IAEA Nuclear Security Series No. 18

Implementing Guide

Nuclear Security Systems and Measures for Major Public Events

IAEA
International Atomic Energy Agency

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International experts assist the IAEA Secretariat in drafting these publications. For Nuclear Security Fundamentals, Recommendations and Implementing Guides, open-ended technical meeting(s) are held by the IAEA to provide interested Member States and relevant international organizations with an appropriate opportunity to review the draft text. In addition, to ensure a high level of international review and consensus, the Secretariat submits the draft texts to all Member States for a period of 120 days for formal review. This allows Member States an opportunity to fully express their views before the text is published.

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IMPLEMENTING GUIDE

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FOREWORD

Terrorism remains a threat to international stability and security. High profile international and national major public events occur regularly, capturing great public interest and receiving intense media coverage. It is widely acknowledged that there is a substantial threat of a terrorist attack on major public events such as high profile political or economic summit meetings or major sporting contests.

The threat of nuclear and radiological terrorism remains on the international security agenda. Nevertheless, to reduce this risk, the international community has made great progress in securing nuclear and other radioactive material that could otherwise be used in a terrorist act. This progress is contingent on the efforts of all States to adopt strong nuclear security systems and measures.

There are large quantities of diverse radioactive material in existence, which are used in areas such as health, the environment, agriculture and industry. The hazards of this material vary according to composition and intensity. Additionally, the use of explosives in combination with this material can drastically enhance the impact of a criminal or terrorist act. If a criminal or terrorist group managed to detonate a so-called ‘dirty’ bomb in an urban area, the result could be mass panic, widespread radioactive contamination and major economic and social disruption.

Major public events are seldom held in the same State or at the same location or even at the same venue. At the national level, the hosting of major public events with proper nuclear security arrangements can provide a foundation on which to build an enduring national framework for nuclear security; one that can exist long after the event.

The organization of a major public event in which large numbers of people congregate presents complex security challenges for the State hosting such an event. Criminal or terrorist acts involving nuclear or other radioactive material at any major public event could result in severe consequences, depending upon the nature and quantity of the specific material involved, the mode of dispersal (violent or non-violent), the location and the population impacted. Implementing nuclear security systems and measures is, therefore, of paramount importance.

This Implementing Guide may be useful to the organizers of major public events. It represents a sound basis, drawn from experience, for raising awareness about nuclear security systems and the measures to be applied for such events.

This Implementing Guide was prepared with the support of experts from the Member States and their contributions in developing and reviewing it are gratefully acknowledged.

EDITORIAL NOTE

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1. INTRODUCTION

1.1. BACKGROUND

The risk that nuclear and other radioactive material could be used in a criminal act or an unauthorized act with nuclear security implications remains high and is regarded as a serious threat to international peace and security. Therefore, it is vital that each State establishes an appropriate and effective *nuclear security regime*[1] for enhancing the State's, and thereby global, efforts to combat nuclear terrorism. An effective *nuclear security regime* should protect persons, society, property and the environment from a criminal or unauthorized act with nuclear security implications involving nuclear and other radioactive material and other acts determined by the State to have an adverse impact on nuclear security.

The organization of a *major public event*, such as a sporting contest or high level political meeting, presents unique security challenges for the responsible organizations. Nuclear and other radioactive material used with criminal or terrorist intent, during or targeting such events, poses serious threats. These threats leading to severe health, social, psychological, economic, political and environmental consequences include:

(a) The dispersal of nuclear and other radioactive material in public places, such as a radiological dispersal device (RDD);
(b) The placement of dangerous radioactive material in public places such as a radiological exposure device (RED) with a deliberate intention to irradiate persons at or near a fixed point source;
(c) The production of nuclear yield, such as an improvised nuclear device (IND);
(d) A sabotage attack on a nuclear facility with the intention of causing a release of radioactive material;
(e) A deliberate act to contaminate food or water supplies with radioactive material.

As stated in the IAEA Nuclear Security Fundamentals, the responsibility for nuclear security rests entirely with each State. The State *nuclear security regime* should aim at the protection of persons, property, society and the environment from a criminal or unauthorized act with nuclear security implications involving nuclear and other radioactive material. This regime should be based on national laws and

[1] Italicized words in the text represent terms in the Glossary.

regulations derived from international instruments and the IAEA Nuclear Security Recommendations publications [1–3]. For a *major public event*, the *nuclear security system* should be an integral part of the overall security plan for the event and be linked to the *nuclear security regime* of the State.

There is considerable experience in implementing *nuclear security systems* and measures for hosting major public events. The success associated with the planning and implementation of such events is due to the international cooperation, including the coordinated efforts, of Member States and host States, together with the lessons learned and shared after each of the events. Past examples include: the 2004 and the 2008 Summer Olympic Games in Athens (Greece) and Beijing (China), respectively; the 2006 and 2010 FIFA Football World Cups in Germany and in South Africa, respectively; the 2007 and 2011 Pan-American Games in Rio de Janeiro (Brazil) and Guadalajara (Mexico), respectively; the 2008 V Latin American and Caribbean–European Union Summit and APEC CEO Summit in Peru; the 2010 South America Games in Colombia; and the 2010 Commonwealth Games in India. The comprehensive security plan, procedures, training and application of these systems and measures for each of these events has served as a valuable model for the IAEA in preparing this publication.

1.2. PURPOSE

The purpose of this publication is to provide structured guidance to States that may be hosting a *major public event*. It describes *nuclear security systems* and measures that may need to be established or enforced to enhance the effectiveness and efficiency of the overall security for the event. This publication is intended for policy makers, event organizers, law enforcement agencies, emergency services and other relevant responsible and technical support organizations.

1.3. SCOPE

This Implementing Guide provides an overview, based on practical experience, for establishing *nuclear security systems* and measures for *major public events*. It covers technical and administrative measures for: (a) developing the necessary organizational structure; (b) developing nuclear security plans, strategies and concepts of operations and (c) arrangements for implementing the developed plans, strategies and concepts. It does not provide comprehensive guidance, such as technical specifications of instruments or detailed information on *nuclear security systems* and measures to be applied by the responsible organizations.

This publication addresses threats related exclusively to nuclear and other radioactive material. There are other serious threats related to the dispersal of chemical or biological agents. Security measures used to detect and respond to the use of chemical and/or biological agents which can also drastically enhance the impact of an act are not discussed here.[2]

1.4. STRUCTURE

Section 2 provides a description of the preliminary arrangements to be considered in planning for a *major public event*. Section 3 addresses preventive measures in the context of the *major public event*, including those intended to prevent a criminal or unauthorized act with nuclear security implications involving nuclear and other radioactive material. Section 4 provides guidance on the process of *detection* by instruments, including its associated concept of operations, instrument selection and deployment plan. Section 5 addresses the assessment of *information alert*s and/or *instrument alarms*. Section 6 provides guidance on *response measures* to be applied after the determination that a *nuclear security event* has occurred. Section 7 covers the logistics involved in the implementation of *nuclear security systems* and measures for a *major public event*. Section 8 presents the lessons identified from the implementation of *nuclear security systems* and measures in previous *major public event*s.

Further information for the action plan, generic concepts and procedures, and types of instrument are presented in Annexes I–VI.

2. PRELIMINARY ARRANGEMENTS

2.1. GENERAL

After the decision to host a *major public event* is taken and a decision to implement *nuclear security systems* and measures has been adopted on the basis of perceived threats and the potential consequences of such threats, as well as on

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[2] Nevertheless, for dealing with chemical agents, most of the provisions outlined in this publication would be similar, specifically the organizational structure and concept of operations to put in place. Only *detection* instruments would be obviously different.

a pre-event assessment to determine the level of resources and preparedness required, preliminary arrangements are crucial for effectively implementing these measures. These arrangements rely on:

(a) Incorporation of *nuclear security systems* and measures into the overall security plan for the *major public event*.
(b) Designation of a single authority to be responsible for the overall security of the event, within the allocated budget.
(c) Designation of authorities and specialized organizations (comprising multiple competent authorities), referred to in this publication as the responsible organizations.
(d) Coordination among the designated responsible organizations, preferably by the single authority established for the overall security organization for the *major public event*.
(e) Participation of all responsible organizations in the planning process.
(f) Allocation of financial resources, balanced between the objectives to be met and the availability of funds.
(g) Availability of trained personnel, equipment and supporting infrastructures.
(h) Development of a *nuclear security system*, which should comprise the following:
    - Organizational structure with assigned roles and responsibilities;
    - Developed and updated national threat assessment;
    - Identified and prioritized *targets, venues* and *strategic locations*, as well as prioritized actions for implementation of *nuclear security systems* and measures;
    - Established coordination among the responsible organizations and bilateral and multilateral cooperation arrangements for international support;
    - Developed concept of operations and *response* procedures for appropriate *detection* and *response measures*;
    - Established administrative and technical infrastructures for *detection*, location and identification of *nuclear security events*;
    - Established protocols and procedures for assessment of alarms and *information alert*s;
    - Identified logistical support and human resource needs for the implementation of the planned *nuclear security systems* and measures;
    - Established schedule of training drills and exercises.

The overall approach applied for developing a *nuclear security system* for a *major public event* should be based on:

(a) Protection of *venues* and other *strategic location*s;
(b) Protection of *sensitive information* concerning *nuclear security systems* and measures at these *venues* and at other *strategic locations*.

These main actions, to be performed before and during any *major public event*, should be planned and prepared in close cooperation with all responsible organizations involved, taking into account *sensitive information*, as appropriate. Planning activities need to be carried out well in advance of the *major public event*. Once the planning activity is completed, the concept of operations has to be developed, approved and implemented. As an example, specific actions that the State may consider applying are presented in Annex I.

2.2. PUBLIC SECURITY AND PRIVATE SECURITY AT MAJOR PUBLIC EVENTS

The security of a *major public event* requires comprehensive planning, systematic preparation and effective implementation. The implementation step will reflect the scope and scale of the event. In many instances, *major public events* are held on private premises and the event organizers hire their own private security to work alongside the State's public security apparatus. Depending on the event, private security can take the lead role in ensuring the security, or assume a supporting role to the State public security apparatus. Regardless of the exact nature of the employment relationship between the event organizers and private security, the overall security realized at the *major public event* requires:

(a) Roles and responsibilities of private security in the context of overall event security be clearly articulated and understood and be consistent with the overall security plan for the event.
(b) The technical and operational capabilities and information assets of private security, including information on potential threats and targets, are fully shared with the event organizers and the State security apparatus.
(c) Recognition that private security may not have the same level of awareness and understanding as other officials of the threat from nuclear and other radioactive material at *major public events* nor prior experience in the *detection* and *response* to incidents involving such material.

Although a variety of models using public–private security partnerships can be envisaged, it is imperative that the security forces, information assets and technical capabilities be synchronized from the initial planning to the closing of a *major public event*.

2.3. ORGANIZATIONAL STRUCTURE AND COORDINATION

In planning for a *major public event*, the organizing State should designate a single authority to assume responsibility for the overall security of the *major public event*.

For the development of the concept of operations and to ensure coordination of the necessary plans and preparations and their execution, a specialized organizational structure for nuclear security at *major public event*s should be established. The need for a unified command and control security structure [4] is a lesson drawn from past *major public events*. Security involves many different authorities and agencies, each with its own responsibilities. Therefore, effective management and coordination of the activities of these authorities is essential.[3] The unified command and control structure should therefore be interoperable and coordinate all security organizations in a State, as well as relevant technical expertise with definite roles and responsibilities at all levels, including:

(a) Policy level;
(b) Strategic level;
(c) Operational level;
(d) Tactical level.

An example of a unified command and control structure is presented in Annex II. In developing the nuclear security structure for *major public events* the following steps should be taken:

(a) Identify the responsible organizations involved in nuclear security at the *major public event* assigned to work with the lead organization;
(b) Integrate the organization(s) responsible at all levels for *detection* of criminal or unauthorized acts involving nuclear and other radioactive material;
(c) Identify the *response* organization(s) for *nuclear security events*;

[3] The responsible organizations should be aware of all potential chemical, biological, radiological and nuclear threats associated with explosives (CBRNE) and have an integrated ability to respond to these threats.

(d) Ensure close cooperation among all organizations involved, in particular law enforcement, private security (whenever applicable) and technical and/or scientific support organizations.

To ensure effective coordination, protocols and memorandums should be established and distributed detailing:

(a) Roles and responsibilities of participating organizations;
(b) Points of contact and key persons from each organization with decision making authority;
(c) Clear lines of communication between the organizations and the unified command and control centre;
(d) Work plans with participating personnel, along with timely updates and contingency plans.

The role and function of the organization responsible for the overall coordination of the entire security for the event (lead organization) has to be defined well in advance. The unified command structure applied should consist of officials responsible for conventional *response* functions and those responsible for radiological *response* functions. The organizations responsible for *response* should ensure that appropriate *response* capabilities are available at all *venues* and at *strategic locations*. In addition, periodic reviews of the assigned activities of all responsible organizations should be scheduled and performed prior to the event.

2.4. THREAT ASSESSMENT

The *nuclear security systems* and measures employed for a *major public event* should be based on the threat assessment by the responsible organizations and should provide answers to the following:

(a) What are the potential threats?
(b) Who can threaten?
(c) What or who can be threatened?
(d) Where and when can the threat occur?
(e) What are the political and public perceptions?
(f) What are the motivations?
(g) What are the capabilities of the perpetrators?
(h) What are the potential consequences if the threat is perpetrated?

The likelihood of such threats and their potential consequences should be assessed and operational concepts and *response* procedures should be developed to provide efficient and effective *nuclear security systems* and measures to address the threat. In this regard, any reliable source of information should be considered. For example, law enforcement can provide a valuable source of information on regional and international trends in nuclear security, such as:

(a) Information on stolen, lost and seized nuclear and other radioactive material;
(b) Incidents (burglaries, trespassing, espionage) at associated facilities (e.g. nuclear facilities, sterilization plants, hospitals) or at *venues* and other *strategic locations* related to the *major public event*;
(c) Non-compliance with transport and other regulations for nuclear and other radioactive material.

In addition, the IAEA Illicit Trafficking Database (ITDB)[4] verified media reports and government reporting sources are valuable sources of information.

Designated responsible organizations should continuously update the assessment of the potential threats in connection to any *major public event*. The threat assessment can be performed, on the basis of information and surveillance, by taking into consideration the motivation, intentions and capabilities of those who can threaten. For assuring its completeness, the assessment should include information from counterterrorism and law enforcement agencies as well as input from all agencies involved in the safety and security of nuclear and other radioactive material and associated facilities and activities. For the threat assessment, the following basic scenarios can be considered:

(a) Domestic theft of nuclear and other radioactive material for the purposes of using it as an RDD, or an RED or an IND at, or near, a *venue* or any other *strategic location*;
(b) Illicit trafficking of nuclear and other radioactive material into the State for the purpose of using it as an RDD or an RED or an IND at, or near, a *strategic location*;

[4] The ITDB was established in 1995 as a repository for information on illicit trafficking in nuclear and other radioactive material. The ITDB receives information from States on incidents ranging from illegal possession, attempted sale, smuggling and scams, to unauthorized disposal of material and discovery of uncontrolled radioactive sources. The information collected is analysed to identify common trends and patterns, assess threats and evaluate weaknesses in material security and *detection* capabilities and practices.

(c) Sabotage involving nuclear and other radioactive material located at facilities (such as nuclear facilities, medical facilities and industrial installations), within the vicinity of the *major public event* and/or which could have an impact on the *major public event*.

2.5. PRIORITIZATION OF VENUES AND OTHER STRATEGIC LOCATIONS

The threat assessment highlights the potential consequences of the criminal or unauthorized use of nuclear and other radioactive material. The prioritization of the *nuclear security systems* and the measures to be implemented should be made on the basis of the extent of coverage of locations where the implementation of these systems and measures are foreseen, and the type, quantity and sensitivity of the instruments to be used and related *response measures*. Information with regard to this prioritization should be protected as *sensitive information* under an appropriate information security policy. The list of *venues* and any other *strategic locations* that may be considered for protection against a criminal or unauthorized act with nuclear security implications involving nuclear and other radioactive material can be divided into four categories:

(i) All locations where the *major public event* will occur. Depending upon the *major public event*, the *venues* could be facilities, such as conference centres, stadiums, sport facilities, religious sites, exhibition centres, hotels and public viewing areas, which may have multiple access points and various entry points to protect.

(ii) Locations where the participants/officials for the event would be gathered. Among these are media centres, press conference centres, airports, seaports, railways stations, housing (such as an Olympic village), adjacent hotels, or residences of high ranking dignitaries.

(iii) Specific buildings or monuments that are representative of the host city or of symbolic importance to a State and could be considered as *targets* for an attack, or used to increase the potential consequences of an attack.

(iv) Transportation systems or specific routes used by participants, high ranking dignitaries and the public for commuting between the *venues* during a *major public event* could also be *targets* for such acts.

Ultimately, if several *venues* are close to each other, it may be possible to create a unique security perimeter around a large *strategic location*. There are past examples where entire villages or small towns have been considered as a *venue* for a *major public event*.

2.6. COOPERATION ARRANGEMENTS

Implementation of *nuclear security systems* and measures for a *major public event* will depend on the infrastructure provided by an array of different, multidisciplinary, responsible organizations. It is vital that the responsibilities of each organization are clearly defined to guarantee proper cooperation, coordination, information exchange and integration of activities among all responsible organizations. The designated single authority responsible for the overall security should coordinate all supporting activities as part of an effective *nuclear security regime*. Roles and responsibilities need to be identified in protocols and/or memorandums of understanding among all relevant organizations. These documents should further include specific points of contact.

Furthermore, developing a comprehensive *nuclear security system* to protect a *major public event* can be a challenging task for a State. International cooperation should be considered by the State that hosts a *major public event* by obtaining information, and technical and legal assistance under bilateral and multilateral arrangements and from international organizations.

3. PRE-EVENT PREVENTIVE MEASURES

3.1. GENERAL

A *major public event*, by virtue of its profile or status, represents an attractive target for terrorist attack. Pre-event preventive measures in the context of *major public event*s are intended to prevent individuals or groups from undertaking a criminal or unauthorized act with nuclear security implications involving nuclear and other radioactive material that may result in radiation exposure and/or radioactive contamination to the general public and/or the environment.

In order to establish which *nuclear security systems* and measures should be implemented, a pre-event analysis, including the threat assessment, should be conducted to determine the scale of resources and the degree of preparedness required. The analysis should include consideration of the size, importance, duration, location, attendance and media coverage, as well as the presence of dignitaries and/or political perceptions of the event.

Depending on the pre-event analysis, the following actions are deemed necessary:

(a) Perform vulnerability analysis to decide upon the requirements needed for additional *nuclear security systems* and measures by:
  - Analysing the relevant design of venues and other *strategic locations* and transport plans for athletes, VIPs, the public, etc., before and during the event;
  - Identify vital areas, buildings and other *strategic locations*, systems and components that need *nuclear security systems* and measures.

(b) Assess the need for strengthening nuclear security, by:
  - Updating operational procedures;
  - Training personnel on new equipment and security structures;
  - Evaluating the effectiveness of the security system with repeated drills and exercises to update the system accordingly.

Additionally, States should ensure that appropriate *nuclear security systems* and measures for nuclear facilities and associated activities are in place according to the national requirements and consistent with the IAEA and other relevant international guides [1, 2].

3.2. PREVENTING CRIMINAL OR UNAUTHORIZED ACTS

In addition to *nuclear security systems* and measures described in Sections 4 and 5, additional simple actions can minimize the risk of a *nuclear security event*. Such actions should be strongly considered for events that may require extensive interagency coordination and preparedness and should, inter alia, be to:

(a) Secure mechanical ventilation systems at *venues*.
(b) Ensure that all authorized nuclear and other radioactive material (including, in particular, sealed radioactive sources in Categories 1–3)[5] are protected

[5] The categorization system described in Ref. [5] provides a ranking of radioactive sources and practices into five categories, with Category 1 sources being (potentially) the ‘most’ dangerous because they can pose a very high risk to human health if not managed safely and securely and Category 5 sources the ‘least’ dangerous. Radioactive sources that fall into Categories 1–3 are considered to require additional security measures to those required for safety reasons. Further information on the security of sources and recommended measures can be found in Ref. [6].

and kept according to the conditions of the licence. Furthermore, taking account of the assessed threat, the responsible authority may wish to enhance the security of sources in Categories 4 and 5 during the *major public event* [5–8].

(c) Ensure that appropriate law enforcement agencies, in coordination with the relevant competent authority, have updated information on authorized nuclear and other radioactive material (location, owner, contact information, etc.).

(d) Ensure that enhanced security measures are in place during the transport of nuclear and other radioactive material [9, 10].

(e) Ensure that all responsible organizations are informed of the transport of nuclear and other radioactive material, including medical isotopes in the vicinity of *strategic locations*.

(f) Limit and/or prohibit the transport of nuclear and other radioactive material in the vicinity of the *strategic locations* during the period of the *major public event*.

(g) Utilize counterterrorism capabilities to investigate trading of nuclear and other radioactive material (who is buying and for what purpose).

(h) Ensure border protection at designated and non-designated points of entry (such as land crossing points, seaports and airports), through:
   - Control of imports/exports;
   - Control of trans-shipment of goods;
   - Control of persons and belongings;
   - Control of baggage;
   - Control of non-designated points of entry.

(i) Ensure control of delivery of food, equipment, mail and other items into *venues* or other *strategic locations*.

3.3. INFORMATION MANAGEMENT

It is imperative that nuclear security information be made available in a timely manner and be available for decision making in the context of the *major public event*. Policies and procedures for protection of *sensitive information* should include:

(a) Classification of information according to national requirements;

(b) Preparation, identification, marking, or transmission of documents or correspondence containing the *sensitive information*;

(c) Appropriate encryption methods while transmitting *sensitive information*;

(d) Policy for controlling and communicating *sensitive information* among responsible organizations;
(e) Destruction of documents containing *sensitive information*;
(f) Declassification of documents when they are obsolete or no longer sensitive.

3.4. TRUSTWORTHINESS OF PERSONNEL

The responsible authorities should ensure that all personnel involved in nuclear security activities in relation to the *major public event* are explicitly deemed trustworthy, to the appropriate levels for their roles, by a formal process.[6] This formal process should reduce the risk of authorized personnel with access to privileged information engaging in illegal activities. Such individuals may hold any position in an organization or may not be directly employed by the organization. Nevertheless, they may have: (i) access to some or all *strategic locations*, *sensitive information*, *detection* instruments, equipment or tools; (ii) authority over operations or personnel and/or (iii) knowledge of procedures, layout and other *sensitive information*.

The responsible authorities and organizations should adopt measures and procedures to ensure that the trustworthiness of personnel is periodically renewed or revalidated according to national requirements.

4. DETECTION BY INSTRUMENTS

4.1. GENERAL

Nuclear and other radioactive material can generally be detected by instruments without intrusive search by using various kinds of specialized radiation *detection* instruments available commercially.

To prevent a criminal or terrorist act involving nuclear and other radioactive material at *major public events*, radiation *detection* instruments can be deployed

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[6] Measures taken against possible ‘insiders’ for nuclear facilities are described in Ref. [11].

for the purpose of *detection* and interdiction of the material before a criminal or terrorist act involving nuclear and other radioactive material can be carried out.

Nuclear and other radioactive material produce various types of radiation (alpha, beta, gamma, neutron). The radiation emitted depends on the quantity and configuration of the material and the specific radionuclides. Since gamma and neutron radiations have greater penetration than other types of radiation, gamma and neutron *detection* instruments can be used for detecting and identifying the presence of nuclear and other radioactive material. Nevertheless, if the nuclear or other radioactive material is well shielded and the radiation levels fall below the *detection* levels of the instruments used, the material may not be detected. Since no specific instrument is able to detect all kinds of nuclear and other radioactive material in any quantity, a great deal of attention must be paid to the type of instruments chosen for each location, their installation and use, as well as user knowledge, including training needs.

The deployment of *detection* instruments at prioritized *strategic locations* should increase the probability of detecting the presence of nuclear and other radioactive material. The effectiveness and efficiency of these systems will depend on the type and the numbers of radiation *detection* instruments, their sensitivity to produce correct and relevant information and the procedures for assessment of alarms and follow-up *response measures*. A concept of operations that combines radiation *detection* with metal *detection*, however, can enhance the capability to detect shielding and the potential presence of nuclear and other radioactive material.

An important condition for the successful implementation of *nuclear security systems* for protecting a *major public event* is the coverage of potential *targets*, to the extent possible, with adequate numbers of radiation instruments appropriately adapted to detect radiation, in accordance with procedures.

The establishment of appropriate mechanisms, protocols and procedures is essential for the collection and assessment of operational information, medical surveillance and/or reports from the competent authorities.

In designing *nuclear security system*s for *major public event*s, there should be provision to ensure that the security alert status can be elevated during times of increased likelihood of a criminal or terrorist act involving nuclear and other radioactive material. This includes the introduction of additional *nuclear security systems* and measures such as restrictions in the movement/availability of this material for defined periods.

4.2. CONCEPT OF OPERATIONS FOR DETECTION BY INSTRUMENTS

The overall concept of operations for *detection* by instruments at a *major public event* should include, in part or in total, the following:

(a) Background radiation mapping of *venues* and other *strategic locations*, which can be performed before the *major public event* for *detection* of nuclear and other radioactive material out of regulatory control and to serve as a baseline for radiation level in case a nuclear security event occurs.
(b) Pre-event surveys to provide reassurance that these *strategic locations* are free from nuclear and other radioactive material, which is implemented prior to the imposition of full access control by law enforcement agencies.[7]
(c) Radiation *detection* instruments which are deployed at the entry points of a *strategic location* to detect the presence of nuclear and other radioactive material out of regulatory control that might be entering the area hidden on an individual and/or in goods, and/or in vehicles. These *detection* instruments should be integrated, where feasible, with existing security measures (e.g. metal detectors, physical screening).

An example of a timeline for implementing *detection* by instruments at a football stadium is presented in Annex III.

For *detection* of nuclear and other radioactive material, different approaches could be applied at *strategic locations* for *major public event*s. These may include:

(a) Radiation monitoring at controlled convergence security screening points (locations where people pass, individually or in small numbers where they can be easily isolated). In this case, the localization of the source of radiation is relatively easy.
(b) Early *detection* of nuclear and other radioactive material out of regulatory control that can be triggered by roving security patrols equipped with specialized *detection* instruments around *strategic locations*, including areas outside of the secure perimeter.
(c) Area monitoring with a mobile radiation detector (detector installed in a mobile platform), which can detect and identify fixed or moving nuclear and other radioactive material. In this case, special search and localization

[7] Experience has shown that a pre-event radiation survey combined with a bomb squads' lockdown operation is very effective.

techniques are utilized to find the nuclear and other radioactive material quickly without attracting undue attention.

A detailed example of a concept of operation for *detection* by instruments in connection with the *major public event* is described in Annex IV.

The measures for detecting nuclear and other radioactive material at *venue* entry points, in other *strategic locations* and in the surrounding areas should be augmented by additional measures that are usually the responsibility of authorities other than those in charge of security for the *major public event*. An example is installing *detection* instruments at identified *points of entry* to prevent nuclear and other radioactive material out of regulatory control from entering the State.

The effectiveness of the *detection systems* and measures are contingent upon the concept of operations and the training of personnel. Thus, special attention must be paid to the training of front line officers and personnel responsible for nuclear security at the *major public event*.

4.3. SELECTION OF RADIATION DETECTION INSTRUMENTS

Instruments for detecting nuclear and other radioactive material are described in detail in Refs [12, 13]. All instruments require trained personnel for their effective use at a *major public event*. For the purpose of *major public events*, radiation *detection* instruments can be divided into four categories:

(1) Radiation portal monitors (RPMs) are designed to be used at controlled convergence security screening points for detecting the presence of nuclear and other radioactive material being carried by passengers/pedestrians or transported by vehicles.
(2) Personal radiation detectors (PRDs)[8] are small, lightweight instruments worn by personnel on a belt or uniform, designed to alert the user to increasing levels of radiation intensity and to detect the presence of nuclear and other radioactive material. A PRD can be used under specific situations by trained personnel as a device for searching individuals or small packages when more sensitive instruments are not available and where there is a small distance between the detector and the source.

[8] These instruments (PRDs) can be used for the radiation protection of the user but are not suitable for the purpose of personal dosimetry.

(3) Hand-held instruments are portable devices used to detect, locate and/or identify nuclear and other radioactive material. The use of such instruments in *major public event*s can be divided into three subcategories:
   (i) Gamma search devices: Designed for detecting and locating sources of gamma rays.
   (ii) Neutron search devices: Designed for detecting and locating sources of neutrons, in particular nuclear material or commercial neutron sources. These may be combined with gamma search detectors.
   (iii) Radionuclide identification devices (RIDs): Multipurpose instruments used for search and identification of nuclear and other radioactive material. They may also be used for the assessment of an alarm triggered by an RPM or PRD.

(4) Portable radiation scanners (PRSs) (or advanced mobile radiation *detection* instruments) consist of automated gamma spectrometers and radionuclide identification software, allow mapping with a global positioning system and possess communication capabilities. They are often used for pre-event radiological surveys and background mapping. They may also be used for real time *detection* near the *strategic locations*. There are two types of mobile measurement systems: (i) for small area surveys (backpack) and (ii) for large area surveys (airborne and/or vehicles and/or watercraft monitors).

The aforementioned monitors cannot detect alpha or beta radiation; additional types of monitor are required for this purpose. A summary of the types of radiation *detection* instrument and their applications is presented in Annex V.

4.4. DEPLOYMENT OF RADIATION DETECTION INSTRUMENTS

The selection of *detection* instruments (types and numbers) should be made in accordance with the instrument deployment plan and the concept of operations for each *strategic location* and their expected use. In selecting sites for the deployment of radiation *detection* instruments, the general approach should be to:

(a) Deploy radiation *detection* instruments at *venues* and other *strategic locations*, which may be *targets* for attack. Such locations may include *venues*, public transportation, sites of simultaneously organized events if applicable, tourist or heritage sites, and local and intercity maritime ports and airports.

(b) Deploy, whenever possible, radiation *detection* instruments at controlled convergence security screening points and in combination with other security measures already in place.

(c) Use mobile radiation *detection* instruments where appropriate.
(d) Consider the location and characteristics of radiation *detection* instruments as *sensitive information*.
(e) Consider deployment, as determined by State authorities, of radiation *detection* instruments at *points of entry*.
(f) Acquire radiation *detection* instruments that comply with international standards and recommendations.

The deployment plan for radiation *detection* by instruments should reflect:

(a) The prioritized list of *venues* and other *strategic locations* during the *major public event*;
(b) The transportation routes at borders and within the State's territory, at locations where the likelihood of *detection* is maximized, or in proximity to locations where nuclear and other radioactive material is produced, used, stored, consolidated or disposed;
(c) The operational and *detection* performance specifications of the *detection* instruments, in accordance with national and international technical guidelines;
(d) The mobile and relocateable *detection* instruments to provide flexibility and speedy relocation to address newly evolving threats;
(e) The *detection* requirements in support of law enforcement operations associated with *information alerts*.

The instrument deployment plan should specify the type and the number of each radiation *detection* instrument to be provided at each location during the specified period. This plan should also foresee the number of trained personnel and resources needed to operate the instruments. In particular, the plan should consider:

(a) Initial installation, calibration and the testing of installed radiation *detection* instruments.
(b) Maintenance procedures and the adequate training and qualification of users and technical support personnel:
    - Systems and procedures for conducting *radiation surveys* or *radiation searches* for nuclear and other radioactive material;
    - Defining threshold levels for *instrument alarms*;
    - Establishing systems and procedures for performing initial alarm assessments and other secondary inspection actions such as localization, identification, categorization and characterization of nuclear and other radioactive material, including obtaining technical support from experts

(tertiary inspection) to assist in the assessment of an alarm that cannot be resolved on-site;
- Provision and sustainment of supporting infrastructure to ensure effective *detection*, including personnel training, equipment maintenance, safe and secure temporary storage, transport and disposal of detected and interdicted nuclear and other radioactive material out of regulatory control and documented *response* procedures.

A possible approach for deploying radiation *detection* instruments is the integration of PRDs into existing security measures (walk-through metal detector gates, hand-held metal detectors and X ray machines) at the gates of the outer security perimeter of the *venue*. A security screening point may contain a variety of *detection* instruments, such as metal detectors, radiation detectors and X ray machines. Radiation *detection* instruments should be located in such a way that there will not be interference from the X ray machines or metal detectors. In a situation with a high threat level, it would be advisable that all visitors to a *venue* (including spectators, athletes, VIPs, journalists, employees, participants in the event and organizers, etc.) and their luggage and tools be monitored for radiation, using gamma/neutron search detectors (NSDs) (and possibly PRDs). Hand-held RIDs should be available for the assessment of the *instrument alarm*. As new and more sophisticated radiation *detection* instruments become available, their incorporation into the *nuclear security system* should be considered.

PRDs can either be deployed in fixed locations, or carried by trained and designated personnel. It should be noted that the audio alarm signal pattern of the various radiation *detection* instruments (metal detector gates, hand-held metal detectors and PRDs) can be quite similar. This should be addressed in configuring the instruments, because these similarities can make it more difficult to recognize which of the instruments has been triggered. If a wide entrance gate feeds a number of downstream parallel security gates, a two stage *detection* and segregation process can be effective. Nuclear and other radioactive material could be detected and categorized while passing through the detector. The results can be transmitted to the downstream security gates where the officers can receive the alarm remotely and in advance and use PRDs to detect nuclear and other radioactive material.

Roving security patrols could also carry PRDs with interoperable communications to supplement the fixed radiation *detection* instruments. Additional RIDs, together with PRDs, could also be provided to firefighters and other *response* teams.

In order to prevent the entry of any nuclear and other radioactive material out of regulatory control into a *venue*, early *detection* is essential. For this purpose, in addition to the security perimeter equipped with radiation *detection* instruments installed around the *venue*, an organized random search for such material can also be undertaken by using techniques such as road blocks/screening points and/or security patrols. In these cases, hand-held detectors (and possibly PRDs) can be used to detect radiation in stop and search security operations of vehicles at roadblocks or screening points on roads leading to *venues* or other *strategic locations*. Such road blocks/screening points can be at regular security checkpoints, toll stations, etc.

Radiation surveys can be performed at the *strategic locations* by using instruments carried by personnel or using mobile systems. Such a survey should also be used for mapping the background radiations of the area for assessment of the *instrument alarms*. For the purpose of a mobile survey, it is imperative that all alarms can be accurately located to maps of the site *venue*. Hand-held gross gamma radiation detectors and gamma spectrometer systems are well suited for this purpose. The use of automated spectrometers based on large volume NaI detectors are preferable since, in addition to detecting gamma radiation, spectral information collected allows identification of the radionuclide(s).

Radiation *detection* instruments can also be used to assess *information alert*s through search campaigns. An instrument alarm and/or *information alert* should be checked, and if verified, the source of the radiation should be located and, wherever possible, the strength of the nuclear and other radioactive material should be assessed to determine the appropriate *response* level. If an alarm is verified as being a radiation safety issue, then all suitable radiation protection measures should be put into operation in order to protect both personnel and the general public.

For the area monitoring systems, the location of the nuclear and other radioactive material is unknown and could be, for example, a moving vehicle or any person nearby. In such a case, special search techniques employed by law enforcement officers and radiation experts need to be implemented to detect, identify, localize, interdict, recover and shield the nuclear and other radioactive material out of regulatory control.

5. ASSESSMENT OF ALERTS AND/OR ALARMS

5.1. GENERAL

Any *information alert* and/or *instrument alarm* always requires further assessment. All alerts and/or alarms should be verified and independently cleared locally by a secondary or tertiary inspection team and this may be performed remotely with expert support. Figure 1 presents a generic scheme for assessment of an *information alert* and/or *instrument alarm* for suspicious objects cleared of explosives.

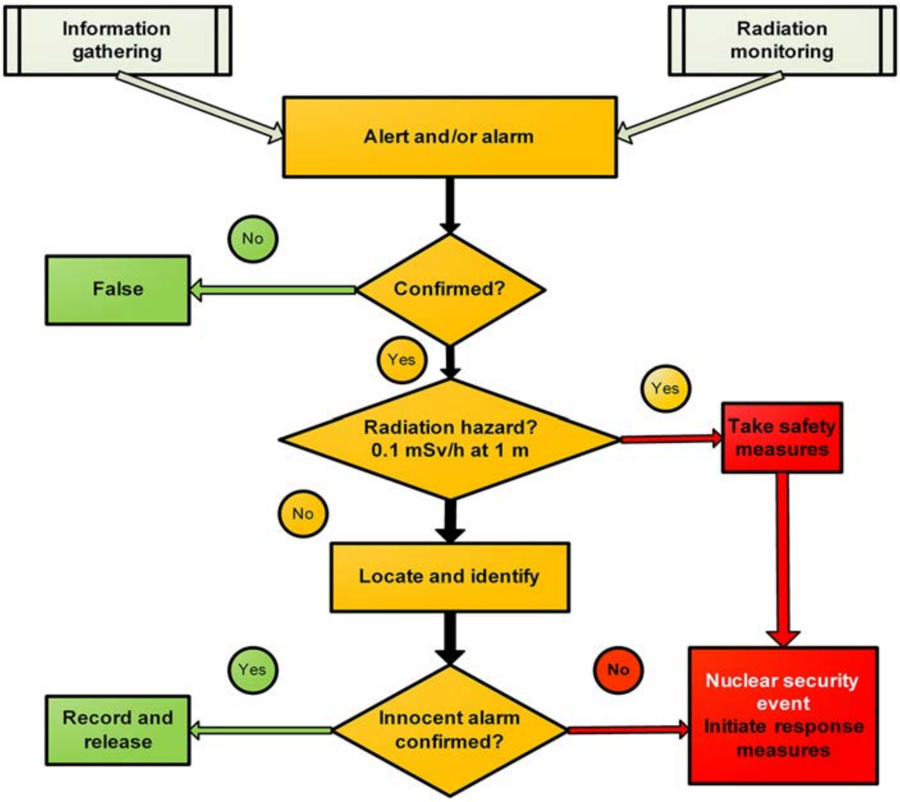

FIG. 1. Generic scheme for assessment of information alert and/or instrument alarm for suspicious objects cleared of explosives.

5.2. INFORMATION ALERTS

As part of the measures intended to detect a criminal or unauthorized act with nuclear security implications involving nuclear and other radioactive material, responsible organizations should oversee the collection and assessment of *information alert*s. This information process may include counterterrorism warnings, notification from law enforcement officials, regulatory non-compliances, border monitoring, medical surveillance, and/or reports of a potential *nuclear security event*. Examples of *information alert*s triggered by the competent authorities include:

(a) Bomb threats involving nuclear and other radioactive material;
(b) Suspected RED, RDD or IND;
(c) Suspected contamination of food or water supply;
(d) Report of regulatory non-compliance;
(e) Report of loss of regulatory control;
(f) Abandoned luggage or package suspected of containing nuclear and other radioactive material;
(g) Vehicle suspected of containing/transporting nuclear and other radioactive material out of regulatory control;
(h) Report on person(s) with potential radiation symptoms;
(i) Any other information on theft, illicit trafficking and other potential criminal or unauthorized act with nuclear security implications involving nuclear and other radioactive material out of regulatory control.

The concept of operations for the assessment of *information alert*s should foresee the evaluation of the credibility of the information, the arrangements for the survey and search of the area and the discovery and identification of specific nuclear and other radioactive material.

5.3. INSTRUMENT ALARMS

An alarm by an instrument can be of three types:

(i) False alarm;
(ii) Innocent alarm;
(iii) Confirmed non-innocent alarm.

A false alarm occurs when a radiation *detection* instrument is activated in the absence of any triggering radiation signal/source.

Innocent alarms refer to an actual increase in the radiation level in the search area/persons due to the presence of radioactive material that is not considered a threat, i.e. patients that recently underwent a medical procedure using radiopharmaceuticals or NORM.

Confirmed non-innocent alarms are due to the presence of nuclear and other radioactive material out of regulatory control and can indicate a criminal or unauthorized act with nuclear security implications and should trigger a proper *response*.[9]

The concept of operations should also foresee the interaction of front line officers (whose instruments will trigger an alarm) with secondary and tertiary inspection teams (which may be performed remotely with expert support). Communication means and arrangements are needed for the timely transfer of the experts with specialized equipment to an alarm location for responding in a timely manner to possible criminal acts. Annex VI presents procedures for interdiction and adjudication.

5.4. EXPERT SUPPORT

Expert support (reach back) is a process that brings remote resources to the field teams. This support is of vital importance to that part of the assessment process related to in-field measurement. A well-designed programme of expert support separates the measurement and analysis processes.

Expert support removes the burden of data interpretation from the field units to experts at a remote location. The process is facilitated by modern communication channels and data processing software. Typically, the mobile teams acquire spectra in a few second intervals. The raw data can be transferred to a remote database where real time analysis is performed and the key results transmitted back to the field. In addition, the results of the analysis can be forwarded to a dedicated and secure web page or sent by electronic means to other organizations involved in the security arrangement of the *major public event*.

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[9] When nuclear and other radioactive material out of regulatory control is detected appropriate *response* organization(s) must be promptly notified. Before initiating *response measures*, an assessment of the hazards situation should be conducted for both radiological and non-radiological dangers (radiation, explosives, weapons, confined space, high voltage, exposed utilities, natural gas, debris, etc.). Danger reduction procedures are applied and the nuclear and other radioactive material seized and isolated, using appropriate safety, security and forensic actions, together with any other potential evidence, such as associated packaging and documentation.

6. RESPONSE MEASURES

6.1. GENERAL

The first phase of the *response* is the assessment phase (to include the compound hazards situation) which is a continuation of the initial assessment after an *information alert* or an *instrument alarm*. The outcome of the assessment process could determine that a *nuclear security event* has occurred. The second phase of the *response* is the management of the *nuclear security event* through the execution of the nuclear security *response* plan for the *major public event*.

A *major public event* is typically planned well in advance. Therefore, the technical capabilities and infrastructure foreseen in the nuclear security *response* plan should be operational before the *major public event* and be exercised in advance. The organizations in charge of the implementation of the *response* plan must confirm their preparedness.

To minimize *response* time, *response* resources and assets should be deployed in the vicinity of *strategic locations,* preferably outside of the secured perimeter, during the *major public event*. The location outside of the secured perimeter should also take into account, among other criteria, the predicted meteorological conditions and the ease of access to the *strategic locations* of the *major public event*. Another important arrangement is the accreditation of the *response* teams. This facilitates the authentication of the *response* teams for entering the *venues* and other affected controlled areas without any delay. Accreditation of the *response* teams for authorizing their entry to the *venues* and/or other controlled areas without delay is essential.

The *response* organizations must follow established procedures. These procedures should include:

(a) Assessment for resolving immediate threats and responding appropriately (e.g. telephone calls, emails);
(b) Roster of the *response* team with their responsibilities and contact information;
(c) Means of transport for the *response* organization’s personnel, equipment and related infrastructures;
(d) Step by step actions to be performed by each *response* individual;
(e) Procedures for *response* to all credible scenarios;
(f) *Response* reporting forms;
(g) Equipment list and basic description of each piece of equipment;
(h) Useful references and supporting bibliography.

Procedures should be established to include a medical *response* for contaminated and/or overexposed individuals. It should be the responsibility of the authority in overall charge of the *major public event* security to decide to what extent they should prepare one or several medical facilities to receive wounded or contaminated/overexposed individuals. Further guidance is provided in Ref. [14].

A *nuclear security event* will attract the immediate attention of the news media. Local and possibly international media representatives are likely to be at the scene or even be broadcasting live coverage of the *response* mobilization. Arrangements should be made for promptly providing consistent and understandable information to the public and media when the situation requires. The use of pre-prepared information can be valuable in such circumstances. An official spokesperson should disseminate information from a media centre. Regular media briefings should be prepared in plain language with descriptions of the situation and answers to anticipated questions from the public and the media. The assistance of the media is invaluable for disseminating information and providing important instructions to the public about radiation safety [15].

6.2. CONCEPT OF OPERATIONS FOR RESPONSE MEASURES

The concept of operations for *response measures* should be based on the *response* plan and the coordination of activities by all responsible organizations and agencies.

Once a secondary/tertiary inspection team and/or remote expert support team has confirmed that an alarm is non-innocent and that the situation constitutes a *nuclear security event* without the possibility of dispersal of radioactive material, the following measures should be taken by radiation safety experts:

(a) Assess the radiological risk, provide advice on radiation safety measures and establish the radiation safety perimeter;
(b) Recommend isolation and/or evacuation up to the radiation safety perimeter, to be determined, at the scene, by the responders [16];
(c) Assist the *venue* safety and security officers until appropriate additional support arrives;
(d) Activate notification and *response* procedures;
(e) Assist in the operational *response* and the crime scene management, in particular, assistance to the CBRNE team and the forensic evidence management team [17];

(f) Provide advice to the *venue* or any other *strategic location* security chief (*Incident Commander*) on the potential escalation of the situation, taking into account the circumstantial factors;
(g) Advise and assist all *response* organizations on countermeasures;
(h) Recover, secure and arrange for the safe transportation and storage of the nuclear and other radioactive material, as well as preserving potential forensic evidence [17].

In the case that the situation constitutes a *nuclear security event* with a real possibility of the dispersal of radioactive material and the event escalates, appropriate *response* procedures, in addition to the aforementioned, should be applied by the designated disciplinary *response* group, such as:

(a) Site control:
- Recommend isolation and/or evacuation up to radiation safety perimeter, to be determined, at the scene, by the responders [16];
- Recommend perimeter security and traffic control.

(b) Compound hazards assessment/scene assessment.
(c) Apply danger reduction procedures.
(d) Evaluate the radiological status and consequences through monitoring activities:
- Dose rate;
- Airborne activity;
- Spread of contamination;
- Site characterization;
- Assessment of exposure through various pathways;
- Level of protection needed.

(e) Rescue and triage operations — save life, evacuate people, assemble in a safe area.
(f) Public announcements and perceptions (preferably to be prepared in advance).
(g) Forensic evidence management.
(h) Recovery operations:
- Population monitoring, decontamination and registration of personal details;
- Medical management and biodosimetry;
- Environmental remediation;
- Radiological cleanup;
- Embargo of zones/areas.

(i) Restore operations — long term impacts.

6.3. NUCLEAR SECURITY RESPONSE PLAN

An important step towards a comprehensive *response* capability during a *major public event* is the development of an event specific *response* plan (‘the Plan’) for *response* to *nuclear security event*s by the responsible organizations. All identified organizations responsible for conducting preparedness and *response* activities should actually participate in the planning process. The Plan should be part of the plan for responding to CBRNE threats. The Plan should include provisions for cooperation among all organizations involved and should serve functional areas, such as: (a) coordination on all supporting elements, (b) counterterrorism measures (prevention and *response*), (c) consequence management, (d) casualty management, (e) media and (f) joint training and exercises. The Plan should take into account the existing national radiological emergency plan [18] and its associated procedures as well as complementing the national nuclear security *response* plan.

All organizations involved in *response* should establish internal plans describing their particular roles, responsibilities, equipment, teams and the various standard operating procedures to be followed in a *nuclear security event*, as well as multidisciplinary group agreements and protocols to determine intergroup cooperation foreseen by the Plan.

The Plan should also describe provisions for simultaneous events and different scenarios with nuclear security implications that the *response* organization is required to respond to during the *major public event*. This should be based on the threat assessment, risk analysis and deployed technical resources. To fulfil its obligations under the Plan, the *response* organizations should ensure that they have sufficient human resources and adequate technical infrastructures. In this context, the *response* organization should ensure the availability of the following assets, including:

(a) Expert support and *response* teams, CBRNE teams, remote expert support system (reach back) and a designated laboratory. Expert support teams could consist of radiation measurement and protection experts whereas the CBRNE team is led by a law enforcement officer and has expertise to search and respond to different CBRNE threats.
(b) Measuring and *detection* instruments which may include: those for rapid search, monitoring and identification (gamma/neutron *detection* instruments); gamma/neutron dose rate meters/dosimeters for dose rate assessment (survey meters, telescopic probes), contamination monitors for alpha, beta and gamma radiations and portable spectrometers for radionuclide identification.

(c) Protective equipment of different types, in order to protect while responding to a range of events of any severity (e.g. overalls, gloves, masks, shoes, shielded recovery containers, respiratory devices).
(d) Dedicated and reliable communication systems, in order to allow personnel to communicate independently of the general communication network, if needed.
(e) Transport vehicle(s) that can safely carry nuclear and other radioactive material (with shielding of different types, such as containers made of lead, sheets of lead, lead bricks and lead pellets).

In addition, the Plan should foresee the means to assess the environmental consequences of any release of radioactive material, including those resulting from explosions. Arrangements for obtaining the necessary tools to predict the potential consequences should be in place as well as access to expert support and software for the dispersal scenario.

7. PREPAREDNESS AND SUSTAINABILITY

7.1. GENERAL

As part of the national policy and commensurate with their respective assigned roles and responsibilities, each responsible organization should establish and maintain adequate preparedness and resources for sustainability. Effective implementation of *nuclear security systems* and measures for a *major public event* requires that preparedness and resources for sustainability be established well in advance.

The following items illustrate some of these arrangements, specifically designed for *major public events*. They are based on the assumption that the necessary budget, facilities and other resources are to be made available well before the event, for the successful implementation of *nuclear security systems* and measures by the responsible organizations.

7.2. LOGISTICS SUPPORT

Logistics support should address all aspects required for the implementation of *nuclear security systems* and measures for a *major public* *event*. The planning for logistics support should be incorporated under the overall plan.

The logistics arrangements established should ensure that the necessary instruments, procedures, supplies (such as consumables) and resources are in place before the *major public event* and are readily available and maintained throughout the event on a '24/7' basis. In particular, these arrangements should ensure that the personnel involved has the following:

(a) Access accreditation to *venues* and/or other *strategic locations*;
(b) Transport;
(c) Communication equipment;
(d) Pre-planned shift schedules;
(e) Operation space;
(f) Accommodation;
(g) Catering.

7.3. TRAINING AND EXERCISES

Training programmes should include, among others, an appropriate number of theoretical and practical courses for all of the key organizations and positions identified in the Plan. Various training needs should be identified a priori to determine specific training modules that support the overall plan.

As a minimum, the training of responders should incorporate the elements of their organization's internal *response* procedures, standard operating procedures and procedures for notification and handling of *nuclear security event*s and for mitigating health hazards.

Training should be given to users of *detection* instruments on the operation of the equipment, the procedures to be used and the evaluation of data. The aim of the training should be to implement efficient *detection* and *response* capabilities in order to achieve an effective *nuclear security system*. Since this domain is fairly new for decision makers and for other personnel of the overall security organization, some level of training should be provided to all concerned with particular emphasis on situations dealing with nuclear security.

For the training of personnel in the use of *detection* instruments, the involved organizations should define the general training policy and requirements, including the person responsible for providing each specific type of training. A detailed and specific training plan should be developed, which should include, among others, a number of drills and exercises. The implementation of the training programme should ensure that sufficient numbers of personnel are trained to meet the requirements for any *major public event*, and that refresher training is provided as necessary. The training programme on the use of radiation *detection* instruments should be completed well in advance of the opening day of the *major public event*.

Effective training of radiation *detection* instrument users entails the following approach to:

(a) Ensure that all personnel understand what the instruments can do and their limitations in resolving security and safety concerns;
(b) Train a group of people to use the instruments and to carry out the secondary inspections;
(c) Establish expert groups that will provide tertiary expert support.

Training on the use of radiation *detection* instruments and procedures for the *major public event* is essential. An effective training approach combines:

(a) Nuclear security awareness and concept of operation;
(b) Basics on ionizing radiation and nuclear and other radioactive material;
(c) Principles of radiation protection and radiation *detection*;
(d) Survey, search, monitoring and identification methods, techniques and procedures;
(e) Coordination among the responsible organizations;
(f) Train-the-trainer concepts;
(g) Hands-on training using actual equipment and radioactive sources, where possible.

Time is a crucial factor for a State preparing to host a *major public event*. In order to receive training on radiation *detection* instruments, designated responders should be nominated early enough to ensure their readiness before and during the *major public event*. The early introduction and discussion in an awareness seminar for procedures, instruments and concepts of operations for the *major public event* is important.

Finally, a practical schedule is essential in procuring radiation *detection* instruments; more lead time allows more time for training.

Response personnel should be well trained before they are assigned for a *major public event*. The objectives for training responders are to enhance their ability to take appropriate action to protect themselves and the public.

Healthcare workers working at the scene or being at risk when a hospital receives contaminated patients (medical doctors, nurses, paramedics, medical assistants, security personnel, etc.) should receive adequate training to enable them to perform their duties safely. Training seminars should be organized, based on a comprehensive phased plan, taking into account different stages and different categories of personnel according to their tasks, i.e. who is doing what and when.

Awareness training should be scheduled and implemented for *response* personnel in all organizations involved. This should include the requirements for technical assistance and coordination protocols for *response* to nuclear security events. Awareness briefings should be addressed to managers, decision makers and relevant personnel in organizations involved in the national *response* plan (e.g. first responders, expert support team members, CBRNE teams).

All personnel involved in the specialized organization dealing with nuclear security at the *major public event* should receive adequate training appropriate to their position and responsibility in order to optimize *response*. It is also important that the personnel involved in overall security receive training in order to understand the *response* of the specialized organization to any situation dealing with a positive *detection* by any of the radiation *detection* instruments operating during the *major public event*.

Exercises[10] are conducted:

(a) To validate plans and procedures and to test performance;
(b) To provide an opportunity for training in a realistic situation;
(c) To explore and test new concepts and ideas for the *response* arrangements.

The preparation and conduct of each exercise varies in complexity, scope and objectives [19]. These exercises should be organized with emphasis on *major public event*s to ensure that all personnel involved in *detection*, assessment and *response* activities are familiar with their respective functions.

7.4. TESTING AND MAINTENANCE OF DETECTION AND RESPONSE INSTRUMENTS

Acceptance testing of all instruments before implementation is essential for verifying conformity to specifications and proper functioning of the systems. A qualified technical support organization could provide the necessary radiation sources and could carry out the necessary acceptance tests on all instruments prior to their use. Sufficient time should be foreseen for testing, problem fixing and retesting of instruments. The presence of a technician of the vendor during testing is important to demonstrate equipment failures directly to the vendor and

[10] The term ‘exercises’ includes drills, ‘tabletop’ exercises, partial and full-scale exercises as well as field exercises.

to shorten the time needed for diagnostics and repair. These actions should be documented as this information may be required in any subsequent legal proceedings.

Calibration and maintenance arrangements should ensure the sustainability of the radiation *detection* instruments during the *major public event* on a 24/7 basis. These arrangements should include, among others, the following:

(a) A responsible organization for performing maintenance, providing supplies and ensuring the proper operation of the *detection* instruments;
(b) Arrangements for timely distribution and collection of the instruments to the assigned personnel;
(c) Preventive maintenance schedules and provisions for corrective maintenance (in the case of system breakdowns/malfunctions) for all instruments;
(d) Sufficient inventory of key components and supplies to ensure uninterrupted functioning of the instruments (e.g. power supplies and batteries);
(e) Maintained records pertaining to instrument calibration and maintenance as *sensitive information*;
(f) Records of maintenance and calibration of radiation *detection* instruments as these records may be required as evidence at any subsequent legal proceedings.

8. LESSONS LEARNED FROM PAST MAJOR PUBLIC EVENTS

This Implementing Guide incorporates examples and lessons learned by Member States that have implemented *nuclear security systems* and measures *for major public events*. In particular, the lessons learned from previous *major public events* include:

(a) The need for strong political leadership from the State, dedicated to the successful implementation of *nuclear security systems* and measures.
(b) Pre-event assessment to determine the resources and preparedness required, including considerations on the size, importance, duration, location, attendance, media coverage, presence of dignitaries or public perceptions of the event.

(c) Adequate financing to ensure comprehensive planning and successful execution.
(d) A unified command structure with a legal framework, authorities and clear roles and responsibilities to ensure coordination among the various entities prior to, and during, the event.
(e) A requirement for early planning.
(f) Formal commitment of responsible organizations is required at the earliest stage of planning.
(g) Effective interdisciplinary group cooperation is essential since experts in a multitude of disciplines contribute to the project.
(h) Adequate personnel and *detection* instruments need to be identified well in advance.
(i) Expert support is needed to determine appropriate instruments to be purchased, tested and deployed.
(j) Allowance for adequate lead time for contracts and procurements should be initiated as early as the instrument needs are defined.
(k) The documentation needed for planning the technical measures should be available in time to be released to the experts involved on a need-to-know basis.
(l) Adequate coordination is necessary to combine assets and capabilities in time: instruments, procedures, training facilities, training material, trainers and the personnel to be trained.
(m) Training should be conducted at the appropriate time and should be based on a comprehensive, phased plan, taking into account the different responsibilities of personnel.[11]
(n) Ensuring that officers receiving the training will be made available at the *major public event*.
(o) The responsible organization should be prepared to conduct training on the use of radiation *detection* instruments for front line officers.
(p) Training must be designed for security officers who generally do not have an extensive background in radiation science. Experts should provide timely information to alleviate concern over potential health effects.
(q) Exercises based on the event-specific nuclear security response plan are needed to enable testing of the practicalities of the cooperation agreements among the various participating interdisciplinary groups. In addition, small scale exercises and/or drills are needed for personnel within individual organizations.

[11] For example a multilayered training programme consisting of awareness training, training-the-trainers, operational training, ad hoc training and refresher training.

(r) A fast and efficient system should be in place for evaluating *instrument alarms* generated by radiation *detection* instruments. The responsible organizations should be aware of false alarms and innocent alarms from radiation *detection* instruments and have relevant procedures to deal with them if they occur.
(s) Mobile radiation *detection* instruments can be effective in securing the *venues* but may be more difficult to use in the field. A well-trained expert support team (in the field or remotely) is needed to verify any triggering of an alarm and to establish if it is a false alarm or not, and the *detection* and analysis methods should be fast and robust.
(t) Some days prior to the start of, and during, the *major public event*, medical facilities providing diagnosis or treatment with radioisotopes should issue, in agreement with the appropriate regulatory authority and the security services, certificates to (local) patients detailing the radioisotope and activity used. This may facilitate subsequent investigation following the triggering of an alarm.
(u) International assistance can provide supporting resources but should preferably be planned well in advance and through established agreements.

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Annex I

GENERIC ACTION PLAN

This annex describes examples of specific actions that the State may consider to apply to enhance nuclear security in the organization of a *major public event*. Some of the items may not be applicable for all *major public event* situations and the timetable may vary widely depending upon the State and current circumstances. The generic time periods before the start of the event, in parentheses, reflect the time needed (in days) to achieve the action and the time prior to the start of the event (in months) when action should be initiated. An example of lead time derived from the experience gained at the Athens 2004 Olympic Games is illustrated in Fig. I–1.

(a) Establishing an organizational structure (90 days and 18 months):
- Identify the roles and responsibilities of all organizations involved in the various areas of nuclear security during the *major public event*;

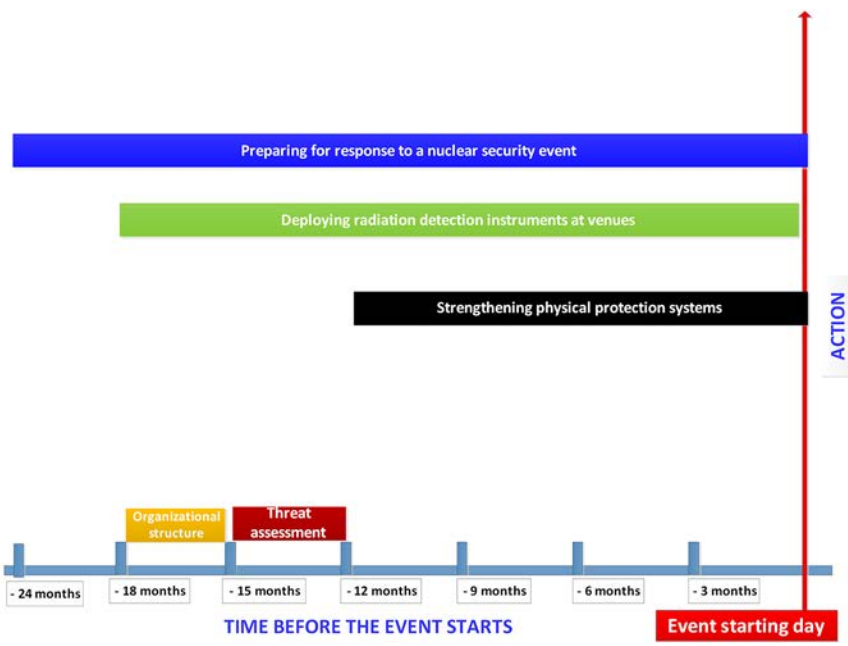

FIG. I–1. Graphic representation exemplifying generic time periods needed to achieve an action and when to initiate that action, prior to the start of the event.

- Identify key personnel from each agency having appropriate decision making authority to ensure effective coordination (interdisciplinary groups as well as with international partners);
- Prepare a budget and obtain the funding.

(b) Conducting national threat assessment (90 days and 15 months):
- Develop or review the national threat assessment based on threat information;
- Incorporate the threat assessment into the overall nuclear security plan and developing concepts, procedures and resources.

(c) Strengthening physical protection systems for nuclear and other radioactive material and associated facilities, as applicable (360 days and 12 months). The following steps may be required:
- Assess needs;
- Design a strengthened physical protection system using the existing needs assessment;
- Procure and install equipment;
- Develop and test procedures;
- Train on-site personnel.

(d) Deploying *detection* instruments at *venue*s and other *strategic locations* (540 days and 18 months). Main tasks of this action include:
- Select sites where radiation *detection* instruments are to be installed;
- Procure and deploy radiation *detection* instruments;
- Perform acceptance testing;
- Develop and test *detection* and *response* procedures;
- Designate personnel to use radiation *detection* instruments and allocate responsibilities;
- Train personnel on radiation *detection* instrument use and procedures;
- Perform pre-event radiological surveys and background mapping;
- Select roadblocks and security screening points.

(e) Preparing for response to a nuclear security event (730 days and 24 months):
- Develop or adapt the nuclear security *response* plan for the *major public event*;
- Enhance the *response* organization's preparedness:
  - — Develop the concept of operations;
  - — Establish an administrative and technical infrastructure for *response*;
  - — Develop a set of procedures according to the concept of operations;
  - — Arrange for international assistance to augment *response* capability;
  - — Develop a training programme;
  - — Train personnel and conduct exercises.

Annex II

GENERIC UNIFIED COMMAND AND CONTROL STRUCTURE

On the basis of the security plan, the command and control structure for a *major public event* needs to take into consideration four actionable levels (some States may use different terminology):

(i) Policy level;
(ii) Strategic level;
(iii) Operational level;
(iv) Tactical level.

An example of a generic unified command and control structure, similar to that used in the Athens 2004 Olympic Games, is described below and represented graphically in Fig. II–1.

Policy level

The policy level was the highest level with overall responsibility for security at the Athens 2004 Olympic Games. A this level, a coordination body for

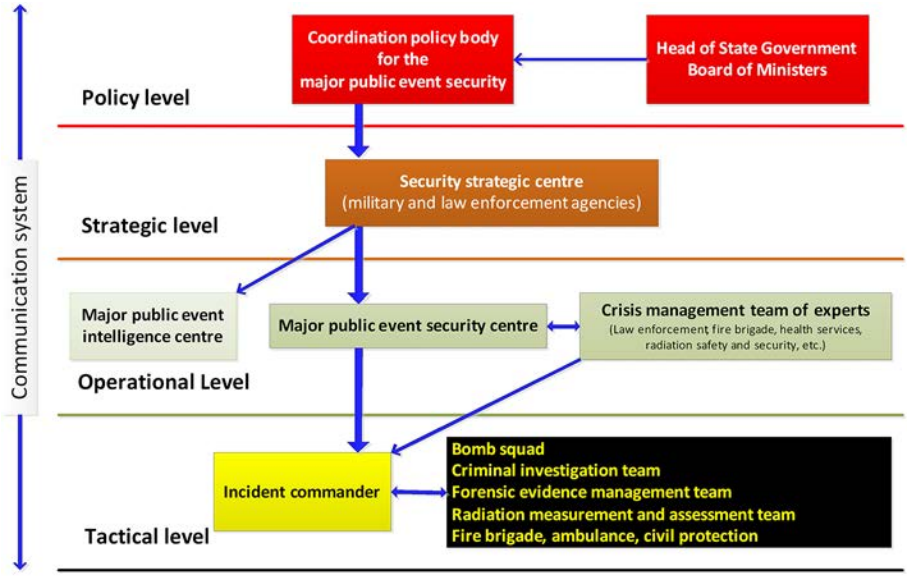

FIG. II–1. Generic unified command and control structure, similar to that used in the Athens 2004 Olympic Games.

the security of the Games was established and comprised the head of the Government and the board of relevant ministers, in accordance with the State's general plan for civil protection from all possible causes, natural or technological. This coordination body made decisions and directed the security apparatus prior to, and during, the Games and lasting until a few days after its conclusion.

Strategic level

At the strategic level, a Security Strategic Centre was established and staffed by chiefs of the military, counterterrorism assets, internal security and law enforcement agencies. This high level body was to provide advice to the Government when decisions needed to be taken involving large scale incidents and national crises.

The Security Strategic Centre was linked with both the Intelligence Centre and the Security Centre for the Games, providing and exchanging relevant information.

Operational level

The Intelligence Centre and the Security Centre for the Games operated at this level. Their main activities were to perform continuously a technical assessment of any threatening situation, including the potential consequences if the threat were perpetrated, and to decide on the implementation of field operations. In addition, the Security Centre for the Games was responsible for communicating with the security strategic centre and for providing operational instructions to the *Incident Commander*. A multidisciplinary group of experts functioned within the operational level; this group was responsible for providing technical advice on conducting field operations in any potential situation. This was available '24/7' during the Games. For example, all agencies taking part in the chemical, biological, radiological and nuclear threats associated with explosives *response* plan were represented by at least one member in this group.

Tactical level

The tactical level comprised teams of responders. Responders were those individuals who were responsible for performing specific field operations for the protection and preservation of life, property, and the environment. The responders were personnel drawn from State or local organizations, such as: law enforcement, coast guard, fire brigade, radiation assessment and other technical support organizations, military, medical, and paramedical services.

A roster of trained *Incident Commander* was available. These *Incident Commanders* were on standby and would be appointed, as appropriate. They would be in charge of deployment, direction and coordination of resources at the scene in the occurrence of an event. In case of a nuclear security event, the *Incident Commander* would have at its disposal radiation experts and other technical support personnel to conduct the required procedures.

Annex III

TIMELINE FOR IMPLEMENTATION OF STADIUM LOCKDOWN

The following scheme for the implementation of *nuclear security systems* and measures in a football stadium is based on the experiences gained during the 2010 Football World Cup in South Africa.

Approximately 48 hours before the start of the first match, the stadium was locked down, surveyed for any radioactive material and declared safe. This activity was performed in conjunction with the explosives *detection* units. After lockdown, access to the stadium was strictly controlled and all vehicles entering were searched and screened for radioactive material. At the same time, pedestrian access was controlled and all persons entering the stadium were screened for radioactive material.

Approximately three hours before the start of the first match, the spectators were allowed to enter the stadium. All persons were screened for radioactive material.

During the match, surveillance of the stadium continued, with emphasis placed on the inside perimeter fences. A schematic diagram exemplifying these actions is shown on Fig. III–1.

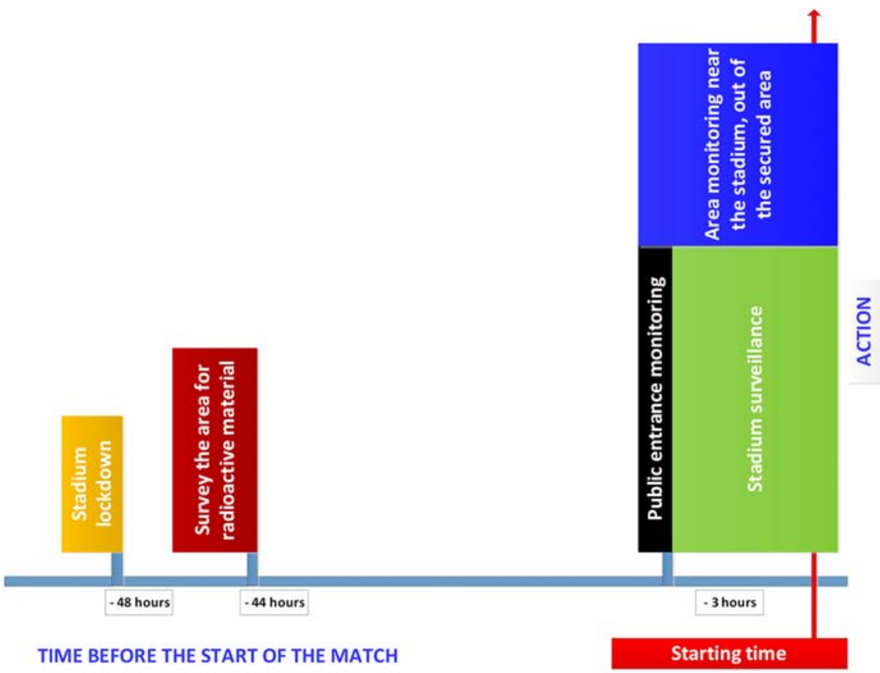

FIG. III–1. Example of a timeline for a stadium holding a major sporting event.

Annex IV

GENERIC CONCEPT OF OPERATION FOR DETECTION BY INSTRUMENTS

Pre-event survey

(a) The pre-event survey needs to include buildings and roadways, as a minimum, and extended boundaries surrounding the event location.
(b) The goal of the pre-event survey is to locate anomalous radiation levels.
(c) Anomalous radiation levels can originate from intentionally placed nuclear and other radioactive material for criminal or unauthorized acts or from variations in the natural radiation background[1].
(d) The interior and exterior of *venues* and other *strategic locations* can be surveyed for anomalous radiation levels by foot teams equipped with radiation *detection* instruments.
(e) A meticulous survey of a *venue* will include gaining access to all areas of the building, including basements, underground parking lots, mechanical spaces, storage rooms, roof areas, ventilation systems, etc.
(f) Attention needs to be given to potential storage areas such as dumpsters, temporary facilities and trailers. Typically, a two-person team can survey the area. Roadways can be surveyed using larger radiation *detection* instruments mounted on mobile platforms.
(g) Mobile search systems are effective at scanning vehicles parked along roadways, loading docks, storage yards and parking areas.
(h) By simultaneously recording the data with global positioning system (GPS) coordinates, it is possible to overlay these data on aerial photographs or street maps.
(i) Aerial surveys conducted using low flying helicopters equipped with radiation *detection* instruments can be used to provide large area surveys, extending the survey boundary of the event site to many kilometres in all directions.
(j) The aerial survey can generate a map of the radiological environment which may be used for comparison if a dispersal of radioactive material were to

[1] Variations in the natural radiation background are typical and caused by the minute quantities of radioactive material that reside in all materials. For example, construction materials such as red brick and granite have slightly more elevated radionuclide concentrations than wood and concrete. As such, these materials may appear to register anomalous radiation levels.

occur. Typical flight altitude is 45–90 metres. As with the mobile survey, the aerial radiation data are correlated with the GPS coordinates and overlaid on aerial photographs or street maps.

(k) Once the pre-event surveys have been completed, it is important to review the data and identify radiation anomalies.

(l) The anomalies need to be investigated, initially, by first localizing hotspots and then by performing radionuclide identification.

(m) Any confirmed innocent alarm needs to be recorded.

Security screening points

(a) Once the event *venue* has been surveyed and the security perimeter[2] established, it is necessary to place radiation *detection* instruments at key locations to monitor all incoming pedestrian and vehicular traffic in the security perimeter.

(b) Protocols should be established for these tasks. For example:
- When a pedestrian or vehicle containing nuclear and other radioactive material passes through a radiation *detection* instrument and an alarm is sounded.
- Security officers manning the instrument will then stop the pedestrian or vehicle and conduct an investigation.
- The investigation will be a combination of questions, documentation review, radiation anomaly localization and radioactive material identification.
- The security officer will then follow the established protocols for adjudicating the alarm.[3]
- The radiation *detection* instruments should remain in operation from the end of the pre-event survey until the end of the event and manned 24 hours a day for optimum security.
- Security checkpoints are deliberately high profile to discourage those with criminal or terrorist intent.

[2] The area inside the security perimeter can be referred to as the hard zone and the area outside as the soft zone.

[3] Common causes of radiation *detection* alarms are individuals that recently underwent a medical diagnostic test using radiopharmaceuticals or a vehicle containing a commercial product with slightly elevated concentrations of naturally occurring radioactive material (NORM). Examples of NORM include certain ceramics, fertilizers and building supplies.

Roving monitoring teams

(a) When it is not possible to secure completely all entrance ways with radiation *detection* instruments, roving teams equipped with radiation *detection* instruments can be deployed to move throughout the event *venue* scanning for radioactive material.
(b) Foot teams can be deployed throughout the event *venues*.
(c) Vehicle survey teams can be deployed both inside and outside the security perimeter.
(d) All foot and vehicle survey teams will need to have all access credentials in order to pass in and out of the security perimeter with ease.
(e) The roving *response* teams typically operate with a low profile so as not to interfere with the event's activities but still provide surveillance.

Annex V

TYPES OF RADIATION *DETECTION* INSTRUMENT AND THEIR APPLICATIONS

Personal radiation detectors (PRDs) or radiation pagers are compact detectors that are worn attached to the operator's belt. The pagers have simple alarm thresholds, including a safety alarm in the case of high doses that will alert the operator by vibrating, flashing lights and/or audible tones. They are relatively inexpensive and do not require extensive operator training. In general, training on their use can be accomplished within 10 minutes for a single person.

FIG. V–1. Typical example of a PRD.

Portable radiation scanners (PRSs) or backpacks are more sensitive than radiation pagers and allow the operator to survey a larger area in a shorter period of time. The backpacks have simple alarm thresholds that will alert the operator via indicators on the personal digital assistant, such as display indicators, flashing lights and/or audible tones. They weigh approximately 10 kg. The backpacks require some basic training to enable the operator to conduct proper operation and search techniques. Training can be accomplished in 30 minutes for a single person.

FIG. V–2. Representation of a typical PRS with a mode of survey.

Mobile radiation detection instruments are large radiation detectors for surveying or searching roadways, parking lots and parking garages. The mobile systems typically require an experienced technician to install and set up, but the operation can be performed by operators with 30 minutes of training. A good team composition is to have a law enforcement officer drive the vehicle and a technician on radiation *detection* instruments to operate the instrument. The technician will monitor the radiation *detection* instrument via a computer display. Typically, the law enforcement officer will be familiar with the local area whereas the operator may have been deployed from another city to support the event. These systems can also be mounted on small watercraft for maritime operation.

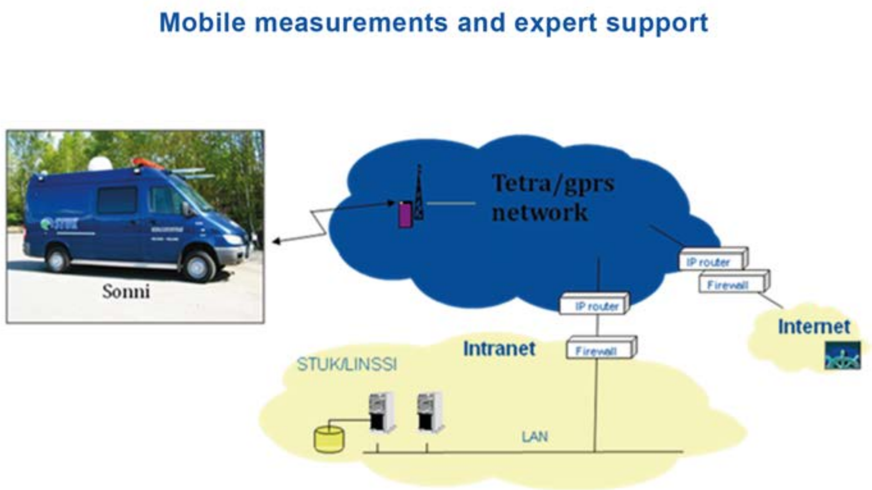

FIG. V–3. Example of an advanced mobile measurement laboratory (courtesy of STUK, Finland) used for nuclear security purposes at the Athletics World Championships in Helsinki in 2005. The system consists of short in-field measurements (4 s), secure data transfer to headquarters and automated software to handle the measurements in real time. All data, including alarms, can be remotely reviewed by experts using a digital mapping system and related analysis software.

Radiation portal monitors[1] (RPMs) can be pedestrian portal monitors or vehicle portal monitors.

Pedestrian RPMs are designed to monitor pedestrians entering *venues*. Configurations include single stanchion or two-sided walk-through systems.

[1] RPM detection thresholds: The RPM continuously measures the background radiation level and adjusts the alarm threshold to the actual background. Once the RPM threshold is exceeded, by radioactive material passing through, the system will sound an alarm.

The portals require an experienced technician to set them up but can be operated by security personnel. Ad hoc solutions, in case RPMs are not available, can be as simple as personnel with pagers or backpack detectors deployed next to the screening point.

FIG. V–4. Example of a typical pedestrian RPM installed at a port.

Vehicle RPMs are designed to monitor vehicle traffic entering a *venue* or other *strategic location*. Configurations include two types: fixed installed single or double pillar systems at controlled convergence points.

FIG. V–5. Example of a typical vehicle RPM installed at a point of entry.

Aerial radiation survey systems comprise large detectors mounted on helicopters and are used to conduct large area surveys or searches. These systems require experienced technicians to set up and to operate. It is also important to have pilots who are training in low altitude pattern flying to undertake these survey and search missions.

FIG. V–6. Example of an aerial radiation survey system Hélinuc™ (Courtesy CEA/DAM–FRANCE).

Radionuclide identification devices (RIDs) are low resolution instruments for identification of discovered radionuclides. Resolution refers to the instrument's capacity to resolve or distinguish between the energies of gamma rays emitted from the radioactive material and depends on the type of detector

FIG. V–7. Typical hand-held RIDs.

FIG. V–8. Examples of typical high resolution gamma spectrometry systems with the electrically cooled HPGe detector.

material used. The RIDs require 1 hour of training for basic operations. Detailed analysis of the recorded gamma ray spectrum requires an expert in spectroscopy.

High resolution gamma spectrometry systems are based on high purity germanium (HPGe) detectors. High resolution gamma spectrometry systems are most suitable for acquiring the ‘fingerprint’ of radioactive material. Two different

FIG. V–9. Examples of a typical high resolution gamma spectrometry system employing a liquid nitrogen cooled HPGe detector.

types are currently available: the electrically cooled system and the liquid nitrogen cooled system.

Electrically cooled HPGe systems are available as high resolution radionuclide identification systems and could be used by experts in gamma spectroscopy and by other trained persons. Such *detection* instruments require 1 hour of training for basic operation. Detailed analysis of the gamma ray spectrum requires an expert in spectroscopy.

Liquid nitrogen cooled HPGe systems provide better resolution compared with the electrically cooled types but are designed as an expert tool only.

ANNEX VI

GENERIC INTERDICTION AND ADJUDICATION PROTOCOLS

Radiation responders typically do not have law enforcement authority, and as such, work directly with law enforcement officers or event security officers to conduct interdictions in the event of a instrument alarm. A short (30 minute) training course with security officers in advance and providing a wallet card with the procedure and contact information has been found to be an effective approach. The most likely cause of the instrument alarms at the pedestrian portals is individuals that have recently undergone medical procedures. Some medical procedures use radiopharmaceuticals (i.e. short lived radionuclides). In these instances, detaining and questioning the individual who may have triggered the alarm and identifying the radionuclide can resolve the alarm.

While the security officer conducts the investigation, the secondary inspection team will conduct the radionuclide identification with the radionuclide identification device. The instrument will be held close to the individual (but without touching them) for one minute to collect the data for the identification. One minute is usually sufficient for identifying radionuclides from a medical procedure. The radionuclide(s) used in medical procedures have relatively short half-lives, but even then, an individual can still contain sufficient radionuclide activity to trigger portal alarms several days to a week after the procedure. Upon completion of the measurement, the team will notify the security officer of the radionuclide(s) and provide confirmation of a medical radionuclide that requires further investigation. If the investigation reveals the use of a radionuclide for medical purposes, the individual can be released and the investigation results reported. The security officer will then complete a log of the event detailing the following information:

(a) Line 1: Time
(b) Line 2: Location
(c) Line 3: Radionuclide
(d) Line 4: Data file name for radionuclide identification
(e) Line 5: Last name
(f) Line 6: First name
(g) Line 7: Radiation *detection* instrument used (type, model, serial no.)
(h) Line 8: Additional identifying data/information

If the radionuclide identification reveals a suspicious source, the individual will need to be detained in a secure area for further questioning and additional measurements.

GLOSSARY

For the purposes of this publication, the following key definitions are assumed:

detection. Awareness of a criminal or unauthorized act with *nuclear security* implications or measurement(s) indicating the unauthorized presence of nuclear and other radioactive material at an associated facility or associated activity or a *strategic location.*

detection measure. Measures intended to detect a criminal or unauthorized act with nuclear security implications.

detection system. Integrated set of *detection measures* including capabilities and resources necessary for *detection* of a criminal or unauthorized act with nuclear security implications.

incident commander (IC). The person in charge of the *nuclear security event*. The IC commands the entire *response* and directs all those supporting the *response*. The IC may delegate authority for performing certain activities to others as required, e.g. to on-scene controller, the public information officer/team.

information alert. Time sensitive reporting that could indicate a *nuclear security event*, requiring assessment, and may come from a variety of sources, including operational information, medical surveillance, accounting and consigner/consignee discrepancies, border monitoring, etc.

instrument alarm. Signal from instruments that could indicate a *nuclear security event*, requiring assessment. An *instrument alarm* may come from devices that are portable or deployed at fixed locations and operated to augment normal commerce protocols and/or in a law enforcement operation.

major public event. A high profile event that a State has determined to be a potential *target* to include, for example, sporting, political, and religious gatherings involving large numbers of spectators and participants.

nuclear security event. An event that has potential or actual implications for *nuclear security* that must be addressed.

nuclear security measures. Measures intended to prevent a *nuclear security* threat from completing criminal or intentional *unauthorized acts* involving or directed at nuclear and other radioactive material, associated facilities, or associated activities or to detect or respond to *nuclear security events*.

nuclear security regime. The *nuclear security regime* comprises:

- The legislative and regulatory framework and administrative systems and measures governing the nuclear security of nuclear and other radioactive material, associated facilities and associated activities;
- The institutions and organizations within the State responsible for ensuring the implementation of the legislative and regulatory framework and administrative systems of nuclear security;
- *Nuclear security systems* and *nuclear security measures* at the facility level, transport level and activity level for *detection* of, and *response* to, *nuclear security events*.

The *nuclear security regime* is composed of *nuclear security systems*. The *nuclear security systems* are made up from various *nuclear security measures.*

nuclear security system. An integrated set of *nuclear security measures*.

point of entry. An officially designated *point of entry* is a place on the land border between two States, seaport, international airport or other point where travellers, means of transport, and/or goods are inspected. Often, customs and immigration facilities are provided at these *points of entry.* A non-designated *point* of entry is any air, land and water crossing point that is not officially designated for travellers and/or goods by the State, such as green borders, sea shores and local airports.

radiation search. The set of activities used to detect, and identify suspicious nuclear and other radioactive material out of regulatory control and to determine its location.

radiation survey. Activities to map the radiation background of natural and human-made radioactive material in an area or to facilitate later search activities.

response. All of the activities by a State that involve the assessment and response to a *nuclear security event*.

response measure. A measure intended to assess an alarm/alert and to respond to a *nuclear security event*.

sensitive information. Information, in whatever form, including software, the unauthorized disclosure, modification, alteration, destruction, or denial of use which could compromise nuclear security.

strategic location. A location of high security interest in the State which is a potential *target* for terrorist attack using nuclear and other radioactive material or a location for *detection* of nuclear and other radioactive material out of regulatory control.

target. Nuclear and other radioactive material, associated facilities, associated activities, or other locations or objects of potential exploitation by a nuclear security threat, including *major public events, strategic locations, sensitive information* and sensitive information assets.

venue. Any identified location (such as a building, stadium, open area/park, religious place) where a *major public event* actually takes place. A *venue* is considered to be a *strategic location*.

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