IAEA SAFETY STANDARDS SERIES

Preparedness and Response for a Nuclear or Radiological Emergency

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REQUIREMENTS

No. GS-R-2

INTERNATIONAL
ATOMIC ENERGY AGENCY
VIENNA

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IAEA SAFETY STANDARDS

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PREPAREDNESS AND RESPONSE FOR A NUCLEAR OR RADIOLOGICAL EMERGENCY

SAFETY STANDARDS SERIES No. GS-R-2

PREPAREDNESS AND RESPONSE FOR A NUCLEAR OR RADIOLOGICAL EMERGENCY

SAFETY REQUIREMENTS

JOINTLY SPONSORED BY THE
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FOREWORD

by Mohamed ElBaradei
Director General

One of the statutory functions of the IAEA is to establish or adopt standards of safety for the protection of health, life and property in the development and application of nuclear energy for peaceful purposes, and to provide for the application of these standards to its own operations as well as to assisted operations and, at the request of the parties, to operations under any bilateral or multilateral arrangement, or, at the request of a State, to any of that State's activities in the field of nuclear energy.

The following bodies oversee the development of safety standards: the Commission on Safety Standards (CSS); the Nuclear Safety Standards Committee (NUSSC); the Radiation Safety Standards Committee (RASSC); the Transport Safety Standards Committee (TRANSSC); and the Waste Safety Standards Committee (WASSC). Member States are widely represented on these committees.

In order to ensure the broadest international consensus, safety standards are also submitted to all Member States for comment before approval by the IAEA Board of Governors (for Safety Fundamentals and Safety Requirements) or, on behalf of the Director General, by the Publications Committee (for Safety Guides).

The IAEA's safety standards are not legally binding on Member States but may be adopted by them, at their own discretion, for use in national regulations in respect of their own activities. The standards are binding on the IAEA in relation to its own operations and on States in relation to operations assisted by the IAEA. Any State wishing to enter into an agreement with the IAEA for its assistance in connection with the siting, design, construction, commissioning, operation or decommissioning of a nuclear facility or any other activities will be required to follow those parts of the safety standards that pertain to the activities to be covered by the agreement. However, it should be recalled that the final decisions and legal responsibilities in any licensing procedures rest with the States.

Although the safety standards establish an essential basis for safety, the incorporation of more detailed requirements, in accordance with national practice, may also be necessary. Moreover, there will generally be special aspects that need to be assessed on a case by case basis.

The physical protection of fissile and radioactive materials and of nuclear power plants as a whole is mentioned where appropriate but is not treated in detail; obligations of States in this respect should be addressed on the basis of the relevant instruments and publications developed under the auspices of the IAEA. Non-radiological aspects of industrial safety and environmental protection are also not explicitly considered; it is recognized that States should fulfil their international undertakings and obligations in relation to these.

The requirements and recommendations set forth in the IAEA safety standards might not be fully satisfied by some facilities built to earlier standards. Decisions on the way in which the safety standards are applied to such facilities will be taken by individual States.

The attention of States is drawn to the fact that the safety standards of the IAEA, while not legally binding, are developed with the aim of ensuring that the peaceful uses of nuclear energy and of radioactive materials are undertaken in a manner that enables States to meet their obligations under generally accepted principles of international law and rules such as those relating to environmental protection. According to one such general principle, the territory of a State must not be used in such a way as to cause damage in another State. States thus have an obligation of diligence and standard of care.

Civil nuclear activities conducted within the jurisdiction of States are, as any other activities, subject to obligations to which States may subscribe under international conventions, in addition to generally accepted principles of international law. States are expected to adopt within their national legal systems such legislation (including regulations) and other standards and measures as may be necessary to fulfil all of their international obligations effectively.

EDITORIAL NOTE

An appendix, when included, is considered to form an integral part of the standard and to have the same status as the main text. Annexes, footnotes and bibliographies, if included, are used to provide additional information or practical examples that might be helpful to the user.

The safety standards use the form 'shall' in making statements about requirements, responsibilities and obligations. Use of the form 'should' denotes recommendations of a desired option.

PREFACE

It is recognized among organizations responsible for emergency management (including those responsible for the management of conventional emergencies) that good preparedness in advance of an emergency can substantially improve the emergency response. Moreover, one of the most important features of the preparations is that they are integrated among the different bodies involved, ensuring clear lines of responsibility and authority.

The Convention on Early Notification of a Nuclear Accident ('Early Notification Convention') and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency ('Assistance Convention') adopted in 1986[1] place specific obligations on the Parties and on the IAEA. The practical implementation of the various articles of these conventions as well as the fulfilment of some obligations on the IAEA (under the convention on Nuclear Safety, Legal Series No. 16, 1994, Article 16, and the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management, INFCIRC/546, 1997, Article 25) warrant appropriate requirements for emergency management.

In fulfilling its functions under these two conventions, the IAEA regularly convenes meetings of an Inter-Agency Committee for Response to Nuclear Accidents (IACRNA). IACRNA was constituted as an interagency mechanism to co-ordinate the arrangements of the relevant international intergovernmental organizations for preparing for and responding to a nuclear or radiological emergency. IACRNA has co-operated in the establishment of common requirements for preparedness and response for a nuclear or radiological emergency. In particular, the Food and Agriculture Organization of the United Nations (FAO), the International Labour Organization (ILO), the OECD Nuclear Energy Agency (OECD/NEA), the Pan American Health Organization (PAHO), the United Nations Office for the Co-ordination of Humanitarian Affairs (OCHA) and the World Health Organization (WHO) are joint sponsors of the requirements established in this publication.

This Safety Requirements publication incorporates and establishes requirements for emergency preparedness and response so that emergency management can be seen in its entirety by the bodies concerned. It elaborates on, augments and structures all the requirements relating to emergency management established in other IAEA safety standards.

An Advisory Group drafted the requirements and the Radiation Safety Standards Committee took the lead in their development. Consultations were held with the Nuclear Safety Standards Committee, the Transport Safety Standards Committee, the Waste Safety Standards Committee and the Commission on Safety Standards, and with Member States, as well as with the members of the IACRNA.

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[1] See Ref. [1].

The General Conference of the IAEA in resolution GC(44)/RES/16 has encouraged Member States "to implement instruments for improving their response… to nuclear and radiological emergencies" and "to participate actively in the process of strengthening international, national and regional capabilities for responding to nuclear and radiological emergencies, and to make those capabilities more consistent and coherent". In responding to the Secretariat's submission to the IAEA Board of Governors, GOV/2002/5, the Board established the draft Safety Requirements "as an Agency safety standard — in accordance with Article III.A.6 of the Statute" and "authorized the Director General to promulgate these Safety Requirements… and issue them as a Safety Requirements publication in the Safety Standards Series". It also encouraged Member States "to implement arrangements for meeting these Safety Requirements" and, in responding to the Secretariat's submission to the Board of Governors, GOV/2002/6, "to actively support" the Secretariat's plans "for supporting the strengthening of international, national and regional arrangements for nuclear or radiological emergency response". These plans reflect the view of the IAEA Secretariat, as expressed in GOV/2002/6, that "Compliance with these requirements will make for greater consistency between the emergency response criteria and arrangements of different States and thereby facilitate the emergency response at the regional and the international level". In order to achieve the objectives expressed by the General Conference in its resolution GC(44)/RES/16, it is manifestly desirable that all States adopt these requirements. Subsequently, at its 46th regular session, the IAEA General Conference in resolution GC(46)/RES/9 has encouraged Member States "to implement" the Safety Requirements for Preparedness and Response for a Nuclear or Radiological Emergency.

These safety requirements will be binding on the IAEA in relation to its own operations and on States in relation to operations assisted by the IAEA. It is recognized that it will take some time to make changes to existing systems for emergency response in order to meet the requirements fully. The IAEA Secretariat intends to make arrangements to meet those aspects of the requirements that are functional in nature (see paras 4.14, 4.15, 4.29, 4.30 and 4.84) by 1 December 2002. These arrangements are described in the IAEA's Emergency Notification and Assistance Technical Operations Manual (ENATOM). The Secretariat envisages that, for the IAEA's own operations and for those operations assisted by the IAEA, arrangements need to be in place to meet the requirements within a period of no more than two years from the date of their publication.

If a State or a joint sponsoring organization adopts these requirements, at its own discretion, for use in regulating its own activities, to fulfil the objectives of GC(44)/RES/16 and in response to GC(46)/RES/9, the IAEA Secretariat envisages that the requirements would come into force at a time to be indicated by that State or organization, and preferably within a period of no more than two years from the date of their publication.

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1. INTRODUCTION

BACKGROUND

1.1. The Safety Fundamentals publication on Radiation Protection and the Safety of Radiation Sources [2] and the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (Basic Safety Standards) [3] issued by the IAEA were jointly sponsored by five other international organizations: the Food and Agriculture Organization of the United Nations (FAO), the International Labour Organization (ILO), the OECD Nuclear Energy Agency (OECD/NEA), the Pan American Health Organization (PAHO) and the World Health Organization (WHO). These publications were developed on the basis of principles set out in publications by the International Commission on Radiological Protection (ICRP) [4, 5] and the International Nuclear Safety Advisory Group (INSAG) [6].

1.2. Complementary to and elaborating on those two IAEA publications [2, 3], and representing an important consolidation and reorganization, this Safety Requirements publication in the IAEA Safety Standards Series covers the preparation and implementation of arrangements for responding to a nuclear or radiological emergency.

1.3. The response to a nuclear or radiological emergency may involve many organizations. The functions of many of these organizations would be the same for a nuclear or radiological emergency as for a conventional emergency. However, the response to a nuclear or radiological emergency may also involve highly specialized agencies and technical experts. Therefore, in order to be effective, the response to a nuclear or radiological emergency must be well co-ordinated and arrangements must be appropriately integrated with those for a conventional emergency. In addition, the many misconceptions prevalent concerning nuclear and radiological emergencies and the possible health effects of radiation exposure could lead to inappropriate actions being taken. Consequently, preplanning on the basis of established principles of radiation protection and safety is essential. Such preplanning can be achieved only through a co-ordinated approach. Hence, this Safety Requirements publication establishes requirements for: common concepts and expectations; the clear allocation of responsibilities among all response organizations; well defined agreements between these organizations; and arrangements for co-ordinating an integrated response.

1.4. The requirements derive their force from the provisions of the IAEA Statute and they also provide guidance for the operations of the Inter-Agency Committee for Response to Nuclear Accidents (IACRNA).

OBJECTIVE

1.5. This Safety Requirements publication establishes the requirements for an adequate level of preparedness and response for a nuclear or radiological emergency in any State. Their implementation is intended to minimize the consequences for people, property and the environment of any nuclear or radiological emergency.

1.6. The fulfilment of these requirements will also contribute to the harmonization of arrangements in the event of a transnational emergency.

1.7. These requirements are intended to be applied by authorities at the national level by means of adopting legislation, establishing regulations and assigning responsibilities.

SCOPE

1.8. The requirements apply to all those practices and sources that have the potential for causing radiation exposure or environmental radioactive contamination warranting an emergency intervention and that are:

(a) Used in a State that chooses to adopt the requirements or that requests any of the sponsoring organizations to provide for the application of the requirements;
(b) Used by States with the assistance of the FAO, IAEA, ILO, PAHO, OCHA or WHO in compliance with applicable national rules and regulations;
(c) Used by the IAEA or which involve the use of materials, services, equipment, facilities and non-published information made available by the IAEA or at its request or under its control or supervision; or
(d) Used under any bilateral or multilateral arrangement whereby the parties request the IAEA to provide for the application of the requirements.

1.9. The requirements also apply to the off-site jurisdictions that may need to make an emergency intervention in a State that adopts the requirements.

1.10. The types of practices and sources covered by these requirements include: fixed and mobile nuclear reactors; facilities for the mining and processing of radioactive ores; facilities for fuel reprocessing and other fuel cycle facilities; facilities for the management of radioactive waste; the transport of radioactive material; sources of radiation used in industrial, agricultural, medical, research and teaching applications; facilities using radiation or radioactive material; and satellites

and radiothermal generators using radiation sources or reactors. The requirements also cover emergencies arising from radiation sources of an unknown or untraceable origin.

1.11. The requirements apply to actions in preparedness and response for emergencies involving hazards associated with ionizing radiation only. The requirements do not apply to preparedness or response for emergencies involving hazards associated with non-ionizing radiation such as microwave, ultraviolet or infrared radiation.

1.12. The IAEA has issued Safety Fundamentals publications relating to nuclear installations [7] and to radioactive waste management [8]. In addition, the IAEA has issued Safety Series and Safety Standards Series publications that have established requirements relating to emergency preparedness for the safe use of radiation sources [3], the transport of radioactive material [9], legal and governmental infrastructure [10], the design and operation of nuclear power plants [11, 12], and the design and operation of research reactors[2]. This Safety Requirements publication incorporates, elaborates on, augments and structures all the requirements for emergency preparedness and response established in these previously issued safety standards. To this effect some requirements established in these other safety standards have been incorporated as quotations in this publication (revised text is shown in square brackets and omissions are indicated by ellipses). In other cases footnotes state where related requirements have been established.

STRUCTURE

1.13. This Safety Requirements publication comprises four main sections. Section 2 provides the basic objectives of emergency preparedness and response for protection and safety, together with the principles for intervention that apply in taking actions to meet these objectives. Section 3 establishes the general requirements that must be met before effective preparations can be started and defines the categories of threat for which requirements are established. Section 4 establishes the requirements for performing the functions critical to effective emergency preparedness and response.

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[2] Code on the Safety of Nuclear Research Reactors: Design, Safety Series No. 35-S1, IAEA, Vienna (1992); Code on the Safety of Nuclear Research Reactors: Operation, Safety Series No. 35-S2, IAEA, Vienna (1992). These two Codes are to be superseded by a Safety Requirements publication on the Design and Operation of Nuclear Research Reactors (in preparation).

The requirements for emergency preparedness apply to preparations to be made in advance of any emergency in order to ensure that there is a capability to meet the response requirements. The requirements for emergency response apply to the performance of critical functions or tasks in an emergency. Section 5 establishes requirements for the infrastructure necessary to develop and maintain adequate arrangements for response. The internationally agreed criteria for intervention in an emergency and for the protection of workers undertaking such an intervention are reproduced in Annexes I, II and III.

2. PRINCIPLES AND OBJECTIVES

GOALS OF EMERGENCY RESPONSE

2.1. The Safety Fundamentals publication on Radiation Protection and the Safety of Radiation Sources [2] presents the primary objectives for protection and safety as follows:

> "**Protection objective:** *to prevent the occurrence of deterministic effects in individuals by keeping doses below the relevant threshold and to ensure that all reasonable steps are taken to reduce the occurrence of stochastic effects in the population at present and in the future.*"

> "**Safety objective:** *to protect individuals, society and the environment from harm by establishing and maintaining effective defences against radiological hazards from sources.*"

2.2. The Safety Fundamentals publication on The Safety of Nuclear Installations [7] presents the primary objectives for nuclear installations[3] as:

> "**Radiation protection objective:** *To ensure… mitigation of the radiological consequences of any accidents.*"

[3] A nuclear installation is a nuclear fuel fabrication plant, nuclear reactor (including subcritical and critical assemblies), research reactor, nuclear power plant, spent fuel storage facility, enrichment plant or reprocessing facility. This is essentially any authorized facility that is part of the nuclear fuel cycle except for radioactive waste management facilities.

"**Technical safety objective:** *To take all reasonably practical measures to prevent accidents in nuclear installations and to mitigate their consequences should they occur; to ensure with a high level of confidence that, for all possible accidents taken into account in the design of the installation, including these of very low probability, any radiological consequences would be minor and below prescribed limits...*"

2.3. In a nuclear or radiological emergency, the practical goals of emergency response are:

(a) To regain control of the situation;
(b) To prevent or mitigate consequences at the scene;
(c) To prevent the occurrence of deterministic health effects in workers and the public;
(d) To render first aid and to manage the treatment of radiation injuries;
(e) To prevent, to the extent practicable, the occurrence of stochastic health effects in the population;
(f) To prevent, to the extent practicable, the occurrence of non-radiological effects on individuals and among the population;
(g) To protect, to the extent practicable, property and the environment;
(h) To prepare, to the extent practicable, for the resumption of normal social and economic activity.

2.4. Taking measures towards achieving these goals (undertaking interventions) is governed at all times by the principles established in the Safety Fundamentals publication on Radiation Protection and the Safety of Radiation Sources [2] and derived from the recommendations of the ICRP [4, 5]. These principles are:

"**Justification of intervention:** *Any proposed intervention shall do more good than harm.*"

"**Optimization of intervention:** *The form, scale and duration of any intervention shall be optimized so that the net benefit is maximized.*"

GOALS OF EMERGENCY PREPAREDNESS

2.5. The goals of emergency response are most likely to be achieved in accordance with the principles for intervention by having a sound programme for emergency preparedness in place as part of the infrastructure for protection and safety [3].

Emergency preparedness also helps to build confidence that an emergency response would be managed, controlled and co-ordinated effectively.

2.6. The practical goal of emergency preparedness may be expressed as:

> *To ensure that arrangements are in place for a timely, managed, controlled, co-ordinated and effective response at the scene, and at the local, regional, national and international level, to any nuclear or radiological emergency.*

3. GENERAL REQUIREMENTS

BASIC RESPONSIBILITIES

3.1. "Despite all the precautions that are taken in the design and operation of nuclear facilities and the conduct of nuclear activities, there remains a possibility that a failure [, an intentional act] or an accident may give rise to a [nuclear or radiological] emergency. In some cases, this may give rise to [exposure or] the release of radioactive materials within facilities and/or into the public domain, which may necessitate emergency response actions. Such emergencies may include transport accidents. Adequate preparations shall be established and maintained at local and national levels and, where agreed between States, at the international level to respond to [nuclear or radiological] emergencies." (Ref. [10], para. 6.2.)

3.2. "The arrangements for emergency response actions both within and outside facilities, if applicable, or elsewhere under the control of the operator, are dealt with through the regulatory process. [The State] shall ensure that [the regulatory body and response organizations] have the necessary resources and that they make preparations and arrangements to deal with any consequences of [a nuclear or radiological emergency] in the public domain, whether the [nuclear or radiological emergency] occurs within or beyond national [borders]. These preparations shall include the actions to be taken both in and after an emergency." (Ref. [10], para. 6.3.)

3.3. "It is presumed that the State will have determined in advance the allocation of responsibilities for the management of interventions in emergency exposure situations between the [regulatory body], national and local [response organizations] and [operators]." (Ref. [3], Appendix V, para. V.1.)

3.4. Jurisdictions of the various orders and levels of government may be laid out in substantially different ways between States. Likewise, the authorities of the various organizations that could be involved in emergency response may be allocated in substantially different ways. In this Safety Requirements publication a generic approach to the management of a nuclear or radiological emergency is therefore adopted: in many cases requirements are stated without being assigned as responsibilities of a particular organization. Legislation shall be adopted to allocate clearly the responsibilities for preparedness and response for a nuclear or radiological emergency and for meeting the requirements established in this Safety Requirements publication. This shall include establishing or identifying an existing governmental body or organization to act as a national co-ordinating authority whose function, among others, is to co-ordinate the assessment of the threats within the State (see paras 3.13–3.20) and to co-ordinate the resolution of differences and incompatible arrangements between the various response organizations. This authority shall ensure that the functions and responsibilities of operators and response organizations as specified in these requirements are clearly assigned and are understood by all response organizations, and that arrangements are in place for achieving and enforcing compliance with the requirements.

3.5. The national co-ordinating authority shall make all reasonable efforts[4], in accordance with international obligations, to foster the implementation by other States of measures to fulfil their obligations in compliance with these requirements.

3.6. For the purposes of the requirements nuclear and radiation related threats are grouped according to the threat categories shown in Table I. The five threat categories in Table I establish the basis for developing generically optimized arrangements for preparedness and response. Threat categories I, II and III represent decreasing levels of threat at facilities and in the corresponding stringency of requirements for preparedness and response arrangements. Threat category IV applies to activities that can lead to emergencies occurring virtually anywhere; it is also the minimum level of threat, which is assumed to apply for all States and jurisdictions. Threat category IV always applies to all jurisdictions, possibly together with threats in other categories. Threat category V applies to the off-site areas where arrangements for preparedness and response are warranted to deal with contamination resulting from a release of radioactive material from a facility in threat category I or II.

[4] This could include obtaining assistance through the IAEA under the terms of the Assistance Convention [1].

TABLE I. FIVE CATEGORIES OF NUCLEAR AND RADIATION RELATED THREATS FOR THE PURPOSES OF THE REQUIREMENTS

Threat category	Description
I	Facilities, such as nuclear power plants, for which on-site events[a] (including very low probability events) are postulated that could give rise to severe deterministic health effects[b] off the site, or for which such events have occurred in similar facilities.
II	Facilities, such as some types of research reactors, for which on-site events[a] are postulated that could give rise to doses to people off the site that warrant urgent protective action in accordance with international standards[c], or for which such events have occurred in similar facilities. Threat category II (as opposed to threat category I) does not include facilities for which on-site events (including very low probability events) are postulated that could give rise to severe deterministic health effects off the site, or for which such events have occurred in similar facilities.
III	Facilities, such as industrial irradiation facilities, for which on-site events are postulated that could give rise to doses that warrant or contamination that warrants urgent protective action on the site, or for which such events have occurred in similar facilities. Threat category III (as opposed to threat category II) does not include facilities for which events are postulated that could warrant urgent protective action off the site, or for which such events have occurred in similar facilties.
IV	Activities that could give rise to a nuclear or radiological emergency that could warrant urgent protective action in an unforeseeable location. These include non-authorized activities such as activities relating to dangerous sources obtained illicitly. They also include transport and authorized activities involving dangerous mobile sources such as industrial radiography sources, nuclear powered satellites or radiothermal generators. Threat category IV represents the minimum level of threat, which is assumed to apply for all States and jurisdictions.
V	Activities not normally involving sources of ionizing radiation, but which yield products with a significant likelihood[d] of becoming contaminated as a result of events at facilities in threat category I or II, including such facilities in other States, to levels necessitating prompt restrictions on products in accordance with international standards.

[a] Involving an atmospheric or aquatic release of radioactive material or external exposure (such as due to a loss of shielding or a criticality event) that originates from a location on the site.

[b] Doses in excess of those for which intervention is expected to be undertaken under any circumstances; see Schedule IV of Ref. [3], reproduced in Annex II. See the Glossary under 'deterministic effect'.

[c] Schedule V of Ref. [3] is reproduced in Annex III.

[d] Conditional on the occurrence of a significant release of radioactive material from a facility in threat category I or II.

3.7. Threat categories are used in this Safety Requirements publication to implement a graded approach to establishing and maintaining adequate arrangements for preparedness and response by establishing requirements that are commensurate with the potential magnitude and nature of the hazard as identified in a threat assessment.

3.8. The regulatory body shall require that arrangements for preparedness and response be in place for the on-site area for any practice or source that could necessitate an emergency intervention. For a facility in threat category I, II or III "Appropriate emergency [preparedness and response] arrangements shall be established from the time that nuclear fuel [or significant amounts of radioactive or fissile material] is brought to the site, and complete emergency preparedness as described here shall be ensured before the commencement of operation." (Ref. [12], para. 2.36.) The regulatory body shall ensure that such emergency arrangements are integrated with those of other response organizations as appropriate before the commencement of operation. The regulatory body shall ensure that such emergency arrangements provide a reasonable assurance of an effective response, in compliance with these requirements, in the case of a nuclear or radiological emergency. The regulatory body shall require that the emergency arrangements "shall be tested in an exercise before the commencement of operation [of a new practice]. There shall thereafter at suitable intervals be exercises of the emergency [arrangements], some of which shall be witnessed by the regulatory body." (Ref. [12], para. 2.37.)

3.9. "In fulfilling its statutory obligations, the regulatory body… shall establish, promote or adopt regulations and guides upon which its regulatory actions are based;… shall provide for issuing, amending, suspending or revoking authorizations, subject to any necessary conditions, that are clear and unambiguous and which shall specify (unless elsewhere specified):… the requirements for incident reporting;… and emergency preparedness arrangements." (Ref. [10], para. 3.2.)

3.10. "In planning for, and in the event of [a nuclear or radiological emergency], the regulatory body shall act as an adviser to the government and [response organizations] in respect of nuclear safety and radiation protection." (Ref. [10], para. 6.6.)

3.11. The national co-ordinating authority and the response organizations shall ensure that the arrangements for response to a nuclear or radiological emergency are co-ordinated with the arrangements for response to conventional emergencies. The regulatory body shall ensure that the co-ordinated arrangements are implemented adequately by the operators.

3.12. In the event of a nuclear or radiological emergency the time available for decision making and for implementing an effective strategy for response may be

short. It is therefore important that an appropriate management system be used. All organizations that may be involved in the response to a nuclear or radiological emergency shall ensure that appropriate management arrangements are adopted to meet the timescales for response throughout the emergency. Where appropriate, the management system shall be consistent with that used by other response organizations in order to ensure a timely, effective and co-ordinated response.

ASSESSMENT OF THREATS

3.13. In designing a threat category I facility "[a] probabilistic safety analysis of the [facility] shall be carried out in order… to assess the adequacy of [the operator's] emergency [response arrangements]". (Ref. [11], para. 5.73.)

3.14. In designing a threat category I, II or III facility "[a] comprehensive safety analysis is carried out to identify all sources of exposure and to evaluate radiation doses that could be received by workers at the [facility] and the public, as well as potential effects on the environment… The safety analysis examines… event sequences that may lead to [an emergency]. On the basis of this analysis… requirements for emergency [preparedness and] response can be established." (Ref. [11], para. 2.7.)[5]

3.15. "The nature and extent of emergency arrangements [for preparedness and response] shall be commensurate with the potential magnitude and nature of the [threat]… associated with the facility or activity." (Ref. [10], para. 6.4.) The full range of postulated events shall be considered in the threat assessment. In the threat assessment, emergencies involving a combination of a nuclear or radiological emergency and a conventional emergency such as an earthquake shall be considered[6]. Any threat associated with nuclear facilities in other States shall also be considered. In the threat assessment any populations at risk shall be identified and, to the extent practicable, the likelihood, nature and magnitude of the various radiation related threats shall be considered. The threat assessment shall be so conducted as to provide a basis for establishing detailed requirements for arrangements for preparedness and

[5] A related requirement for research reactors was established in the Code on the Safety of Nuclear Research Reactors: Operation, Safety Series No. 35-S2, IAEA, Vienna (1992), para. 1604; this Code is to be superseded by a Safety Requirements publication on the Design and Operation of Nuclear Research Reactors (in preparation).

[6] The corresponding requirement for nuclear power plants was established in Ref. [12], para. 2.34.

response by categorizing facilities and practices consistent with the five threat categories shown in Table I.

3.16. Operators, the national co-ordinating authority (see para. 3.4) and other appropriate organizations shall periodically conduct a review in order to ensure that all practices or situations that could necessitate an emergency intervention are identified, and shall ensure that an assessment of the threat is conducted for such practices or situations. This review shall be undertaken periodically to take into account any changes to the threats within the State and beyond its borders, and the experience and lessons from research, operating experience and emergency exercises (see paras 5.33, 5.37 and 5.39).

3.17. In a threat assessment, facilities, sources, practices, on-site areas, off-site areas and locations shall be identified for which a nuclear or radiological emergency could warrant:

(a) Precautionary[7] urgent protective action to prevent severe deterministic health effects by keeping doses below those for which intervention would be expected to be undertaken under any circumstances[8, 9];
(b) Urgent protective action to prevent stochastic effects to the extent practicable by averting doses, in accordance with international standards[10];
(c) Agricultural countermeasures, countermeasures to ingestion and longer term protective measures, in accordance with international standards[10]; or
(d) Protection for the workers responding (undertaking an intervention), in accordance with international standards[11].

3.18. Non-radiological threats (such as the release of uranium hexafluoride (UF_6) or other hazardous chemicals) to people on and off the site that are associated with the practice shall be identified in the threat assessment[12].

3.19. Locations at which there is a significant probability of encountering a dangerous source that has been lost, abandoned, illicitly removed or illicitly transported shall also be identified in the threat assessment.

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[7] Taken on the basis of conditions at the facility or at the scene before environmental monitoring is carried out.

[8] Schedule IV of Ref. [3] is reproduced in Annex II.

[9] To include events with a very low estimated probability of occurrence [7].

[10] Schedule V of Ref. [3] is reproduced in Annex III.

[11] Appendix V, paras V.27, V.28, V.30 and V.32 of Ref. [3] are reproduced in Annex I.

[12] A related requirement for nuclear power plants was established in Ref. [12], para. 2.34.

3.20. Large scrap metal processing facilities, national border crossings and abandoned military or other facilities where large sources may have been used should be considered in the threat assessment.

4. FUNCTIONAL REQUIREMENTS

GENERAL

4.1. The requirements for response established in this section apply in the event of a nuclear or radiological emergency. The response requirements must be met to achieve the practical goals of emergency response (see para. 2.3). In order to ensure that there is a capability to meet the response requirements, the requirements for preparedness apply as part of the planning and preparation process. If no threat category is indicated, the requirements apply to all threat categories. Many response requirements refer to 'arrangements': the term is used as defined in the Glossary.

ESTABLISHING EMERGENCY MANAGEMENT AND OPERATIONS

Response

4.2. The on-site emergency response shall be promptly executed and managed without impairing the performance of the continuing operational safety functions.

4.3. The off-site emergency response shall be effectively managed and co-ordinated with the on-site response.

4.4. The emergency response shall be co-ordinated between all responding organizations[13].

4.5. Information necessary for making decisions on the allocation of resources shall be appraised throughout the emergency.

[13] To include the response by those response organizations specialized in responding to a nuclear or radiological emergency and those organizations specialized in responding to a conventional emergency.

4.6. For facilities in threat category I or II jurisdictions and response organizations (including other States) that fall within the precautionary action zone or the urgent protective action planning zone (see para. 4.48) shall co-ordinate their emergency responses and shall provide mutual support.

Preparedness

4.7. For facilities in threat category I, II or III the transition from normal to emergency operations shall be clearly defined and shall be effectively made without jeopardizing safety. The responsibilities of everyone who would be on the site in an emergency shall be designated as part of the transition. It shall be ensured that the transition to the emergency response and the performance of initial response actions do not impair the ability of the operational staff (such as the control room staff) to follow the procedures needed for safe operations and for taking mitigatory actions.

4.8. For facilities in threat category I or II arrangements shall be made to co-ordinate the emergency responses of all the off-site response organizations with the on-site response.

4.9. Arrangements for a nuclear or radiological emergency shall be integrated with arrangements at the national and local level for response to conventional emergencies[14].

4.10. Arrangements shall be made for the implementation of a command and control system for the response to a nuclear or radiological emergency. This shall include arrangements for co-ordinating activities, for developing strategies and for resolving disputes between the response organizations[15] concerning functions, responsibilities, authorities, the allocation of resources and priorities. In addition, arrangements shall be made for obtaining and assessing the information necessary in order to allocate resources for all response organizations.

4.11. For facilities in threat category I or II arrangements shall be made for co-ordinating the response to a nuclear or radiological emergency between the response

[14] To include law enforcement response and investigation activities during an emergency.

[15] To include the response by those response organizations specialized in responding to a nuclear or radiological emergency and those organizations specialized in responding to a conventional emergency.

organizations and jurisdictions (including other States) that fall within the precautionary action zone or the urgent protective action planning zone (see para. 4.48).

IDENTIFYING, NOTIFYING AND ACTIVATING

Response

4.12. When circumstances necessitate an emergency response, operators shall promptly determine the appropriate emergency class (see para. 4.19) or the level of emergency response and shall initiate the appropriate on-site actions. The operator shall notify and provide updated information, as appropriate, to the off-site notification point.

4.13. Upon notification of a nuclear or radiological emergency warranting an off-site response, the off-site notification point shall promptly notify all appropriate off-site response organizations. Upon notification, the off-site response organizations shall promptly initiate the preplanned and co-ordinated response appropriate to the emergency class or the level of emergency.

4.14. Appropriate emergency response actions shall be initiated promptly upon the receipt of a notification from another State or information from the IAEA of a notification relating to an actual or potential transnational emergency that could affect the State or its nationals.

4.15. In the event of a transnational emergency the notifying State shall promptly notify directly or through the IAEA those States that may be affected. The notifying State shall also notify the IAEA of a transnational emergency upon recognition or when it notifies another State. The notifying State shall provide information concerning the nature of the emergency and any potential transnational consequences[16] and shall respond to requests from other States and from the IAEA for information with the intent of minimizing the consequences.

[16] This is in accordance with the State's obligations under the general principles and rules of international law and, if it is a State Party to the Convention, for the case of a significant transboundary release, it is in accordance with the Convention on Early Notification of a Nuclear Accident [1].

Preparedness

4.16. Notification points[17] shall be established that are responsible for receiving emergency notifications of an actual or potential nuclear or radiological emergency. The notification points shall be continuously available to receive any notification or request for assistance and to respond promptly or to initiate an off-site response.

4.17. In jurisdictions in which there is a significant probability of a dangerous source being lost, abandoned, illicitly removed or illicitly transported (see para. 3.19), arrangements shall be made to ensure that the on-site managers of operations and the local officials responsible for response are aware of the indicators of a potential emergency and aware of the appropriate notifications and other immediate actions warranted if an emergency is suspected.

4.18. Arrangements shall be made to ensure that first responders are aware of: the indicators of the presence of radiation or radioactive material, such as the trefoil symbol and 'dangerous goods' labels and placards [9, 13], and the significance of these indicators; the symptoms that would indicate a need to conduct an assessment to determine whether there may be an emergency; and the appropriate notification and other immediate actions warranted if an emergency is suspected.

4.19. The operator of a facility or practice in threat category I, II, III or IV shall make arrangements for the prompt identification of an actual or potential nuclear or radiological emergency and determination of the appropriate level of response[18, 19]. This shall include a system for classifying[20] all potential nuclear and radiological emergencies that warrant an emergency intervention to protect workers and the

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[17] This can be a facility used to receive notification of and to initiate the off-site response to an emergency of any type (conventional, nuclear or radiological).

[18] A related requirement for nuclear power plants was established in Ref. [12], para. 2.32.

[19] A related requirement for research reactors was established in the Code on the Safety of Nuclear Research Reactors: Operation, Safety Series No. 35-S2, IAEA, Vienna (1992), para. 1601; this Code is to be superseded by a Safety Requirements publication on the Design and Operation of Nuclear Research Reactors (in preparation).

[20] A related requirement for research reactors was established in the Code on the Safety of Nuclear Research Reactors: Operation, Safety Series No. 35-S2, IAEA, Vienna (1992), para. 1605; this Code is to be superseded by a Safety Requirements publication on the Design and Operation of Nuclear Research Reactors (in preparation).

public, in accordance with international standards[21], which covers emergencies of the following types[22] at facilities (1–4) and other emergencies such as (5) below:

(1) General emergencies at facilities in threat category I or II involving an actual, or substantial risk of, release of radioactive material or radiation exposure[23] that warrants taking urgent protective actions off the site. Upon declaration of this class of emergency, actions shall be promptly taken to mitigate the consequences and to protect people on the site and within the precautionary action zone and urgent protective action planning zone (see para. 4.48), as appropriate.
(2) Site area emergencies at facilities in threat category I or II involving a major decrease in the level of protection for those on the site and near the facility. Upon declaration of this class of emergency, actions shall be promptly taken to mitigate the consequences, to protect people on the site and to make preparations to take protective actions off the site if this becomes necessary.
(3) Facility emergencies at facilities in threat category I, II or III involving a major decrease in the level of protection for people on the site. Upon declaration of this class of emergency, actions shall be promptly taken to mitigate the consequences and to protect people on the site. Emergencies in this class can never give rise to an off-site threat.
(4) Alerts at facilities in threat category I, II or III involving an uncertain or significant decrease in the level of protection for the public or people on the site. Upon declaration of this class of emergency, actions shall be promptly taken to assess and mitigate the consequences and to increase the readiness of the on-site and off-site response organizations, as appropriate.
(5) Other emergencies such as an uncontrolled source emergency involving the loss, theft or lack of control of a dangerous source, including the re-entry of a satellite containing such a source.

4.20. The emergency classification system for facilities or practices in threat category I, II, III or IV shall take into account all postulated nuclear and radiological[24, 25, 26] emergencies. The criteria for classification shall be predefined emergency action levels (EALs) that relate to abnormal conditions for the facility

[21] Appendix V and Schedule V of Ref. [3] are reproduced in Annexes I and III.

[22] The emergency classes may differ from those specified in (1–5) provided that emergencies of all these types are addressed.

[23] This could be due to a loss of shielding or a criticality.

[24] This includes emergencies of very low probability [7].

[25] A related requirement was established in Ref. [3], Appendix V, para. V.5.

[26] A related requirement was established in Ref. [12], para. 2.32.

or practice concerned, security related concerns, releases of radioactive material, environmental measurements and other observable indications (see para. 4.70). The classification system shall be established with the aim of initiating a response prompt enough to allow for effective management and the implementation of emergency operations, including mitigation by the operator, urgent protective action and the emergency protection of workers. It shall be ensured that the process of rating the event on the joint IAEA and OECD/NEA International Nuclear Event Scale (INES)[27] [14] does not delay classification or other response actions.

4.21. In the classification system each emergency class shall represent circumstances that pose approximately the same level of risk and prompt approximately the same level of response to be initiated when declared at different facilities in the State.

4.22. For each facility or practice in threat category I or II an off-site notification point[28] in each State with territory within the emergency zones shall be designated responsible for receiving emergency notification of an actual or potential nuclear or radiological emergency. This notification point shall be continuously available to receive a notification or request for assistance and to initiate promptly the appropriate preplanned off-site response.

4.23. Each facility or practice in threat category I, II, III or IV[29] shall have a person on the site at all times with the authority and responsibilities: to classify a nuclear or radiological emergency and upon classification promptly and without consultation to initiate an appropriate on-site response; to notify the appropriate off-site notification point (see para. 4.22); and to provide sufficient information for an effective off-site response. This person shall be provided with a suitable means of alerting on-site response personnel[30] and notifying the off-site notification point[31].

4.24. Operators of a facility or practice in threat category I, II, III or IV "shall ensure that adequate [arrangements are] made for [identifying a situation that warrants

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[27] The emergency response classification system is not to be confused with the INES. The INES is used for communicating to the public the severity or estimated severity of an event and cannot be used as the basis for emergency response actions.

[28] An off-site notification point is responsible for the initiation of protective actions within the emergency zones and providing support to the operator or facility. This could be the notification point established to fulfil the requirement in para. 4.16.

[29] For threat category III or IV this only applies for periods when operations pose a potential risk.

[30] A related requirement for nuclear power plants was established in Ref. [12], para. 2.32.

[31] A related requirement for nuclear power plants was established in Ref. [12], para. 2.33.

emergency response and] generating adequate information promptly and communicating it to the responsible authorities, for[32, 33]:

(a) the early prediction or assessment of the extent and significance of any [unplanned] discharge of radioactive substances to the environment [or exposures];
(b) rapid and continuous assessment of the [nuclear or radiological emergency] as it proceeds; and
(c) determining the need for protective actions [for the public and workers]" (Ref. [3], Appendix V, para. V.5.)

4.25. Declaration of a particular class of emergency at a facility or practice in threat category I, II, III or IV shall promptly initiate the appropriate level of co-ordinated and preplanned emergency response on and off the site. The responsibilities and initial response actions of all response organizations shall be defined for each class of emergency.

4.26. For facilities in threat category I or II the threat assessment shall demonstrate for the range of postulated emergencies that identification, notification, activation and other initial response actions can be performed in time to achieve the practical goals (see para. 2.3) of emergency response.

4.27. Arrangements shall be made for response organizations to have sufficient personnel available to perform their assigned initial response actions.

4.28. Arrangements shall be made to provide a response to a nuclear or radiological emergency for which detailed plans could not be formulated in advance.

4.29. The State shall make known to the IAEA and to other States, directly or through the IAEA, its single warning point of contact responsible for receiving emergency notifications and information from other States and information from the IAEA. This warning point shall be continuously available to receive any notification, request for assistance or request for verification of information from the IAEA and to initiate promptly a response or verification. The State shall promptly inform the IAEA and, directly or through the IAEA, relevant States of any changes that may occur in respect of the point of contact.

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[32] A related requirement for nuclear power plants was established in Ref. [12], para. 2.33.

[33] A related requirement for research reactors was established in the Code on the Safety of Nuclear Research Reactors: Operation, Safety Series No. 35-S2, IAEA, Vienna (1992), para. 1605; this Code is to be superseded by a Safety Requirements publication on the Design and Operation of Nuclear Research Reactors (in preparation).

4.30. The State shall make arrangements for promptly notifying and providing relevant information to, directly or through the IAEA, those States that may be affected by a transnational emergency. The State shall make arrangements for promptly responding to requests from other States or from the IAEA for information in respect of a transnational emergency, in particular with regard to minimizing any transnational consequences.

4.31. Arrangements shall be made for promptly and directly notifying any State in

Netherlands, Norway, Portugal, Republic of Korea, Slovakia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States of America. The European Commission also takes part in the work of the NEA. The mission of the NEA is: to assist its Member countries in maintaining and further developing, through international co-operation, the scientific, technological and legal bases required for a safe, environmentally friendly and economical use of nuclear energy for peaceful purposes, as well as to provide authoritative assessments and to forge common understandings on key issues, as input to government decisions on nuclear energy policy and to broader OECD policy analyses in areas such as energy and sustainable development. Specific areas of NEA competence include safety and regulation of nuclear activities, radioactive waste management, radiological protection, nuclear science, economic and technical analyses of the nuclear fuel cycle, nuclear law and liability, and public information. The NEA Data Bank provides nuclear data and computer program services for participating countries. In these and related tasks, the NEA works in close collaboration with the IAEA, with which it has a Co-operation Agreement, as well as with other international organizations in the nuclear field.

The Pan American Health Organization (PAHO), founded in 1902, initiated activities in radiological health in the 1950s, promoting public health aspects of radiation and providing fellowships for the training of physicians and other professionals in radiation medicine. Owing to the introduction of various activities associated with the peaceful application of nuclear energy in the member countries, a Radiation Protection Unit was established at the regional level in 1960. The objectives of the unit were "to encourage national health services to develop procedures and regulations and to adopt international standards for radiation protection connected with the use of X rays and radioisotopes and for the disposal of radioactive wastes; to promote the teaching of basic health physics, radiobiology and radiation protection in medical, dental, veterinary, public health and other professional schools; and to foster the use of radioisotopes for medical diagnosis, therapy and research." The radiological health activities of PAHO cover all aspects of diagnostic imaging, radiation therapy and nuclear medicine, including radiation protection. Consultation is provided for planning radiological services, including: shielding design; specification, selection, acceptance testing, maintenance and repair of radiological equipment; review of diagnostic and therapeutic radiological procedures; calibration of radiation beams for diagnosis and treatment; physical and clinical dosimetry; radioactive waste disposal for medical facilities; development and implementation of quality assurance programmes; radiation accidents; and preparedness for a radiological emergency. Educational activities involve the organization of and participation in courses, workshops and seminars; the publication and dissemination of radiation related publications and audiovisual programmes; and the exchange of information on training programmes.

The United Nations Office for the Coordination of Humanitarian Affairs (OCHA) is that part of the UN Secretariat which is charged by the UN General Assembly with: processing requests from affected Member States for emergency assistance requiring a co-ordinated response; maintaining an overview of all emergencies with a view to co-ordinating and facilitating the humanitarian assistance of the UN system in emergencies; organizing in consultation with the government of the affected country a joint interagency needs assessment mission and preparing a consolidated appeal by the Secretary-General; actively facilitating access by the operational organizations to emergency areas for the rapid provision of emergency assistance; managing the central emergency revolving fund and assisting in the mobilization of resources; serving as a central focal point with governments and intergovernmental and non-governmental organizations concerning UN emergency relief operations and mobilizing their emergency relief capacities; providing consolidated information to all interested governments and concerned authorities particularly affected and to disaster prone countries; actively promoting the smooth transition from relief to rehabilitation and reconstruction; and preparing an annual report for the Secretary-General on the coordination of humanitarian emergency assistance to be submitted to the UN General Assembly. OCHA is headed by a UN Under-Secretary-General, the UN Emergency Relief Coordinator, who is supported by a secretariat.

The WHO, which is a specialized agency of the United Nations, had its origin in the proposal made at the United Nations Conference held in San Francisco in 1945 that a specialized agency be created to deal with all matters relating to health. The Constitution came into force on 7 April 1948, the first World Health Assembly met in Geneva in June 1948, and on 1 September 1948 the permanent Organization was established. The work of the Organization is carried out by three organs: the World Health Assembly, the supreme authority, to which all Member States send delegates; the Executive Board, the executive organ of the Health Assembly; and a Secretariat under the Director-General. Through this Organization, the health professionals of nearly 190 countries exchange knowledge and experience, with the aim of making possible the attainment by all citizens of the world of a level of health that will permit them to lead a socially and economically productive life. WHO works as one organization, with its headquarters in Geneva, and six regional offices for Africa, the Americas, the Eastern Mediterranean, Europe, South-East Asia and the Western Pacific, and with representatives and field offices in many countries. WHO also includes the International Agency for Research in Cancer (IARC). WHO conducts co-operative efforts with other international organizations; its WHO Collaborating Centres; its panels of expert advisers; and various non-governmental scientific and professional organizations, among which are the International Society of Radiology, the International Society of Radiographers and Radiological Technicians, and the International Organization for Medical Physics. WHO has official relationships with

ICRP and IRPA. By means of direct technical co-operation with its Member States, and by stimulating such co-operation among them, WHO promotes the development of comprehensive health services, the prevention and control of diseases, the improvement of environmental conditions, the development of human resources for health, the co-ordination and development of biomedical research and research on health services, and the planning and implementation of health programmes. In the radiological area, WHO's interests cover the use of radiation in medicine as well as radiation hygiene.

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