

IAEA Nuclear Security Series No. 14

Recommendations

# Nuclear Security Recommendations on Radioactive Material and Associated Facilities



**IAEA**

International Atomic Energy Agency

# THE IAEA NUCLEAR SECURITY SERIES

Nuclear security issues relating to the prevention and detection of, and response to, theft, sabotage, unauthorized access and illegal transfer or other malicious acts involving nuclear material and other radioactive substances and their associated facilities are addressed in the **IAEA Nuclear Security Series** of publications. These publications are consistent with, and complement, international nuclear security instruments, such as the amended Convention on the Physical Protection of Nuclear Material, the Code of Conduct on the Safety and Security of Radioactive Sources, United Nations Security Council Resolutions 1373 and 1540, and the International Convention for the Suppression of Acts of Nuclear Terrorism.

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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.

Technical Guidance publications are developed in close consultation with international experts. Technical meetings are not required, but may be conducted, where it is considered necessary, to obtain a broad range of views.

The process for drafting and reviewing publications in the IAEA Nuclear Security Series takes account of confidentiality considerations and recognizes that nuclear security is inseparably linked with general and specific national security concerns. An underlying consideration is that related IAEA safety standards and safeguards activities should be taken into account in the technical content of the publications.

NUCLEAR SECURITY  
RECOMMENDATIONS  
ON RADIOACTIVE MATERIAL  
AND ASSOCIATED FACILITIES

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RECOMMENDATIONS  
ON RADIOACTIVE MATERIAL  
AND ASSOCIATED FACILITIES

RECOMMENDATIONS

INTERNATIONAL ATOMIC ENERGY AGENCY  
VIENNA, 2011

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## FOREWORD

The possibility that nuclear or other radioactive material could be used for malicious purposes cannot be ruled out in the current global situation. States have responded to this risk by engaging in a collective commitment to strengthen the protection and control of such material and to respond effectively to nuclear security events. States have agreed to strengthen existing and have established new international legal instruments to enhance nuclear security worldwide. Nuclear security is fundamental in the management of nuclear technologies and in applications where nuclear or other radioactive material is used or transported.

Through its Nuclear Security Programme, the IAEA supports States to establish, maintain and sustain an effective nuclear security regime. The IAEA has adopted a comprehensive approach to nuclear security. This recognizes that an effective national nuclear security regime builds on: the implementation of relevant international legal instruments; information protection; physical protection; material accounting and control; detection of and response to trafficking in such material; and national response plans and contingency measures. With its Nuclear Security Series, the IAEA aims to assist States in implementing and sustaining such a regime in a coherent and integrated manner.

The IAEA Nuclear Security Series comprises Nuclear Security Fundamentals, which includes objectives and essential elements of a State's nuclear security regime; Recommendations; Implementing Guides; and Technical Guidance.

Each State carries the full responsibility for nuclear security. Specifically, to provide for the security of nuclear and other radioactive material and associated facilities and activities; to ensure the security of such material in use, storage or in transport; to combat illicit trafficking and the inadvertent movement of such material; and to be prepared to respond to a nuclear security event.

This is a Recommendations level publication for the nuclear security of radioactive material, associated facilities and associated activities. It is based on national experience and practices, and publications in the field of nuclear security, as well as international instruments related to nuclear security. These recommendations are provided for consideration by States and competent authorities.

The preparation of this publication in the IAEA Nuclear Security Series has been made possible by the contribution of a large number of experts from Member States. An extensive consultation process with all Member States has included open-ended technical meetings in Vienna, the first in February 2010. The draft was then circulated to all Member States for 120 days to solicit further comments and suggestions. During a final open-ended technical meeting in

September 2010, the comments received from Member States were reviewed and consensus was obtained on the final version of this publication.

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# CONTENTS

1.	INTRODUCTION .....	1
	Background (1.1–1.9) .....	1
	Purpose (1.10–1.12) .....	2
	Scope (1.13–1.21) .....	3
	Structure (1.22–1.25) .....	4
2.	OBJECTIVES OF A STATE’S NUCLEAR SECURITY REGIME FOR RADIOACTIVE MATERIAL, ASSOCIATED FACILITIES AND ASSOCIATED ACTIVITIES (2.1–2.4) .....	5
3.	ELEMENTS OF A STATE’S NUCLEAR SECURITY REGIME FOR RADIOACTIVE MATERIAL, ASSOCIATED FACILITIES AND ASSOCIATED ACTIVITIES .....	6
	State responsibility (3.1) .....	6
	Assignment of nuclear security responsibilities (3.2–3.3) .....	6
	Legislative and regulatory framework .....	7
	State (3.4–3.10) .....	7
	Regulatory body (3.11–3.12) .....	8
	Operator, shipper and/or carrier (3.13) .....	9
	International cooperation and assistance (3.14–3.16) .....	9
	Identification and assessment of threats (3.17–3.18) .....	10
	Risk based nuclear security systems and measures .....	10
	Risk management (3.19–3.24) .....	10
	Interfaces with the safety system (3.25–3.28) .....	11
	Sustaining the nuclear security regime (3.29–3.32) .....	12
	Planning and preparedness for and response to nuclear security events (3.33) .....	12
	Import and export of radioactive material (3.34) .....	12
	Detection of nuclear security events (3.35) .....	13
4.	RECOMMENDATIONS FOR THE SECURITY OF RADIOACTIVE MATERIAL, ASSOCIATED FACILITIES AND ASSOCIATED ACTIVITIES .....	13
	General recommendations (4.1) .....	13
	Threat assessment (4.2) .....	13

Graded approach (4.3) .....	14
Categorization (4.4–4.5) .....	14
Regulatory approach (4.6–4.7) .....	14
Recommendations for the security of radioactive material	
in use and storage (4.8–4.9) .....	15
Security system (4.10–4.15) .....	15
Security management (4.16–4.25) .....	17
Recommendations for the security of radioactive material	
in transport (4.26–4.38) .....	19
 DEFINITIONS .....	 23
 REFERENCES .....	 27

# 1. INTRODUCTION

## BACKGROUND

1.1. The IAEA has established a Nuclear Security Programme and instituted a series of publications on nuclear security to provide recommendations and guidance that States can use in establishing, implementing and maintaining their national *nuclear security regime*<sup>1</sup>.

1.2. The IAEA Nuclear Security Series framework comprises four levels of publications: Nuclear Security Fundamentals, Recommendations, Implementing Guides and Technical Guidance.

1.3. The single top tier publication — Nuclear Security Fundamentals — contains objectives and essential elements of nuclear security<sup>2</sup> and provides the basis for security recommendations.

1.4. The second tier set of Recommendations elaborates on the essential elements of nuclear security and presents international consensus on what States should do in applying these essential elements.

1.5. The third and fourth tiers — Implementing Guides and Technical Guidance — provide more detailed information on implementing the recommendations using appropriate measures.

1.6. This publication is complementary to and consistent with the Nuclear Security Recommendations publications on:

- Physical Protection of Nuclear Material and Nuclear Facilities (also INFCIRC/225/Revision 5) [1]; and
- Nuclear and Other Radioactive Material out of Regulatory Control [2].

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<sup>1</sup> Italicized words in the text represent terms defined in the section on Definitions.

<sup>2</sup> Nuclear security focuses on the prevention of, detection of, and response to, criminal or intentional unauthorized acts involving or directed at nuclear material, other radioactive material, associated facilities, or associated activities. Other acts determined by the State to have an adverse impact on nuclear security should be dealt with appropriately.

In order to establish a comprehensive national *nuclear security regime* the recommendations contained in all three publications should be implemented.

1.7. This publication is a Recommendations level document for the security of *radioactive material, associated facilities and associated activities*.

1.8. *Radioactive material* is used throughout the world for a wide variety of beneficial purposes, for example in industry, medicine, research, agriculture and education. Security measures are needed to prevent the acquisition of such material for a *malicious act* causing a radiological hazard, and thus the measures should protect individuals, society and the environment from such harmful effects.

1.9. The present publication will assist States to implement a comprehensive *nuclear security regime*, including any obligations and commitments they might have with respect to international instruments [3] related to the security of *radioactive material, associated facilities and associated activities* such as the International Convention for the Suppression of Acts of Nuclear Terrorism [4] and the Code of Conduct on the Safety and Security of Radioactive Sources [5] and its supplementary Guidance on the Import and Export of Radioactive Sources [6].

## PURPOSE

1.10. The purpose of this publication is to provide guidance to States and *competent authorities* on how to develop or enhance, to implement and to maintain a *nuclear security regime* for *radioactive material, associated facilities and associated activities*. This can be achieved through the establishment or improvement of their capabilities to implement a legislative and regulatory framework to address the security of *radioactive material, associated facilities and associated activities* in order to reduce the likelihood of *malicious acts* involving such material.

1.11. This publication provides a set of recommendations to ensure a consistent level of security of *radioactive material* and to ensure that there is a balance between managing *radioactive material* securely while still enabling it to be used safely by *authorized persons* without unduly limiting the use of *radioactive material* for societal benefits. This is because *radioactive material* is an integral tool in the world's health care, manufacturing, research and quality control industries.

1.12. These recommendations are provided for consideration by States and *competent authorities* but are not mandatory upon a State and do not infringe the sovereign rights of States.

## SCOPE

1.13. This publication applies to the security of *radioactive material, associated facilities* and *associated activities* for the prevention of *malicious acts* intended or likely to cause harmful radiological consequences. Such *radioactive material* includes *nuclear material* (as discussed below), sealed sources, unsealed *radioactive material* and radioactive waste.

1.14. The publication covers the security of *radioactive material* throughout its life cycle: manufacture, supply, receipt, possession, storage, use, transfer, import, export, transport, maintenance, and recycling or disposal. It provides recommendations for the establishment of a *nuclear security regime* to protect against the *unauthorized removal* of *radioactive material*, including *nuclear material* (as discussed below), and against the *sabotage* of *other radioactive material, associated facility* or *associated activities*.

1.15. The purpose of an *unauthorized removal*<sup>3</sup> of *nuclear material* could be for use in the construction of a nuclear explosive device or for subsequent exposure or dispersal leading to harmful radiological consequences. This publication applies to the protection of nuclear material against unauthorized removal for potential subsequent off-site exposure or dispersal. The physical protection of *nuclear material* against *unauthorized removal* for use in a nuclear explosive device and the physical protection of nuclear facilities against *sabotage* are addressed in IAEA Nuclear Security Series No. 13, Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5) [1].

1.16. The security of facilities containing *nuclear material* that could be a potential target both for *unauthorized removal* for use in a nuclear explosive

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<sup>3</sup> The levels of protection of *nuclear material* defined in IAEA Nuclear Security Series No. 13 [1] are based on the categorization of *nuclear material* potentially suitable for use in the construction of a nuclear explosive device and are not based on the radiological consequences of other ways of exposure or subsequent dispersal. Accordingly, to the extent *nuclear material* is a potential target for *unauthorized removal* and subsequent exposure or dispersion, its protection is addressed in this publication.

device and for *unauthorized removal* for subsequent exposure or dispersal should consider both the recommendations in this publication and those in IAEA Nuclear Security Series No. 13 [1]. In those cases the more stringent recommendations and security measures should be applied.

1.17. When a facility contains *nuclear material* and *other radioactive material*, the protection requirements for both should be considered and implemented in a consistent and non-conflicting manner in order to achieve an adequate level of security.

1.18. Facilities holding *radioactive material* may contain other hazardous material that could have severe non-radiological consequences. This publication does not address such material.

1.19. The recommendations made in this publication are in all cases additional to, and not a substitute for, other requirements and recommendations established for safety or radiation protection purposes for *radioactive material*, *associated facilities* and *associated activities*. This publication provides information on the interfaces between safety and security of *radioactive material*. Specific safety requirements are contained in the IAEA Safety Standards.

1.20. *Radioactive material* which is out of *regulatory control* is addressed in the Recommendations level publication Nuclear Security Recommendations on Nuclear and Other Radioactive Material out of Regulatory Control (IAEA Nuclear Security Series No. 15) [2]. That publication includes action taken to locate and to recover material after the reporting of lost, missing or stolen *radioactive material* to a *competent authority* (e.g. regulatory body or law enforcement agency) according to national regulation.

1.21. This publication is intended for use in the security of *radioactive material*, *associated facilities* and *associated activities* used for civil purposes. States may decide whether or not to extend the publication's use to other purposes.

## STRUCTURE

1.22. Section 2 provides the objectives of a State's *nuclear security regime* for *radioactive material*, *associated facilities* and *associated activities*.

1.23. Section 3 applies the essential elements as the management principles that should govern a State's *nuclear security regime* for *radioactive material*,

*associated facilities* and *associated activities* and also the roles and responsibilities of the State, the *regulatory body*, and *operators, shippers* and/or carrier.

1.24. Section 4 provides recommendations for the security of *radioactive material, associated facilities* and *associated activities*. The section further applies the essential elements to recommendations for the security measures that the *regulatory body* should require *operators* to implement, consistent with Section 3.

1.25. Italicized words in the text are defined in the Definitions section.

## **2. OBJECTIVES OF A STATE'S NUCLEAR SECURITY REGIME FOR RADIOACTIVE MATERIAL, ASSOCIATED FACILITIES AND ASSOCIATED ACTIVITIES**

2.1. The overall objective of a State's *nuclear security regime* is to protect persons, property, society, and the environment from *malicious acts* involving *nuclear material* or *other radioactive material* that could cause *unacceptable radiological consequences*. The objectives of a *nuclear security regime* for *radioactive material, associated facilities* and *associated activities* should be:

- Protection against *unauthorized removal* of *radioactive material* used in *associated facilities* and in *associated activities*;
- Protection against *sabotage* of *other radioactive material, associated facilities* and *associated activities*;
- Ensuring the implementation of rapid and comprehensive measures to locate, recover, as appropriate, *radioactive material* which is lost, missing or stolen and to re-establish regulatory control.

The third objective is mainly related to *radioactive material* out of *regulatory control*, which is addressed in IAEA Nuclear Security Series No. 15, Nuclear Security Recommendations on Nuclear and Other Radioactive Material out of Regulatory Control [2].

2.2. These objectives are realized through security measures to deter, detect, delay and respond to a potential *malicious act*, and to provide for the security management of *radioactive material* and *associated facilities* and *associated activities*.

2.3. These security measures should be based on a risk informed *graded approach* so that similar security is provided for material capable of resulting in similar potential radiological consequences arising from use in a *malicious act*. They should also use the concept of *defence in depth*.

2.4. Recognizing the societal benefits of using *radioactive material*, the *nuclear security regime* should strive to achieve a balance between managing *radioactive material* securely without unduly limiting the conduct of those beneficial activities.

### **3. ELEMENTS OF A STATE'S NUCLEAR SECURITY REGIME FOR RADIOACTIVE MATERIAL, ASSOCIATED FACILITIES AND ASSOCIATED ACTIVITIES**

#### **STATE RESPONSIBILITY**

3.1. The responsibility for the establishment, implementation and maintenance of a *nuclear security regime* within a State rests entirely with that State.

#### **ASSIGNMENT OF NUCLEAR SECURITY RESPONSIBILITIES**

3.2. The State should clearly define and assign nuclear security responsibilities to *competent authorities*, noting that they may include *regulatory bodies*, law enforcement, customs and border control, intelligence and security agencies, health agencies, etc. Provision should be made for appropriate integration and coordination of responsibilities within the State's *nuclear security regime*. Clear lines of responsibility and communication should be established and recorded between the *competent authorities*.



3.3. The State should ensure effective overall cooperation and relevant information sharing between the *competent authorities*. This should include sharing of relevant information (such as information about the *threat* to be protected against and other useful intelligence) in accordance with national regulations.

## LEGISLATIVE AND REGULATORY FRAMEWORK

### State

3.4. The State should establish, implement, and maintain an effective national legislative and regulatory framework to regulate the nuclear security of *radioactive material, associated facilities and associated activities*, which:

- Takes into account the risk of *malicious acts* involving *radioactive material* that could cause *unacceptable radiological consequences*;
- Defines the *radioactive material, associated facilities and associated activities* which are subject to the *nuclear security regime* in terms of nuclides and quantities of *radioactive material* present;
- Prescribes and assigns governmental responsibilities to relevant entities including an independent *regulatory body*;
- Places the prime responsibility on the *operator, shipper* and/or carrier for implementing and maintaining security measures for *radioactive material*;
- Establishes the *authorization* process for *radioactive material, associated facilities and associated activities*. As appropriate, the *authorization* process concerning the security of *radioactive material* could be integrated within one defined for safety or radiation protection;
- Establishes the inspection process for security requirements;
- Establishes the enforcement process for the failure to comply with security requirements established under legislative and regulatory framework;
- Establishes sanctions against the *unauthorized removal* of *radioactive material* and *sabotage* of *associated facilities and associated activities*;
- Takes into account the interface between security and safety of *radioactive material*.

3.5. The State should take appropriate steps within the legislative and regulatory framework to establish and ensure the proper implementation of its *nuclear security regime* throughout the life cycle of the *radioactive material*.

3.6. The State should designate one or more *competent authorities*, including a *regulatory body*, for the establishment, implementation and maintenance of a *nuclear security regime*, which have a clearly defined legal status and independence from the *operator, shipper* and/or carrier and which have the legal authority to enable them to perform their responsibilities and functions effectively.

3.7. The State should ensure that the *regulatory body* and other *competent authorities* are adequately provided with the necessary authority, competence and financial and human resources to fulfil their assigned nuclear security responsibilities.

3.8. The State should establish requirements in accordance with national practices to ensure appropriate protection of specific or detailed information, which could compromise the security of *radioactive material, associated facilities* and *associated activities* if the information were disclosed.

3.9. The State should ensure that measures, consistent with national practices, are in place to ensure the trustworthiness of persons with authorized access to sensitive information or, as applicable, to *radioactive material, associated facilities* and *associated activities*.

3.10. The State should establish, develop and maintain a national register of *radioactive material* over thresholds defined by the State. This national register should, as a minimum, include Category 1 and 2 radioactive sealed sources, as described in the Code of Conduct on the Safety and Security of Radioactive Sources [5]. Other *radioactive material* could, as appropriate, be included in this register.

### **Regulatory body**

3.11. The *regulatory body* should implement the legislative and regulatory framework and authorize activities only when they comply with its nuclear security regulations. Where it is required, the security plan, as defined in paras 4.20 and 4.21, can be used by the regulatory body in its determination for issuance of an authorization.

3.12. The regulatory body should verify continued compliance with nuclear security regulations and relevant authorization conditions, notably through periodic inspections and ensuring that corrective action is taken, when needed. Inspections of security measures implemented by an *operator*;

*shipper* and/or carrier could be performed together with inspections for verifying compliance with other regulatory requirements, such as radiation protection and safety. The security plan could be referred to by the *regulatory body* for these activities.

### **Operator, shipper and/or carrier**

3.13. The legislative and regulatory framework should require that the *operator, shipper* and/or carrier:

- Comply with all applicable regulations and requirements established by the State and the *regulatory body*;
- Implement security measures that comply with requirements established by the State and the *regulatory body*;
- Establish quality management programmes that provide:
  - Assurance that the specified requirements relating to nuclear security are satisfied;
  - Assurance that the components of the *nuclear security system* are of a quality sufficient for their tasks;
  - Quality control mechanisms and procedures for reviewing and assessing the overall effectiveness of security measure;
- Report to the *regulatory body* and/or to any other *competent authority*, all *nuclear security events* involving *radioactive material, associated facilities* and *associated activities* according to national practices;
- Cooperate with and assist any relevant *competent authorities* in case of a *nuclear security event*.

## INTERNATIONAL COOPERATION AND ASSISTANCE

3.14. States are encouraged to cooperate and consult, and to exchange information on nuclear security techniques and practices, either directly or through relevant international organizations.

3.15. States concerned should, in accordance with their national law, provide cooperation and assistance to the maximum feasible extent in the location and recovery of *radioactive material* to any State that so requests.

3.16. For the purpose of reporting *nuclear security events*, States should consider establishing suitable arrangements to enable them to participate in relevant regional and international databases and international activities in accordance

with their national legislation. One example is the IAEA's Illicit Trafficking Database (ITDB). Consideration should also be given to other bilateral and multilateral support arrangements.

## IDENTIFICATION AND ASSESSMENT OF THREATS

3.17. The State should assess its national *threat* for *radioactive material*, *associated facilities* and *associated activities*. The State should periodically review its national *threat*, and evaluate the implications of any changes in the *threat* for the design or update of its *nuclear security regime*.

3.18. The *regulatory body* should use the results of the *threat assessment* as a common basis for determining security requirements for *radioactive material* and for periodically evaluating their adequacy. The *regulatory body* should have access to information from other State authorities on present and foreseeable *threats* involving *radioactive material*.

## RISK BASED NUCLEAR SECURITY SYSTEMS AND MEASURES

### **Risk management**

3.19. The State should follow a structured risk management approach to reduce the risks of *malicious acts* to an acceptable level. The State should assess the potential *threats*, the potential consequences and the likelihood of *malicious acts*, and then develop a legislative and regulatory framework that provides for efficient and effective security measures to address the *threat*.

3.20. The State should decide what level of risk is acceptable and what level of effort is justified to protect *radioactive material*, *associated facilities* and *associated activities* against the *threat* so as to reduce the risk to an acceptable level, given the availability of resources, the benefit of the protected asset to society, and other priorities. The required security measures may take advantage of other measures established for radiological safety purposes.

3.21. The *regulatory body* should establish regulations based on a prescriptive approach, a performance based approach or a combined approach in order to achieve the objectives of the *nuclear security regime*, as discussed in paras 4.6 and 4.7.

3.22. The State should consider ways of reducing the nuclear security risk associated with *radioactive material*, particularly *radioactive sources*, for example by encouraging the use of an alternative radionuclide, chemical form, or non-radioactive technology, or by encouraging device designs that are more tamper resistant.

3.23. The *regulatory body* should develop requirements by using a *graded approach* applying the principles of risk management including a categorization of *radioactive material*.

3.24. The *regulatory body* should develop requirements based on the concept of *defence in depth*. Security requirements for *radioactive material* require a designed mixture of hardware (security devices), procedures (access control, follow-up, etc.) and facility design.

### **Interfaces with the safety system**

3.25. Recognizing that both safety and security have a common aim — to protect persons, society and the environment from harmful effects of radiation — a well coordinated approach in safety and in security is mutually beneficial, the State should ensure that:

- Consultation and coordination are maintained between those responsible for safety and security to ensure efficient security of *radioactive material* and to ensure that regulatory requirements are consistent, especially when responsibility for safety and security is assigned to different *competent authorities*;
- Major decisions regarding safety and security require participation of experts in safety and in security on a continual basis;
- The safety and security interfaces should be strengthened by building safety culture and *nuclear security culture* into the management system.

3.26. The State should ensure that a balance is maintained between safety and security throughout the *nuclear security regime*, from the development of the legislative framework to implementation of security measures.

3.27. The *competent authorities* should ensure that security measures for *radioactive material*, *associated facilities* and *associated activities* take into account those measures established for safety and are developed so that they do not contradict each other, during both normal and emergency situations.

3.28. The *competent authorities* working with the *operator* should ensure to the extent possible that security measures during a response to a *nuclear security event* do not adversely affect the safety of the personnel. Security personnel should manage their actions in a way that maintains the safety of all potentially affected persons, whether on or off-site.

## SUSTAINING THE NUCLEAR SECURITY REGIME

3.29. The State should commit the necessary resources, including human and financial resources, to ensure that its *nuclear security regime* is sustained and effective in the long term to provide adequate nuclear security for *radioactive material*.

3.30. The State should promote a *nuclear security culture*.

3.31. All organizations and individuals involved in implementing nuclear security should give due priority to the *nuclear security culture* with regard to *radioactive material*, to its development and maintenance necessary to ensure its effective implementation in the entire organization.

3.32. The foundation of a *nuclear security culture* should be the recognition that a credible *threat* exists, that preserving nuclear security is important, and that the role of the individual is important.

## PLANNING AND PREPAREDNESS FOR AND RESPONSE TO NUCLEAR SECURITY EVENTS

3.33. The *regulatory body* should ensure that the *operator's* security plan includes measures to effectively respond to a *malicious act* consistent with the *threat*.

## IMPORT AND EXPORT OF RADIOACTIVE MATERIAL

3.34. The State should take appropriate steps, including coordination between importer and exporter States prior to the transfer, to reduce the likelihood of *malicious acts* in connection with the import or export of quantities of *radioactive material* above thresholds that it defines. At a minimum, these steps should encompass requirements concerning Category 1 and 2 sealed *radioactive sources*,

consistent with the Guidance on the Import and Export of Radioactive Sources [6].

## DETECTION OF NUCLEAR SECURITY EVENTS

3.35. The *regulatory body* should establish requirements for *operators, shippers* and/or carriers to have appropriate and effective security measures to detect *nuclear security events* and to report any such event promptly with the aim of providing a timely response. These requirements should consider those made in IAEA Nuclear Security Series No. 15, Nuclear Security Recommendations on Nuclear and Other Radioactive Material out of Regulatory Control [2].

## 4. RECOMMENDATIONS FOR THE SECURITY OF RADIOACTIVE MATERIAL, ASSOCIATED FACILITIES AND ASSOCIATED ACTIVITIES

### GENERAL RECOMMENDATIONS

4.1. With the aim of preventing a *malicious act*, security measures should be designed to:

- Deter *malicious acts*;
- Detect and delay unauthorized access to or *unauthorized removal* of the *radioactive material*;
- Allow rapid assessment any *nuclear security events* to enable appropriate response initiation and to allow recovery or mitigation efforts to start as soon as possible;
- Provide for rapid response to any attempted or actual unauthorized access to *radioactive material*, or to other *nuclear security events* involving *radioactive material*.

### **Threat assessment**

4.2. The determination of a national *threat* to *radioactive material* in use, storage and transport and *associated facilities* is a key step in establishing the

required security measures. The results of the *threat assessment* should be used as a common basis for determining security requirements, developed by the *regulatory body* and evaluating security measures, implemented by the *operator, shipper* and/or carrier.

### **Graded approach**

4.3. Security requirements for *radioactive material* should be based on a *graded approach*, taking into account the principles of risk management, including such considerations as the level of *threat* and the relative attractiveness of the material for a *malicious act* leading to potential *unacceptable radiological consequences* (based on such factors as quantity, its physical and chemical properties, its mobility, and its availability and accessibility). Security requirements should be adapted depending on whether the *radioactive material* concerned is sealed source, unsealed source, disused sealed source or waste, and should cover transport.

### **Categorization**

4.4. A categorization system should be established that implements the *graded approach* by associating security levels (required degrees of protection) with specific types and quantities of radioactive material, thereby ensuring greater levels of protection for *radioactive material* for which a *malicious act* could result in higher consequences. The categorization system should take aggregation of *radioactive material* into account as appropriate. As a starting point, the categorization system should take into account international guidance such as the Code of Conduct on the Safety and Security of Radioactive Sources [5] or the Regulations for the Safe Transport of Nuclear Material (TS-R-1) [7].

4.5. The State should define a threshold for *radioactive material* that does not represent a substantial security concern and that should be controlled to prevent *unauthorized removal* and unauthorized access through prudent management practice.

### **Regulatory approach**

4.6. The *regulatory body* should establish goals or objectives that define the required outcome of *nuclear security systems* for each security level.



4.7. The *regulatory body* should select a regulatory approach that the *operator* must follow to meet the required goals and objectives. There are three alternative approaches that the *regulatory body* may use:

- A prescriptive approach, in which the *regulatory body* directly specifies the security measures that the *operator* should implement to meet the goals and objectives, or
- A performance based approach, in which the *regulatory body* requires the *operator* to design the *nuclear security system* and demonstrate to the *regulatory body* that the *nuclear security system* meets the goals and objectives, or
- A combined approach, in which the *regulatory body* draws on elements of both the prescriptive and performance based approaches.

Under all three approaches, the *operator's nuclear security system* must achieve the required outcome defined by the goals and objectives for the applicable security level. This is the standard by which all *nuclear security systems* are evaluated.

## RECOMMENDATIONS FOR THE SECURITY OF RADIOACTIVE MATERIAL IN USE AND STORAGE

4.8. Security requirements should be developed by the State that protect *radioactive material* from *unauthorized removal* or loss of control and should address both security systems and security management. To the extent *nuclear material* is a potential target for *unauthorized removal* and subsequent dispersion, those requirements should also apply.

4.9. *Radioactive material* that represents a substantial security concern (above a threshold defined by the State) should require security measures commensurate with the security levels defined in paras 4.4 and 4.5. For each security level, the State should require graded security measures considering those described below. Particular measures may be required for mobile and portable radioactive sources.

### **Security system**

4.10. The *regulatory body* should require *operators* to implement a security system that meets applicable *nuclear security regime* objectives. The system should be designed to adequately perform the security functions of detection, delay, and response (as described below) in order to deter and prevent *malicious*

*acts*. While deterrence is not measurable, it is clear that a suitably robust security system can help to deter a *malicious act*. In implementing a *graded approach*, the objectives of security systems could range from preventing a *malicious act* to reducing its likelihood.

### *Detection*

4.11. Detection measures should be implemented for the discovery and assessment of an attempted or actual intrusion which could have the objective of *unauthorized removal* or *sabotage of radioactive material*. Detection can be achieved by such means as visual observation, video surveillance, electronic sensors, accountancy records, seals and other tamper indicating devices, and process monitoring systems. In implementing a *graded approach*, the objectives of detection measures could range from immediate detection, assessment and communication of any unauthorized access to subsequent detection of *unauthorized removal* through tamper indicators or periodic physical checks.

### *Delay*

4.12. Delay measures should be implemented to impede an adversary's attempt to gain unauthorized access or to remove *radioactive material* or *sabotage associated facilities*, generally through multiple barriers or other physical means, such as locked doors, cages, tie-downs or the like. A measure of delay is the time, after detection, that is required by an adversary to remove the *radioactive material* or sabotage the *associated facilities*. In implementing a *graded approach*, the objectives of delay measures could range from providing sufficient delay after detection to allow response personnel to interrupt *malicious acts* to providing delay to allow for timely pursuit following *unauthorized removal*.

### *Response*

4.13. Response measures should be implemented following detection and assessment. The *operator* should be required to make appropriate arrangements to communicate with law enforcement personnel following detection and assessment in order that they may perform the response. In implementing a *graded approach*, the objectives of response measures could range from providing immediate response with sufficient resources to interrupt *malicious acts* to providing alarm notification to allow the appropriate authority to investigate the event.

4.14. The *operator* should cooperate with and assist the *competent authorities* as appropriate in their efforts to locate and recover the *radioactive material*, including cooperation in on-site and off-site response.

### *Sabotage*

4.15. The level of protection against *sabotage* may differ from that against *unauthorized removal*. *Nuclear security systems* designed to protect *radioactive material* from *unauthorized removal* generally also provide some degree of protection of the *radioactive material* and *associated facilities* against *sabotage*. If the *regulatory body* becomes aware of a specific *threat* of *sabotage* against particular *radioactive material* or particular facilities, the *regulatory body* should require additional or more stringent security measures to increase the level of protection against *sabotage*.

### **Security management**

4.16. *Operators* should be required to implement security management measures, addressing access control, trustworthiness, information protection, preparation of a security plan, training and qualification, accounting, inventory and event reporting. The stringency of required security management measures should vary as appropriate based on the *graded approach*.

### *Access control*

4.17. The *operator* should be required to provide a means of physically controlling access that allows only individuals with authorized access to enter areas where *radioactive material* is present. Unescorted access should be limited to individuals with authorized access with a demonstrated need for such access in the performance of their jobs. Other individuals should be allowed access to this area only if they are escorted or observed by an individual authorized for unescorted access, or if compensatory measures for the security of *radioactive material* have been implemented.

### *Trustworthiness*

4.18. The *competent authority* should ensure that the trustworthiness and reliability of individuals with authorized access to *radioactive material* and/or security sensitive information are verified in accordance with the State's national practices. In implementing a *graded approach*, the objectives of trustworthiness measures could range from confirmation of identity to a comprehensive

background check by the legitimate national authority, including a verification of references to determine the integrity and reliability of each person. The determination of trustworthiness and reliability is a key measure in mitigating the *threat* posed by *insiders*.

### *Information protection*

4.19. Operators should be required to limit access to security sensitive information to those people who need that information in order to perform their jobs. Key elements of information protection include identifying the information that must be protected; designating individuals with authorized access to such information; and protecting such information from disclosure to individuals who do not have this access.

### *Security plan*

4.20. *Operators* should be required to develop, implement, test, periodically review, revise as necessary a security plan and comply with its provisions. The plan should describe the overall *nuclear security system* in place to protect the *radioactive material* and should include measures to address an increased threat level, response to *nuclear security events* and the protection of sensitive information. *Operators* should demonstrate to the *regulatory body* how it is meeting security requirements. The security plan should be subject to information protection.

4.21. The security plan should include:

- A description of the *radioactive material* and the environment for its use and storage;
- A description of the specific security concerns to be addressed;
- A description of the security system implemented and its objectives;
- Security procedures to provide guidance to *operator* personnel for operating and maintaining security measures, and the security procedures to be followed before and after maintenance;
- Administrative aspects, including defining the roles and responsibilities of individuals with security responsibilities, access authorization processes, trustworthiness determination processes, information protection processes, inventories and records, event reporting, and review and revision of the security plan (including maximum time between reviews);
- How procedural and administrative security measures will be scaled to meet increased levels of threat as assessed by the State;

- Response actions including cooperation with relevant *competent authorities* in the location and recovery of *radioactive material* consistent with national practice.

### *Training and qualification*

4.22. *Operators* should be required to ensure that all personnel with security responsibilities are appropriately trained and qualified prior commencing their responsibilities and afterwards periodically.

### *Accounting*

4.23. *Operators* should, consistent with a *graded approach*, be required to account for radioactive sources, particularly in the case of mobile sources.

### *Inventory*

4.24. *Operators* should be required to establish and maintain a list of *radioactive material* under its responsibility. At intervals prescribed by the *regulatory body*, *operators* should verify that *radioactive material* is present at its authorized location. Inventory verification can be used as part of detection measures.

### *Nuclear security event reporting*

4.25. Any absence or discrepancy regarding the presence or amount of *radioactive material*, particularly during an inventory, should be promptly investigated. *Operators* should be required to promptly report to the *regulatory body* and other relevant *competent authorities* (e.g. law enforcement) upon determination of loss of control of *radioactive material*.

## RECOMMENDATIONS FOR THE SECURITY OF RADIOACTIVE MATERIAL IN TRANSPORT

4.26. Security requirements for *radioactive material* in transport should be developed by the State to minimize the likelihood of loss of control, or *malicious acts*. To the extent *nuclear material* is a potential target for *unauthorized removal* and subsequent dispersion, those requirements should also apply.

4.27. The design of an adequate transport security system should incorporate the concept of *defence in depth* and use a *graded approach* to achieve the objective of

preventing *malicious acts*, taking into account the potential vulnerability of the *radioactive material*.

4.28. Security of *radioactive material* in transport should, in addition to recommendations in this publication, take into account the United Nations Recommendations for the Transport of Dangerous Goods — Model Regulations, which include security requirements for the transport of dangerous goods and are implemented by many States and international modal organizations.

4.29. For air transport, security measures should be carried out in accordance with the applicable security provisions of the Convention on International Civil Aviation and the International Civil Aviation Organization's Technical Instructions for the Safe Transport of Dangerous Goods by Air. For maritime transport, security measures should be carried out in accordance with the applicable security provisions of the International Ship and Port Facility Security Code and of the International Maritime Dangerous Goods Code as required by the International Convention for the Safety of Life at Sea (SOLAS 74 amended).

4.30. The transport security system should be designed to take into account the:

- Quantity and the physical/chemical form of the *radioactive material*;
- Mode(s) of transport;
- Package(s) being used.

4.31. Security measures should be based on a categorization of *radioactive material* and structured into security levels for transport (e.g. basic and enhanced). Security levels should be defined using a *graded approach* that is based on an evaluation of the *threat* to the material and its potential to generate unacceptable consequences. The *graded approach* for transport security should be based at least on the properties and quantities of *radioactive material* being shipped:

- Material posing very low potential radiological consequences should be subject only to prudent management practices;
- Material with limited potential radiological consequences should be subject to basic security measures;
- Material posing higher potential radiological consequences should be subject to enhanced security measures.

4.32. The achievement of effective transport security should include considering transport schedules, routing including security of passage, and information security.

4.33. The basic level of security measures should include requiring that consignors, carriers, consignees and other persons engaged in the transport of *radioactive material* implement graded security systems or other arrangements to deter, detect, delay and respond to *malicious acts* affecting the conveyance or its cargo. These arrangements should be operational and effective at all times. This can be achieved by the following:

- When *radioactive material* is temporarily stored at transit sites (such as warehouses and marshalling yards), appropriate security measures should be applied to the *radioactive material* consistent with the measures applied during use and storage;
- Individuals engaged in the transport of *radioactive material* should receive training, including training in the elements of security awareness;
- Security measures should be applied, verified prior to shipment, and remain effective during transport;
- Information on required security measures, including how to respond to a *nuclear security event* during transport, should be provided in writing to crew members;
- Trustworthiness of persons engaged in the transport of *radioactive material* should be established commensurate with their security responsibilities and in accordance with national practices;
- Security related information should be communicated to consignors and carriers engaged in the transport of *radioactive material*;
- The consignee should be informed by the consignor in advance of the planned shipment of the mode of transport and expected delivery time and should notify the consignor on receipt or non-receipt within the expected delivery time frame;
- The movement of packages and/or conveyances containing *radioactive material* should be monitored appropriately;
- Communication should be available to ensure response or provide assistance to the crew;
- Packages and/or conveyances should not be left unattended for any longer than is absolutely necessary.

4.34. Enhanced security measures should include requiring that consignors, carriers, consignees and other persons engaged in the transport of *radioactive material* should develop, adopt, implement, periodically review as necessary and

comply with the provisions of a transport security plan. Responsibility for and ownership of the transport security plan should be clearly defined. The plan should describe the overall *nuclear security system* in place to protect the *radioactive material* in transport and should include measures to address an increased threat level, response to *nuclear security events* and the protection of sensitive information.

4.35. In certain circumstances, security measures additional to those above should be considered depending on the assessment of the prevailing threat or the attractiveness of the material being transported. In such cases possibly relevant only to certain categories or quantities of *radioactive material* or to particularly sensitive transports, additional security measures should be applied.

4.36. When establishing security measures to protect against a *malicious act* particularly *sabotage*, the safety features of the design of the transport package, container and conveyance should be taken into account.

4.37. If the current or potential *threat* warrants additional security measures to protect against *sabotage*, consideration should be given to:

- Postponing the shipment;
- Rerouting the shipment to avoid high threat areas;
- Enhancing the robustness of the package or the vehicle;
- Enhancing route surveillance to observe the current environment;
- Providing (additional) escorts or guards.

4.38. For international transport, *shippers* and/or carriers should ensure in advance that any State by State variations in security requirements are applied and should determine the point at which the responsibility for security is transferred.



## DEFINITIONS

*Terms used in this publication are defined below and are italicized in the text.*

**associated activity.** The possession, production, processing, use, storage, handling, disposal or transport of *nuclear material* or *other radioactive material*.

**associated facility.** A nuclear facility or radioactive material facility.

**authorization.** The granting by a *competent authority* of written permission for operation of an *associated facility* or for carrying out an *associated activity*.

**authorized person.** A natural or legal person that has been granted an *authorization*. An *authorized person* is often referred to as a ‘licensee’ or ‘operator’.

**competent authority.** A governmental organization or institution that has been designated by a State to carry out one or more nuclear security functions. For example, *competent authorities* include *regulatory bodies*, law enforcement, customs and border control, intelligence and security agencies, and health agencies.

**defence in depth.** The combination of multiple layers of systems and measures that have to be overcome or circumvented before nuclear security is compromised.

**graded approach.** The application of *nuclear security measures* proportional to the potential consequences of a *malicious act*.

**insider.** An individual with authorized access to *associated facilities* or *associated activities* or to sensitive information or sensitive information assets, who could commit, or facilitate the commission of a *malicious act*.

**malicious act.** An act or attempt of *unauthorized removal* of *radioactive material* or *sabotage*.

**nuclear material.** Material listed in the table on the categorization of nuclear material, including the material listed in its footnotes, in Section 4 of IAEA Nuclear Security Series No. 13, Nuclear Security Recommendations on

**nuclear security culture.** The assembly of characteristics, attitudes and behaviours of individuals, organizations and institutions which serves as means to support, enhance and sustain nuclear security.

**nuclear security event.** An event that is assessed as having implications for nuclear security.

**nuclear security regime.** A regime comprising:

- The legislative and regulatory framework and administrative systems and measures governing the nuclear security of *nuclear material, 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* for the prevention of, detection of, and response to, *nuclear security events.*

**nuclear security measures.** Measures intended to prevent a *threat* from completing a *malicious act* or to *detect* or respond to *nuclear security events.*

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

**operator.** Any person, organization, or government entity licensed or authorized to undertake the operation of an *associated facility.*

**other radioactive material.** Any *radioactive material* that is not *nuclear material.*

**radioactive material.** *Radioactive material* is any material designated in national law, regulation, or by a *regulatory body* as being subject to *regulatory control* because of its radioactivity.

**radioactive source.** *Radioactive material* that is permanently sealed in a capsule or closely bonded, in a solid form and which is not exempt from *regulatory control*. It also means any *radioactive material* released if the radioactive source is leaking or broken, but does not mean material encapsulated for disposal, or *nuclear material* within the nuclear fuel cycles of research and power reactors.

**regulatory body.** One or more authorities designated by the government of a State as having legal authority for conducting the regulatory process, including issuing *authorizations*.

**regulatory control.** Any form of institutional control applied to *nuclear material* or *other radioactive material*, *associated facilities*, or *associated activities* by any *competent authority* as required by the legislative and regulatory provisions related to safety, security, or safeguards. Explanation: The phrase ‘out of *regulatory control*’ is used to describe a situation where *nuclear* or *other radioactive material* is present in sufficient quantity that it should be under *regulatory control*, but control is absent, either because controls have failed for some reason, or they never existed.

**sabotage.** Any deliberate act directed against an *associated facility* or an *associated activity* that could directly or indirectly endanger the health and safety of personnel, the public, or the environment by exposure to radiation or release of radioactive substances<sup>4</sup>.

**shipper.** Any person, organization or government that prepares or offers a consignment of *radioactive material* for transport (i.e. the consignor).

**threat.** A person or group of persons with motivation, intention and capability to commit a *malicious act*.

**threat assessment.** An evaluation of the *threats* — based on available intelligence, law enforcement, and open source information — that describes the motivation, intentions, and capabilities of these *threats*.

**unacceptable radiological consequences.** A level of radiological consequences, established by the State, above which the implementation of *nuclear security measures* is warranted.

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<sup>4</sup> Radioactive substance and *radioactive material* have the same meaning.

**unauthorized removal.** The theft or other unlawful taking of *radioactive material*.

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