K. F.		BNPB
30.	Syahrul Nurtama		PT. Rel-ion (Irradiation Facility)
31.	Tubagus Ichsan		PT. Rel-ion (Irradiation Facility)
32.	Suhartono		Serpong Research Reactor, BATAN
33.	Arie Budiarti	Center of Radioactive Waste Facility	BATAN
34.	Triputro Nugroho		Dharmais National Cancer Hospital
35.	Keliek Soedarto		Dharmais National Cancer Hospital
36.	Andri Elzar		MRCCC Siloam Hospital (Medical Radiation Hospital)
37.	Dr. Paul		MRCCC Siloam Hospital (Medical Radiation Hospital)
38.	24 other officials		BAPETEN

No.	Name	Position	Organization
Visit to BNPB, Sentul, Bogor West Java 20 September 2016 (morning)			
1.	Bagus Tjahjono	Head for Education and Training Center	BNPB
2.	Eny Supartini	Deputy Director for Emergency	BNPB
3.	Rodrigo Salinas	Team coordinator	IAEA
4.	Toshimitsu Homma	Team leader	IAEA
5.	Bushra Nasim	Team member	IAEA
6.	Mohammad Ridwan		BAPETEN
7.	Toto Heryanto		BAPETEN
8.	Indah Fitrianasari	Disaster Counsellor	BNPB
9.	Linda Nursanti		BAPETEN
10.	Annisa		BAPETEN
11.	Aidi Adri		BAPETEN
Visit to NBC Detachment Police, Depok West Java 20 September 2016 (afternoon)			
1.	Sofyan Arief	Police Commander	NBC Detachment
2.	Agus Isnaini		NBC Police
3.	Karlina		NBC Police
4.	Rodrigo Salinas	Team coordinator	IAEA
5.	Toshimitsu Homma	Team leader	IAEA
6.	Bushra Nasim	Team member	IAEA
7.	Mohammad Ridwan		BAPETEN
8.	Toto Heryanto		BAPETEN

No.	Name	Position	Organization
9.	Linda Nursanti		BAPETEN
10.	Annisa		BAPETEN
11.	Aidi Adri		BAPETEN
12.	Others from NBC Detachment Police		NBC Detachment Police
Serpong Research Reactor 20 September 2016 (morning)			
1	Slamet Supriyanto		Serpong Research Reactor, BATAN
2	Edison		Serpong Research Reactor, BATAN
3	Suhartono		Serpong Research Reactor, BATAN
4	Loch Castle	Team member	IAEA
5	Marjan Tkavc	Team member	IAEA
6	Ferdinand		BAPETEN
7	Faisal		BAPETEN
8	Astri Indarsih W.		BAPETEN
Center for Radioactive Waste Technology 20 September 2016 (afternoon)			
1	Suryantoro	Head of Center for Radioactive Waste Technology	Center for Radioactive Waste Technology, BATAN
2	Arie Budi		Center for Radioactive Waste Technology, BATAN
3	Suhartono		Center for Radioactive Waste Technology, BATAN
4	Loch Castle	Team member	IAEA
5	Marjan Tkavc	Team member	IAEA
6	Ferdinand		BAPETEN
7	Faisal		BAPETEN

No.	Name	Position	Organization
8	Astri Indarsih W		BAPETEN
Visit to Local DMA, South Tangerang, Banten 21 September 2016 (afternoon)			
1	Uci Sanusi	Head	BPBD
2	Bambang		BPBD
3	Aceng		BPBD
4	Agus		Local Fire Brigade
5	Loch Castle	Team member	IAEA
6	Marjan Tkavc	Team member	IAEA
7	Ferdinand		BAPETEN
8	Faisal		BAPETEN
9	Astri Indrssih W.		BAPETEN
Visit to Crisis Center, Ministry of Health 21 September 2016 (morning)			
1.	Kamaruzzaman	Deputy Director of Evaluation and Information	Ministry of Health
2.	Anang Subur		Ministry of Health
3.	Indro Murwoko		Ministry of Health
4.	Yudhi Pramono		Ministry of Health
5.	Ina Agustina		Ministry of Health
6.	Hadijah Pandita		Ministry of Health
7.	Rim Kwang		WHO
8.	Marini		WHO
9.	Toshimitsu Homma	Team leader	IAEA

No.	Name	Position	Organization
10.	Bushra Nasim	Team member	IAEA
11	Toto Heryanto		BAPETEN
12	Astri Indrasih W.		BAPETEN
Presentation by Forensic Laboratory Police (BAPETEN Office) 21 September 2016 (morning)			
1.	Mohamad Tri Sajogo		Forensic Laboratory Police
2.	Toshimitsu Homma	Team leader	IAEA
3.	Bushra Nasim	Team member	IAEA
4.	Mohammad Ridwan		BAPETEN
5.	Toto Heryanto		BAPETEN
6.	Astri Indrasih W.		BAPETEN
Visit to PT. Rel-ion (Irradiator Facility), Cikarang 21 September 2016 (morning)			
1.	Syahrul Nurtama	Senior Manager	PT. Rel-ion (irradiation facility)
2.	Tubagus Ichsan N.	Production Manager / Radiation Protection Worker	PT. Rel-ion (irradiation facility)
3.	Rully Apriano	Maintenance Manager / Radiation Protection Worker	PT. Rel-ion (irradiation facility)
4.	Dora Inda K.	QA Supervisor / Radiation Protection Worker	PT. Rel-ion (irradiation facility)
5.	Loch Castle	Team member	IAEA
6.	Rodrigo Salinas	Team coordinator	IAEA
7.	Ferdinand		BAPETEN
8.	Faisal		BAPETEN
9.	Ilham Hidayat		BAPETEN

No.	Name	Position	Organization
10	Wahyu Ramdhan		BAPETEN
11	Linda Nursanti		BAPETEN
Visit to PT. Sucofindo, Cikarang 21 September 2016 (afternoon)			
1.	Loch Castle	Team member	IAEA
2.	Rodrigo Salinas	Team coordinator	IAEA
3.	Ferdinand		BAPETEN
4.	Faisal		BAPETEN
5.	Ilham Hidayat		BAPETEN
6.	Wahyu Ramdhan		BAPETEN
7.	Linda Nursanti		BAPETEN
10.	Bernando Sinaga		PT. Sucofindo
11.	Yuntho B		PT. Sucofindo
12	Sugihpayana		PT. Sucofindo
13	Dede Rafiuddin		PT. Sucofindo
14	Bama H.G		PT. Sucofindo
15	Fajria Putra		PT. Sucofindo
16	Pardjio		PT. Sucofindo
Presentation by NBC Army (BAPETEN office) 22 September 2016 (morning)			
1.	F. Mirza		NBC Army
2.	Robert S. Tumanggor		NBC Army
3.	Tabri		NBC Army

No.	Name	Position	Organization
4.	Toshimitsu Homma	Team leader	IAEA
5.	Bushra Nasim	Team member	IAEA
6.	Toto Heryanto		BAPETEN
7.	Linda Nursanti		BAPETEN
Visit to Fatmawati Hospital (BAPETEN office) 22 September 2016 (afternoon)			
1.	Chamim	Director of Medical and Treatment,	Fatmawati Hospital
2.	Sabar Triyono		Fatmawati Hospital
3.	Syahrul		Fatmawati Hospital
4.	Santi		Fatmawati Hospital
5.	Ali		Fatmawati Hospital
6.	Toshimitsu Homma	Team leader	IAEA
7.	Bushra Nasim	Team member	IAEA
8.	Aris Sanyoto		BAPETEN
9.	Linda Nursanti		BAPETEN
Visit to MRCCC Siloam Hospital, South of Jakarta 22 September 2016 (morning)			
1.	Melissa Luwia	Director	MRCCC Siloam Hospital
2.	Paul K Pribadi		MRCCC Siloam Hospital
3.	Andri Elzar		IAEA
4.	Loch Castle	Team member	IAEA
5.	Marjan Tkavc	Team member	IAEA
6.	Ferdinand		BAPETEN

No.	Name	Position	Organization
7.	Astri Indarsih W.		BAPETEN
Visit to Dharmais National Cancer Hospital 22 September 2016 (afternoon)			
1.	Prof. Dr. Abdul Kadir, Phd	President, Director	Dharmais National Cancer Hospital
2.	Keliek Soediarto		Dharmais National Cancer Hospital
3.	Fedelia Mitra		Dharmais National Cancer Hospital
4.	Santi		Fatmawati Hospital
5.	Ali		Fatmawati Hospital
6.	Loch Castle	Team member	IAEA
7.	Marjan Tkavc	Team member	IAEA
8.	Ferdinand		BAPETEN
9.	Astri Indarsih W.		BAPETEN
10	Other officials		Dharmais National Cancer Hospital
Presentation by BNPB (BAPETEN office) 23 September 2016 (morning)			
1.	Medi Herlianto	Director of Preparedness	BNPB
2.	Dedik Eko Sumargo	Director of Technical Support and Emergency Preparedness	BAPETEN
3.	Toshimitsu Homma	Team leader	IAEA
4.	Marjan Tkavc	Team member	IAEA
5.	Bushra Nasim	Team member	IAEA
6.	Toto Heryanto		BAPETEN

REFERENCES

[1] FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, INTERNATIONAL ATOMIC ENERGY AGENCY, INTERNATIONAL CIVIL AVIATION ORGANIZATION, INTERNATIONAL LABOUR ORGANIZATION, INTERNATIONAL MARITIME ORGANIZATION, INTERPOL, OECD NUCLEAR ENERGY AGENCY, PAN AMERICAN HEALTH ORGANIZATION, PREPARATORY COMMISSION FOR THE COMPREHENSIVE NUCLEAR-TEST-BAN TREATY ORGANIZATION, UNITED NATIONS ENVIRONMENT PROGRAMME, UNITED NATIONS OFFICE FOR THE COORDINATION OF HUMANITARIAN AFFAIRS, WORLD HEALTH ORGANIZATION, WORLD METEOROLOGICAL ORGANIZATION, Preparedness and Response for a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSR Part 7, IAEA, Vienna (2015).

[2] FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, INTERNATIONAL ATOMIC ENERGY AGENCY, INTERNATIONAL LABOUR OFFICE, PAN AMERICAN HEALTH ORGANIZATION, WORLD HEALTH ORGANIZATION, Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency, General Safety Guide No. GSG-2, IAEA, Vienna (2011).

[3] FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, INTERNATIONAL ATOMIC ENERGY AGENCY, INTERNATIONAL LABOUR OFFICE, PAN AMERICAN HEALTH ORGANIZATION, UNITED NATIONS OFFICE FOR THE COORDINATION OF HUMANITARIAN AFFAIRS, WORLD HEALTH ORGANIZATION, Arrangements for Preparedness for a Nuclear or Radiological Emergency, Safety Guide No. GS-G-2.1, IAEA, Vienna (2007).

ACRONYMS

ARM	advance reference material
BATAN	National Nuclear Energy Agency
BAPETEN	Nuclear Energy Regulatory Agency
BCR	BAPETEN Chairman's Regulation
BNPB	National Disaster Management Agency)
BPBD	Local Disaster Management Agency
CBRE	Chemical, biological, radiological and explosive
CBRN	Chemical, biological, radiological, nuclear
CONOPS	concept of operations
EALs	emergency action levels
EPC	emergency preparedness category
EPR	emergency preparedness and response
EPREV	Emergency Preparedness Review
EPRIMS	Emergency Preparedness and Response Information Management System
GR	Government Regulations
GSGs	IAEA General Safety Guides
GSRs	IAEA General Safety Requirements
IAEA	International Atomic Energy Agency
I-CoNSEP	Indonesia Centre of Excellence on Nuclear Security and Emergency Preparedness
ISO	International Organization for Standardization
MoH	Ministry of Health
MRCCC	Mochtar Riady Comprehensive Cancer Centre
NBC	Nuclear, biological and chemical
NIM	Nuclear Installation and Material
NNERO	National Nuclear Emergency Response Organization
NNERP	National Nuclear Emergency Response Plan
NUBIKA	Army NBC Detachment
OILs	operational intervention levels
PAZ	precautionary action zone
POLRI	Police CBRE
PT. Rel-ion	irradiation facility
RANET	Response and Assistance Network

RDD	radiological dispersal device (‘dirty bomb’)
RTOs	response time objectives
SAR	safety analysis report
SMS	Short Message Service
Sv	Sievert
TOR	Terms of Reference
UPZ	urgent protective action planning zone