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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<sup>2</sup>. 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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<sup>2</sup> 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 These two Codes are to be superseded by a Safety Requirements publication on the Design and Operation of Nuclear Research Reactors (in preparation).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<sup>3</sup> as:

**“Radiation protection objective:** *To ensure... mitigation of the radiological consequences of any accidents.”*

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<sup>3</sup> 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<sup>4</sup>, 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.

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<sup>4</sup> 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 <sup>a</sup> (including very low probability events) are postulated that could give rise to severe deterministic health effects <sup>b</sup> 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 <sup>a</sup> are postulated that could give rise to doses to people off the site that warrant urgent protective action in accordance with international standards <sup>c</sup> , 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 facilities.
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 <sup>d</sup> 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.

<sup>a</sup> 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.

<sup>b</sup> 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'.

<sup>c</sup> Schedule V of Ref. [3] is reproduced in Annex III.

<sup>d</sup> 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.)<sup>5</sup>

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<sup>6</sup>. 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

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<sup>5</sup> 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).

<sup>6</sup> 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<sup>7</sup> 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<sup>8, 9</sup>;
- (b) Urgent protective action to prevent stochastic effects to the extent practicable by averting doses, in accordance with international standards<sup>10</sup>;
- (c) Agricultural countermeasures, countermeasures to ingestion and longer term protective measures, in accordance with international standards<sup>10</sup>; or
- (d) Protection for the workers responding (undertaking an intervention), in accordance with international standards<sup>11</sup>.

3.18. Non-radiological threats (such as the release of uranium hexafluoride (UF<sub>6</sub>) or other hazardous chemicals) to people on and off the site that are associated with the practice shall be identified in the threat assessment<sup>12</sup>.

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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<sup>7</sup> Taken on the basis of conditions at the facility or at the scene before environmental monitoring is carried out.

<sup>8</sup> Schedule IV of Ref. [3] is reproduced in Annex II.

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

<sup>10</sup> Schedule V of Ref. [3] is reproduced in Annex III.

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

<sup>12</sup> 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<sup>13</sup>.

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

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<sup>13</sup> 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<sup>14</sup>.

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<sup>15</sup> 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

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<sup>14</sup> To include law enforcement response and investigation activities during an emergency.

<sup>15</sup> 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<sup>16</sup> and shall respond to requests from other States and from the IAEA for information with the intent of minimizing the consequences.

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<sup>16</sup> 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<sup>17</sup> 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<sup>18, 19</sup>. This shall include a system for classifying<sup>20</sup> all potential nuclear and radiological emergencies that warrant an emergency intervention to protect workers and the

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<sup>17</sup> 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).

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

<sup>19</sup> 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).

<sup>20</sup> 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<sup>21</sup>, which covers emergencies of the following types<sup>22</sup> 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<sup>23</sup> 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<sup>24, 25, 26</sup> emergencies. The criteria for classification shall be predefined emergency action levels (EALs) that relate to abnormal conditions for the facility

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

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

<sup>23</sup> This could be due to a loss of shielding or a criticality.

<sup>24</sup> This includes emergencies of very low probability [7].

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

<sup>26</sup> 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)<sup>27</sup> [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<sup>28</sup> 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<sup>29</sup> 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<sup>30</sup> and notifying the off-site notification point<sup>31</sup>.

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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<sup>27</sup> 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.

<sup>28</sup> 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.

<sup>29</sup> For threat category III or IV this only applies for periods when operations pose a potential risk.

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

<sup>31</sup> 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<sup>32, 33</sup>;

- (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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<sup>32</sup> A related requirement for nuclear power plants was established in Ref. [12], para. 2.33.

<sup>33</sup> 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 which urgent protective action should be taken, including States with territory within the precautionary action zone or urgent protective action planning zone (see para. 4.48).

## TAKING MITIGATORY ACTION

### **Response**

4.32. First responders shall take all practicable and appropriate actions to minimize the consequences of a nuclear or radiological emergency involving a practice in threat category IV.

4.33. The operator of a facility or practice in threat category I, II, III or IV shall promptly take the actions necessary to minimize the consequences of a nuclear or radiological emergency involving a source or practice under the operator's responsibility.

4.34. Emergency services shall be made available to support the response at facilities in threat category I, II or III.

### **Preparedness**

4.35. Arrangements shall be made to provide expertise and services in radiation protection promptly to local officials and first responders responding to actual or potential emergencies involving practices in threat category IV. This shall include arrangements for on-call advice and arrangements to dispatch to the scene an emergency team that includes radiation specialists capable of assessing threats involving radioactive or fissile material<sup>34</sup>, assessing radiological conditions, mitigating the radiological consequences and managing the exposure of responders.

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<sup>34</sup> This includes the possible use of such material for malicious purposes. An assessment of such threats could possibly be obtained through the IAEA under the terms of the Assistance Convention [1].

In addition, arrangements shall be made to determine when additional assistance is necessary for dealing with radiological aspects and to obtain such assistance<sup>35</sup>. First responders shall also be provided with guidance that is in accordance with international standards on the immediate response to actual or potential transport related emergencies [13] and suspected illicit trafficking involving radioactive material.

4.36. The operator for a practice in threat category IV shall be given basic instruction in the means of mitigating the potential consequences of emergencies and promptly protecting workers and the public in the vicinity.

4.37. The operator for a practice using a dangerous source (such as practices in industrial radiography or radiotherapy) shall make arrangements to respond promptly to an emergency involving the source in order to mitigate any consequences. This response shall include prompt access to a radiological assessor or radiation protection officer who is trained and qualified to assess the emergency and to mitigate any consequences.

4.38. Arrangements shall be made to initiate a prompt search and to issue a warning to the public in the event of a dangerous source being lost or illicitly removed and possibly being in the public domain.

4.39. For facilities in threat category I, II or III arrangements shall be made for mitigatory actions by the operator to prevent an escalation of the threat, to return the facility to a safe and stable state, to reduce the potential for releases of radioactive material or exposures and to mitigate the consequences of any actual releases or exposures. These arrangements shall take into account the following aspects of the response to mitigate the consequences of a nuclear or radiological emergency: the operational actions necessary; the operational information needs; the workload and conditions of the operational staff (such as in the control room); the responder actions necessary in the facility; the conditions in the facility in which responder actions are necessary; and the response of the personnel, instrumentation and systems of the facility under emergency conditions. Arrangements shall include emergency operating procedures and guidance for the operator on mitigatory actions for severe conditions, for the full range of postulated emergencies, including accidents beyond the design basis<sup>36, 37</sup>.

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<sup>35</sup> Possibly through the IAEA under the terms of the Assistance Convention [1].

<sup>36</sup> Related requirements for nuclear power plants were established in Ref. [11], paras 5.29 and 5.31.

<sup>37</sup> Related requirements for nuclear power plants were established in Ref. [12], paras 2.33 and 5.12.

4.40. For facilities in threat category I, II or III arrangements shall be made to provide technical assistance to the operational staff. Teams for mitigating the consequences of an emergency (damage control, fire fighting) shall be available and shall be prepared to perform actions in the facility. “Any equipment necessary in... response and recovery... shall be placed at the most suitable location to ensure its ready availability at the time of need and to allow human access [to it] in the anticipated [emergency conditions or] environmental conditions.” (Ref. [11], para. 5.30.) The personnel directing mitigatory actions shall be provided with an operating environment, information and technical assistance that allows them to take effective action to mitigate the consequences of the emergency. Arrangements shall be made to obtain support promptly from police, medical and fire fighting services off the site. Off-site support personnel shall be afforded prompt access to the facility and shall be informed of on-site conditions and the necessary protective actions.

## TAKING URGENT PROTECTIVE ACTION

### **Response**

4.41. All appropriate measures shall be taken to save lives.

4.42. Urgent protective action, in accordance with international standards<sup>38</sup>, shall be taken to prevent to the extent practicable the occurrence of severe deterministic health effects and to avert doses.

4.43. Urgent protective actions shall be modified as appropriate to take into account any new information relating to the emergency that becomes available.

4.44. A protective action shall be discontinued when it is no longer justified.

### **Preparedness**

4.45. “Optimized [national] intervention levels [for taking urgent protective actions] shall be [established that are in accordance with international standards<sup>39</sup>], modified to take account of local and national conditions, such as:

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<sup>38</sup> Schedule IV of Ref. [3] is reproduced in Annex II and Schedule V of Ref. [3] is reproduced in Annex III.

<sup>39</sup> Schedule V of Ref. [3] is reproduced in Annex III.



- (a) the individual and collective [doses] to be averted by the intervention; and
- (b) the radiological and non-radiological health risks and the financial and social costs and benefits associated with the intervention.” (Ref. [3], para. 3.14.)

4.46. National guidelines in accordance with international standards shall be adopted for the termination of urgent protective actions<sup>40</sup>.

4.47. First responders shall be informed that, in the event of an immediate threat to life (such as a fire), they should not delay any action to save human life or prevent serious injury for the reason that signs or placards indicate the possible presence of radioactive material.

4.48. For facilities in threat category I or II arrangements shall be made for effectively making and implementing decisions on urgent protective actions to be taken off the site. This capability shall make use of existing public infrastructure<sup>41</sup> to limit the occurrence of severe deterministic health effects and to avert doses, in accordance with international standards<sup>42</sup>, for the full range of possible emergencies<sup>43</sup> at those facilities. These arrangements shall include the following:

- (a) The specification of off-site emergency zones<sup>44</sup> for which arrangements shall be made for taking urgent protective action. These emergency zones shall be contiguous across national borders, where appropriate, and shall include:
  - (i) A precautionary action zone, for facilities in threat category I, for which arrangements shall be made with the goal of taking precautionary urgent protective action, before a release of radioactive material occurs or shortly after a release of radioactive material begins, on the basis of conditions at the facility (such as the emergency classification) in order to reduce substantially the risk of severe deterministic health effects.

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<sup>40</sup> A related requirement was established in Ref. [3], Appendix V, para. V.26.

<sup>41</sup> Such infrastructure includes, for example, buildings and transport networks.

<sup>42</sup> Schedule IV of Ref. [3] is reproduced in Annex II and Schedule V of Ref. [3] is reproduced in Annex III.

<sup>43</sup> The full range of possible emergencies includes those of very low probability.

<sup>44</sup> The off-site emergency zones or areas may differ from those specified in these Safety Requirements provided that such areas are designated for which preparations are to be made to take urgent protective actions promptly on the basis of conditions at the facility for facilities in threat category I, in order to reduce the risk of severe deterministic health effects, and on the basis of monitoring and conditions at the facility for facilities in threat category I or II, in order to avert doses, in accordance with international standards.

- (ii) An urgent protective action planning zone, for facilities in threat category I or II, for which arrangements shall be made for urgent protective action to be taken promptly, in order to avert doses off the site in accordance with international standards<sup>45</sup>.
- (b) Criteria, based on the emergency classification and on conditions at the facility and off the site, for the formulation of recommendations for urgent protective actions off the site, which are to be provided to off-site officials responsible for taking protective action within the precautionary action zone and urgent protective action planning zone. In addition, arrangements shall be made to provide for any necessary revision of these recommendations, prior to their implementation, to take account of factors (such as conditions for travelling or sheltering) that may affect the taking of protective actions and of the results of environmental monitoring following a release of radioactive material or an exposure (see para. 4.71).
- (c) A single position on the site at all times with the authority and responsibility promptly to recommend the protective actions to be taken to the appropriate officials off the site upon the declaration of a nuclear or radiological emergency.
- (d) Arrangements for the prompt notification of the off-site notification point with the authority and responsibility to take urgent protective action within the precautionary action zone and urgent protective action planning zone. This shall include all the jurisdictions (including those beyond national borders) within the emergency zones.

4.49. Arrangements shall be made for the officials off the site who are responsible for making decisions on the protective actions to be taken for the population within the precautionary action zone and/or the urgent protective action planning zone to make decisions on protective actions promptly upon the notification of a nuclear or radiological emergency.

4.50. The jurisdictions within the precautionary action zone and/or the urgent protective action planning zone shall make arrangements to take appropriate urgent action promptly upon the notification of a nuclear or radiological emergency. These arrangements shall include arrangements for: taking appropriate actions for the protection of emergency workers; alerting permanent, transient and special population groups or those responsible for them; taking urgent protective actions; protecting supplies of food and water; imposing restrictions on the immediate consumption of produce from farms or gardens and of locally produced milk; monitoring and

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<sup>45</sup> Schedule V of Ref. [3] is reproduced in Annex III.

decontaminating evacuees; caring for evacuees; alerting special facilities; and the control of access to and the restriction of traffic by air, water, road and rail. Arrangements shall be co-ordinated with all the jurisdictions (including those beyond national borders) within any emergency zone.

4.51. The operator of a facility in threat category I, II or III shall make arrangements to ensure the safety of all persons on the site in the event of a nuclear or radiological emergency. This shall include arrangements: to notify people on the site of an emergency<sup>46</sup>; for all persons on the site to take appropriate actions immediately upon notification of an emergency; to account for those on the site; to locate and recover those unaccounted for; to take urgent protective action; and to provide immediate first aid. The facility shall provide suitable assembly points for all persons on the site and “shall be provided with a sufficient number of safe escape routes, clearly and durably marked, with reliable emergency lighting, ventilation and other building services essential to the safe use of these routes<sup>47</sup>. The escape routes shall meet the relevant international requirements for radiation zoning and fire protection and the relevant national requirements for industrial safety and... security.” (Ref. [11], para. 5.61.) “Suitable alarm systems and means of communication shall be provided so that all persons present in the [facility] and on the site can be warned and instructed, even under [emergency] conditions.” (Ref. [11], para. 5.62.)

4.52. [The operator of a facility in threat category I, II or III shall ensure the] “availability of means of communication necessary for [protective actions to be taken within the facility and in the area controlled by the operator] and to off-site agencies [with responsibility for taking protective actions within the precautionary action zone and the urgent protective action planning zone]...<sup>48</sup> at all times. This requirement shall be taken into account in the design and the diversity of the methods of communication selected.” (Ref. [11], para. 5.63.)

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<sup>46</sup> 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. 1607; this Code is to be superseded by a Safety Requirements publication on the Design and Operation of Nuclear Research Reactors (in preparation).

<sup>47</sup> A related requirement for research reactors was established in the Code on the Safety of Nuclear Research Reactors: Design, Safety Series No. 35-S1, IAEA, Vienna (1992), para. 556; this Code is to be superseded by a Safety Requirements publication on the Design and Operation of Nuclear Research Reactors (in preparation).

<sup>48</sup> This applies irrespective of any national borders.

## PROVIDING INFORMATION AND ISSUING INSTRUCTIONS AND WARNINGS TO THE PUBLIC

### Response

4.53. Upon declaration of an emergency class the public shall be promptly warned of the emergency and informed of the actions that they should take. There shall be no undue delay that could jeopardize the effectiveness of the protective actions.

### Preparedness

4.54. For facilities in threat category I or II arrangements shall be made, before and during operations, to provide information on the response to a nuclear or radiological emergency to permanent, transient and special population groups or those responsible for them and to special facilities within the precautionary action zone and the urgent protective action planning zone<sup>49</sup>. This shall include information on the nature of the hazard, on how people will be warned or notified and on the actions to be taken in the event of a nuclear or radiological emergency. The information shall be provided in the languages mainly spoken in these emergency zones and the effectiveness of this public information programme shall be periodically assessed.

4.55. Arrangements shall be made for facilities in threat category I or II to provide promptly a warning and instruction to permanent, transient and special population groups or those responsible for them and to special facilities in the precautionary action zone and the urgent protective action planning zone upon declaration of an emergency class. This shall include instructions in the languages mainly spoken in these emergency zones on the immediate actions to be taken.

## PROTECTING EMERGENCY WORKERS

### Response

4.56. Arrangements shall be made to protect emergency workers, in accordance with international standards<sup>50</sup>.

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<sup>49</sup> A related requirement was established in Ref. [3], Appendix V, para. V.3.

<sup>50</sup> Appendix V, paras V.27, V.28, V.30 and V.32 of Ref. [3] are reproduced in Annex I.

## Preparedness

4.57. Arrangements shall be made to designate as emergency workers those who may undertake an intervention to do the following<sup>51</sup>:

- (a) To save lives or to prevent serious injury, including severe deterministic health effects;
- (b) To take actions to avert a large collective dose<sup>52</sup>; or
- (c) To take actions to prevent the development of catastrophic conditions<sup>53</sup>.

4.58. Those called upon to respond at a facility in threat category I, II or III or within the precautionary action zone or the urgent protective action planning zone shall be designated as emergency workers. Such assisting personnel as police, fire fighters, medical personnel and drivers and crews of evacuation vehicles shall be designated as emergency workers. (See Ref. [3], Appendix V, para. V.27, footnote 31.)<sup>54</sup> In addition, the radiation specialists (see para. 4.35), radiation protection officers and radiological assessors (see para. 4.37) who may respond to emergencies involving practices or other hazards in threat category IV shall be considered emergency workers.

4.59. Those persons who may be called upon as first responders shall be informed of the risks of radiation exposure and the meanings of radiation signs and placards.

4.60. National guidance that is in accordance with international standards<sup>55</sup> shall be adopted for managing, controlling and recording the doses received by emergency workers. This guidance shall include default operational levels of dose for emergency workers for different types of response activities, which are set in quantities that can be directly monitored during the performance of these activities (such as the integrated dose from external penetrating radiation). In setting the default operational levels of dose for emergency workers the contribution to doses via all exposure pathways shall be taken into account.

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<sup>51</sup> A related requirement was established in Ref. [3], Appendix V, para. V.27.

<sup>52</sup> This includes establishing emergency management and operations; identifying, notifying and activating; assessing the initial phase; urgent and longer term protective actions; and managing the medical response.

<sup>53</sup> This includes mitigatory actions by the operator or first responder.

<sup>54</sup> A related requirement for nuclear power plants was established in Ref. [12], para. 2.33 (4).

<sup>55</sup> Appendix V, paras V.27, V.28, V.30 and V.32 of Ref. [3] are reproduced in Annex I.

4.61. For facilities in threat category I, II or III the anticipated hazardous conditions in which emergency workers may be required to perform response functions on or off the site shall be identified.

4.62. Arrangements shall be made for taking all practicable measures to provide protection for emergency workers for the range of anticipated hazardous conditions (see para. 4.61) in which they may have to perform response functions on or off the site<sup>56, 57</sup>. This shall include: arrangements to assess continually and to record the doses received by emergency workers; procedures to ensure that doses received and contamination are controlled in accordance with established guidance and international standards; and arrangements for the provision of appropriate specialized protective equipment, procedures and training for emergency response in the anticipated hazardous conditions.

4.63. “Once the emergency phase of an intervention has ended, workers undertaking recovery operations, such as [the recovery of sources,] repairs to [the facility] and buildings, waste disposal or decontamination of the site and surrounding area, shall be subject to the full system of detailed requirements for occupational exposure prescribed in Appendix I [of Ref. [3]].” (Ref. [3], Appendix V, para. V.30.)

4.64. “When the intervention has ended, the doses received and the consequent health risk shall be communicated to the workers involved.” (Ref. [3], Appendix V, para. V.31.)

4.65. “The [person within each response organization] responsible for ensuring compliance with the... requirements [for the protection of workers undertaking an intervention] shall be specified in emergency plans [and procedures].” (Ref. [3], Appendix V, para. V.29.)

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<sup>56</sup> A related requirement was established in Ref. [3], Appendix V, para. V.31.

<sup>57</sup> 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).

## ASSESSING THE INITIAL PHASE

### Response

4.66. The magnitude and likely development of hazardous conditions shall be appraised initially and throughout the emergency in order to identify new hazards promptly and to refine the strategy for response.

4.67. Radiation monitoring and environmental sampling and assessment shall be carried out in order to identify new hazards promptly and to refine the strategy for response.

4.68. Information about emergency conditions, emergency assessments and the protective actions recommended and taken shall be promptly made available to all relevant response organizations throughout the period of the emergency.

### Preparedness

4.69. Operators of practices or sources in threat category IV shall make arrangements: to characterize the extent and significance of any abnormal exposures or contamination; to initiate immediate mitigatory and protective actions on the site; to identify the members of the public who are potentially exposed; and to communicate the extent of the hazard and the recommended protective actions to the appropriate off-site response organizations.

4.70. The operators of facilities in threat category I, II or III shall make arrangements to assess promptly: abnormal conditions at the facility; exposures and releases of radioactive material; radiological conditions on and off the site<sup>58, 59</sup>; and any actual or potential exposures of the public. These assessments shall be used for mitigatory actions by the operator, emergency classification, urgent protective actions to be taken on the site, the protection of workers and recommendations for urgent protective actions to be taken off the site (see para. 4.20). These arrangements shall include access to instruments displaying or measuring those parameters that can

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<sup>58</sup> A related requirement for nuclear power plants was established in Ref. [12], para. 2.33 (3).

<sup>59</sup> 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).

readily be measured or observed in the event of a nuclear or radiological emergency and which form the basis for the EALs (see para. 4.20) used to classify emergencies. For these arrangements the expected response of the instrumentation or systems at the facility under abnormal conditions shall be taken into account.

4.71. For the precautionary action zone and the urgent protective action planning zone, arrangements shall be made for promptly assessing any radioactive contamination, releases of radioactive material and doses for the purpose of deciding on or adapting the urgent protective actions to be taken following a release of radioactive material. This capability shall include arrangements for promptly conducting environmental monitoring and monitoring for contamination on people (e.g. evacuees) within the emergency zones, including the availability of designated trained teams and instrumentation. In addition, arrangements shall be made for promptly assessing the results of environmental monitoring and monitoring for contamination on people in order to decide on or to adapt urgent protective actions to protect workers and the public, including the application of operational intervention levels (OILs) with arrangements to revise the OILs as appropriate to take into account the conditions prevailing during the emergency.

4.72. For the team (see para. 4.35) of radiation specialists who provide support to the first responders arrangements shall be made for identifying gamma, beta and alpha emitters and for delineating the areas in which urgent protective action is warranted.

4.73. Arrangements shall be made to ensure that relevant information is recorded during an emergency and retained for use during the emergency, in evaluations conducted following the emergency and for the long term health monitoring and follow-up of the emergency workers and members of the public who may potentially be affected.

## MANAGING THE MEDICAL RESPONSE

### **Response**

4.74. On the presentation of medical symptoms of radiation exposure or other effects indicative of a possible radiological emergency, the medical practitioner or other responsible party who recognizes the indications shall notify the appropriate notification point and shall take response actions as appropriate.

4.75. Appropriate specialized treatment shall be given to any person who receives a dose that could potentially result in severe deterministic health effects.



4.76. Where appropriate, measures shall be taken to detect increases in the incidence of cancers among emergency workers and the public resulting from radiation exposure due to a nuclear or radiological emergency, and to provide appropriate treatment.

### **Preparedness**

4.77. Arrangements shall be made for medical personnel, both general practitioners and emergency staff, to be made aware of the medical symptoms of radiation exposure and of the appropriate notification procedures and other immediate actions warranted if a nuclear or radiological emergency is suspected.

4.78. Facilities in threat category I, II or III shall make arrangements to treat a limited number of contaminated or overexposed workers, including arrangements for first aid, the estimation of doses, medical transport and the initial medical treatment of contaminated or highly exposed individuals in local medical facilities.

4.79. Jurisdictions within the emergency zones (see para. 4.48) of a facility in threat category I shall have a medical management plan for performing triage and assigning any highly exposed members of the public to appropriate medical facilities. This plan shall include operational criteria.

4.80. Arrangements shall be made at the national level to treat people who have been exposed or contaminated. These shall include: guidelines for treatment; the designation of medical practitioners trained in the early diagnosis and treatment of radiation injuries; and the selection of approved institutions to be used for the extended medical treatment or follow-up<sup>60, 61</sup> of persons subjected to radiation exposure or contamination. This shall also include arrangements for consultation on treatment following any exposure that could result in severe tissue damage or other severe deterministic health effects with medical practitioners experienced in dealing with such injuries<sup>60</sup>.

4.81. Arrangements shall be made for the identification, long term health monitoring and treatment of people in those groups that are at risk of sustaining detectable increases in the incidence of cancers as a result of radiation exposure due

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<sup>60</sup> This could be effected through the IAEA or the WHO under the terms of the Assistance Convention [1].

<sup>61</sup> A related requirement for nuclear power plants was established in Ref. [12], para. 2.33 (4).

to a nuclear or radiological emergency. The monitoring shall be based on criteria that provide an opportunity to detect increases in the incidence of cancers and to treat cancers more effectively at an early stage.

## KEEPING THE PUBLIC INFORMED

### **Response**

4.82. All practicable steps shall be taken to provide the public with useful, timely, truthful, consistent and appropriate information throughout a nuclear or radiological emergency.

### **Preparedness**

4.83. Arrangements shall be made for: providing useful, timely, truthful, consistent and appropriate information to the public in the event of a nuclear or radiological emergency; responding to incorrect information and rumours; and responding to requests for information from the public and from the news and information media<sup>62</sup>.

4.84. The operator, the response organizations, other States and the IAEA shall make arrangements for co-ordinating the provision of information to the public and to the news and information media in the event of a nuclear or radiological emergency.

## TAKING AGRICULTURAL COUNTERMEASURES, COUNTERMEASURES AGAINST INGESTION AND LONGER TERM PROTECTIVE ACTIONS

### **Response**

4.85. Agricultural countermeasures and longer term protective actions in accordance with international standards<sup>63</sup> shall be taken to avert doses.

4.86. Radioactive waste and contamination shall be appropriately managed.

4.87. “A protective action [shall] be discontinued when further assessment shows that continuation of the action is no longer justified.” (Ref. [3], Appendix V, para. V.26.)

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<sup>62</sup> Related requirements were established in Ref. [3], Appendix V, para. V.4.

<sup>63</sup> Schedule V, paras V-7–V-13 of Ref. [3] are reproduced in Annex III.

## Preparedness

4.88. “Optimized [national] intervention levels and action levels [for agricultural countermeasures<sup>64</sup>, countermeasures against ingestion and longer term protective actions shall be established that are in accordance with international standards<sup>65</sup>], modified to take account of local and national conditions, such as:

- (a) the individual and collective [doses] to be averted by the intervention; and
- (b) the radiological and non-radiological health risks and the financial and social costs and benefits associated with the intervention.” (Ref. [3], para. 3.14.)

4.89. For areas with activities in threat category V arrangements shall be made for taking effective agricultural countermeasures, including restriction of the consumption, distribution and sale of locally produced foods and agricultural produce following a release of radioactive material. These arrangements shall include: default OILs for environmental measurements (such as dose rates due to deposition and deposition densities) and food concentrations; the means to revise the OILs; timely monitoring<sup>65</sup> for ground contamination in the field; the sampling and analysis of food and water; and the means to enforce agricultural countermeasures.

4.90. In the urgent protective action planning zone and beyond, where relocation may be necessary as a result of a major release of radioactive material from a facility in threat category I or II, arrangements shall be made for effective temporary relocation. These arrangements shall include: OILs for dose rates due to deposition and deposition densities; the means to revise the OILs; timely monitoring for ground contamination<sup>66</sup>; the means for accomplishing relocation; and arrangements for assisting those persons who have been relocated.

4.91. For the emergency zones, arrangements shall be made for monitoring the contamination levels of vehicles, personnel and goods moving into and out of contaminated areas in order to control the spread of contamination. This shall include the setting of operational criteria for the results of the monitoring that indicate the need for decontamination or controls in accordance with international standards.

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<sup>64</sup> This includes measures relating to livestock, food production, gardens, forest products, fishing and water supplies.

<sup>65</sup> Schedule V of Ref. [3] is reproduced in Annex III.

<sup>66</sup> This may include aerial monitoring, possibly provided under the terms of the Assistance Convention [1].

4.92. Arrangements shall be made for the safe and effective management of radioactive waste in accordance with international standards<sup>67</sup>. These arrangements shall include: criteria for categorizing waste; a plan for monitoring and sampling to characterize the contamination and the waste; measurable criteria in terms of dose reduction for use in assessing the effectiveness of decontamination efforts; a method of testing decontamination methods before their general use; a method of duly minimizing the amount of material declared as waste and avoiding the unnecessary mixing of different waste types; a method of determining appropriate methods of storage, predisposal management and disposal; and a plan for the long term management of waste.

4.93. “[Arrangements shall be made] to assess exposure incurred by members of the public as a consequence of [a nuclear or radiological emergency], and the results of the assessments shall be made publicly available. The assessments shall be based on the best available information, and shall be promptly updated in the light of any information that would produce substantially more accurate results. Comprehensive records shall be maintained of assessments and their updates, and of monitoring results for workers, the public and the environment.” (Ref. [3], Appendix V, paras V.23–V.25.)

## MITIGATING THE NON-RADIOLOGICAL CONSEQUENCES OF THE EMERGENCY AND THE RESPONSE

### **Response**

4.94. The non-radiological consequences of the response shall be considered in order to ensure that the response actions do more good than harm.

### **Preparedness<sup>68</sup>**

4.95. Jurisdictions within the emergency zones shall make arrangements for justifying, optimizing and authorizing different intervention levels or action levels following an

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<sup>67</sup> This could be done with assistance provided under the Assistance Convention [1].

<sup>68</sup> Aspects of preparedness important for mitigating adverse psychological effects involve providing useful, timely, truthful, consistent and appropriate information on the nature of any hazards and providing clear instructions on the actions to be taken. These aspects are considered in the functional requirements set out in paras 4.53–4.55 and 4.82–4.84.

event for which agricultural countermeasures or longer term protective actions are in place. The process shall include arrangements for consulting the people affected. Public concern, effects on economic conditions and employment, long term needs for social welfare and other non-radiological effects of longer term protective actions shall be considered in this process. This process shall provide for exceptions from accordance with international standards where these are justified<sup>69</sup> (see para. 4.88).

4.96. Arrangements shall be made for responding to public concern in an actual or potential nuclear or radiological emergency. Preparations shall include arrangements for promptly explaining any health risks and what are appropriate and inappropriate personal actions for reducing risks. These arrangements shall include monitoring for and responding to any related health effects and preventing inappropriate actions<sup>70</sup> on the part of workers and the public. This shall include the designation of the organization(s) with the responsibility for identifying the reasons for such actions (such as misinformation from the media or rumours) and for making recommendations on countering them. How these recommendations are to be included in the national emergency response shall be specified.

## CONDUCTING RECOVERY OPERATIONS

### Response

4.97. The transition from the emergency phase to long term recovery operations and the resumption of normal social and economic activity shall be planned and made in an orderly manner and in accordance with international standards and guidance [3, 15].

4.98. “Once the emergency phase of an intervention has ended, workers undertaking recovery operations, such as repairs to plant and buildings, [the recovery of sources,] waste disposal or decontamination of the site and surrounding area, shall be subject to the full system of detailed requirements for occupational exposure prescribed in Appendix I [of Ref. [3]].” (Ref. [3], Appendix V, para. V.30.) All such work shall be carefully planned.

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<sup>69</sup> This could involve consultation with international experts arranged under the Assistance Convention [1].

<sup>70</sup> Inappropriate actions include, for example, discrimination against potentially exposed persons, spontaneous evacuation, the hoarding of food and unwarranted termination of pregnancy.

## **Preparedness**

4.99. Arrangements shall be established for the transition from emergency phase operations to routine long term recovery operations. This process shall include: the definition of the roles and functions of organizations; methods of transferring information; methods of assessing radiological and non-radiological consequences; and methods of modifying the actions taken to mitigate the radiological and non-radiological consequences of the nuclear or radiological emergency.

4.100. Decisions to cancel restrictions and other arrangements imposed in response to a nuclear or radiological emergency shall be made by a formal process that is in accordance with international guidance [15]. “The regulatory body shall provide any necessary input to the intervention process. Such input may be advice to the government or regulatory control of intervention activities. Principles and criteria for intervention actions shall be established and the regulatory body shall provide any necessary advice in this regard.” (Ref. [10], paras 6.15 and 6.16.) This process shall include public consultation. The process shall also provide for exceptions from compliance with national regulations and international standards, where justified.

## **5. REQUIREMENTS FOR INFRASTRUCTURE**

### **GENERAL**

5.1. This section establishes the requirements for infrastructural elements essential to providing the capability for fulfilling the requirements established in Section 4.

### **AUTHORITY**

5.2. The authority for developing, maintaining and regulating (see para. 3.9) arrangements for preparedness and response for a nuclear or radiological emergency shall be established by means of acts, legal codes or statutes.

5.3. All the operating organizations and local and national organizations involved in the performance of the functions specified in Section 4, or in support of their performance, shall document their own roles, functions, authorities and responsibilities in an emergency response and assent to the authorities, roles and responsibilities of other response organizations. Typically this is documented as part

of the appropriate national and local emergency response plans. Conflicting roles and responsibilities shall be resolved as part of the planning process or by the national co-ordinating authority (see para. 3.4).

5.4. The emergency arrangements shall include the clear allocation of responsibilities, authorities and arrangements for co-ordination in all phases of the response<sup>71</sup>. These arrangements shall include: ensuring that for each response organization a single position has the authority and responsibility to direct its response actions; clearly assigning the responsibility for the co-ordination of the entire response and for the resolution of conflicts between response organizations<sup>72</sup>; assigning to an on-site position the authority and responsibility for notifying the appropriate organization(s) of an emergency and taking immediate on-site actions; and assigning to an on-site position the responsibility for directing the entire on-site response<sup>73</sup> (see paras 4.7–4.10).

5.5. The arrangements for the delegation and/or transfer of authority shall be clearly specified in the relevant emergency plans, together with arrangements for notifying all the appropriate parties of the transfer.

## ORGANIZATION

5.6. The organizational relationships and interfaces between all the major response organizations shall be established.

5.7. The positions responsible within each operating and response organization for the performance of the response functions specified in Section 4 shall be assigned in the emergency plans.

5.8. Personnel shall be assigned to appropriate positions in all operating and response organizations in order to perform the functions necessary to meet the requirements established in Section 4.

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<sup>71</sup> Related requirements are established in Ref. [10], para. 6.5, and Ref. [3], Appendix V, paras V.2 and V.3.

<sup>72</sup> This responsibility would typically be assigned to a position in the organization with a primary role during each phase of the response. As the emergency progresses, the responsibility would typically pass from the operator or first responders to a local official and finally to a national official or to a command group (composed of representatives of the facility and other principal responders) for events involving several jurisdictions or ministries.

<sup>73</sup> The responsibility may be transferred to different positions as the emergency develops and as the on-site staff are augmented.

5.9. Sufficient numbers of qualified personnel shall be available at all times in order that appropriate positions can be promptly staffed as necessary following the declaration and notification of a nuclear or radiological emergency.

#### CO-ORDINATION OF EMERGENCY RESPONSE

5.10. Arrangements for the co-ordination of emergency response and protocols for operational interfaces between operators and local, regional and national governments shall be developed, as applicable<sup>74</sup>. These arrangements shall include the organizations responsible for emergency services and for response to conventional emergencies. The arrangements shall be clearly documented and this documentation shall be made available to all relevant parties.

5.11. When several different organizations or other States are expected to have or to develop tools, procedures or criteria for use in responding to the same emergency, co-ordination arrangements shall be put in place to harmonize the results of assessments of contamination, doses and health effects and of any other appropriate assessments made in the event of a nuclear or radiological emergency in order not to give rise to inconsistency and confusion.

5.12. Arrangements shall be made to ensure that all States within defined emergency zones are provided with appropriate information for developing their own preparedness to respond to an emergency and arrangements shall be made for appropriate transboundary co-ordination. These arrangements shall include: agreements and protocols to provide information necessary to develop a co-ordinated means for notification, classification schemes, intervention criteria and criteria for the introduction and revoking of protective actions; arrangements for public information; and arrangements for the exchange of information between decision making authorities. The language and physical units to be used shall be determined in advance. Pending the establishment of such agreements and protocols, due care shall be exercised in relations between States so as to minimize the consequences of any nuclear or radiological emergency.

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<sup>74</sup> 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. 1603; this Code is to be superseded by a Safety Requirements publication on the Design and Operation of Nuclear Research Reactors (in preparation).



## PLANS AND PROCEDURES

5.13. Plans or other arrangements<sup>75</sup> shall be made for co-ordinating the national response to the range of potential nuclear and radiological emergencies. These arrangements for a co-ordinated national response shall specify the organization responsible for the development and maintenance of the arrangements; shall describe the responsibilities of the operators and other response organizations; and shall describe the co-ordination effected between these arrangements and the arrangements for response to a conventional emergency. The arrangements should include provisions that can be used to formulate in detail a response to situations such as: a serious exposure or contamination resulting from contact with a source by a member of the public; the notification of a potential transboundary release of radioactive material; the discovery of a shipment containing a dangerous source that is not under control; the notification of the potential re-entry of a satellite; public concern or rumours about a threat; and other unanticipated situations warranting a response.

5.14. Each response organization “shall prepare a general plan or plans for co-ordinating and [performing their assigned functions as specified in Section 4]. This includes situations involving such sources of exposure as sources illegally brought into the country, falling satellites equipped with sources or radioactive materials released in accidents beyond national borders.” (Ref. [3], para. 3.10.) “Emergency plans shall be prepared which specify how the responsibilities for the management of interventions will be discharged on the site, off the site and across national [borders], as appropriate, in separate but interconnecting plans.” (Ref. [3], Appendix V, para. V.2.)

5.15. Plans for emergency response shall be based on the assessment of the threats as described in Section 3, including events with potentially severe consequences.

5.16. The plans for response to a nuclear or radiological emergency shall be co-ordinated with any other plans (such as plans for physical security, law enforcement or fire fighting) that may be implemented in an emergency in order to ensure that the simultaneous implementation of the plans would not seriously reduce their effectiveness or cause conflicts<sup>76</sup>.

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<sup>75</sup> This could include co-ordinating bodies, letters of agreement or legal instruments.

<sup>76</sup> 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. 1603; this Code is to be superseded by a Safety Requirements publication on the Design and Operation of Nuclear Research Reactors (in preparation).

5.17. “The appropriate responsible authorities shall ensure that:

- (a) emergency plans [are] prepared and approved for any practice or source which could give rise to a need for emergency intervention;
- (b) [response organizations are] involved in the preparation of emergency plans, as appropriate;
- (c) the content, features and extent of emergency plans take into account the results of any [threat assessment] and any lessons learned from operating experience and from [emergencies] that have occurred with sources of a similar type [(see paras 3.13–3.20)];
- (d) emergency plans [are] periodically reviewed and updated.” (Ref. [3], Appendix V, para. V.3.)

5.18. “Emergency plans shall include, as appropriate:

- (a) allocation of responsibilities for [performing the functions specified in Section 4];
- (b) identification of the various operating and other conditions... which could lead to the need for intervention;
- (c) intervention levels, based on a consideration of the guidelines in Schedule V [of Ref. [3]], for the relevant protective actions and the scope of their application, with account taken of the possible degrees of severity of accidents or emergencies that could occur;
- (d) procedures, including communication arrangements, for contacting any relevant [response organizations] and for obtaining assistance from fire fighting, medical, police and other relevant organizations;
- (e) a description of the methodology and instrumentation for assessing the [nuclear or radiological emergency] and its consequences on and off the site;
- (f) a description of the public information arrangements in the event of [a nuclear or radiological emergency]; and
- (g) the criteria for terminating each protective action.” (Ref. [3], Appendix V, para. V.4.)

5.19. “The operating organization [of a facility or practice in threat category I, II, III or IV] shall prepare an emergency plan that covers all activities under its responsibility, to be adhered to in the event of an emergency. This emergency plan shall be co-ordinated with those of all other bodies having responsibilities in an emergency, including public authorities, and shall be submitted to the regulatory body.” (Ref. [12], para. 2.31.)

5.20. “The emergency plan of the operating organization [of a facility or practice in threat category I, II or III] shall include the following [as appropriate]:

- (1) [A description of the on-site organization used to perform the functions specified in Section 4, including the] designation of persons for directing on-site activities and for ensuring liaison with off-site organizations;
- (2) The conditions under which an emergency shall be declared, [including the criteria for classification,] a list of job titles and/or functions of persons empowered to declare it, and a description of suitable [arrangements] for alerting response personnel and public authorities;
- (3) The arrangements for initial and subsequent assessment of the [conditions at the facility and] radiological conditions on and off the site;
- (4) [Arrangements] for minimizing the exposure of persons [on and off the site] to ionizing radiation and for ensuring medical treatment of casualties [, including arrangements to take protective actions if warranted on the basis of conditions at the facility to reduce the risk of severe deterministic health effects];
- (5) Assessment of the state of the [facility or practice] and the actions to be taken on the site to limit the extent of [any] radioactive release;
- (6) The chain of command and communication, including a description of related facilities and procedures;
- (7) An inventory of the emergency equipment to be kept in readiness at specified locations;
- (8) The actions to be taken by persons and organizations involved in the implementation of the plan [for each class of emergency];
- (9) [Arrangements] for declaring the termination of an emergency.” (Ref. [12], para. 2.33.)

5.21. The operating and response organizations shall develop the necessary procedures, analytical tools and computer programs in order to be able to perform the functions specified to meet the requirements for emergency response established in Section 4<sup>77</sup>.

5.22. Procedures, analytical tools and computer programs to be used in performing functions to meet the requirements for emergency response shall be tested under simulated emergency conditions and shall be validated as correct prior to use.

5.23. “On-site emergency plans shall be implemented by [the operators].” (Ref. [3], Appendix V, para. V.6.)

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<sup>77</sup> 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. 1606; this Code is to be superseded by a Safety Requirements publication on the Design and Operation of Nuclear Research Reactors (in preparation).

5.24. “Off-site emergency plans and any transboundary plan shall be implemented by the [response organizations].” (Ref. [3], Appendix V, para. V.7.)

## LOGISTICAL SUPPORT AND FACILITIES

5.25. Adequate tools, instruments, supplies, equipment, communication systems, facilities and documentation (such as procedures, checklists, telephone numbers and manuals) shall be provided for performing the functions specified in Section 4<sup>78</sup>. These items and facilities shall be selected or designed to be operational under the postulated conditions (such as the radiological, working and environmental conditions) that may be encountered in the emergency response, and to be compatible with other procedures and equipment for the response (such as the communication frequencies of other response organizations), as appropriate. These support items shall be located or provided in a manner that allows their effective use under postulated emergency conditions.

5.26. For facilities in threat category I or II emergency facilities shall be designated where the following will be performed in the different phases of the response: the co-ordination of on-site response actions; the co-ordination of local off-site response actions (radiological and conventional); the co-ordination of national response actions; co-ordination of public information; and co-ordination of off-site monitoring and assessment. Several of these activities may be performed at a single centre and the location may change in the different phases of the response. These emergency facilities shall be suitably located and/or protected so as to enable the exposure of emergency workers to be managed in accordance with international standards.

5.27. [For facilities in threat category I, an] “on-site emergency control centre<sup>79</sup>, separated from the [facility] control room, shall be provided to serve as [a] meeting place for the emergency staff who will operate from there in the event of an emergency. Information about important [facility] parameters and radiological conditions in the [facility] and its immediate surroundings should be available there. The room should provide means of communication with the control room, the

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<sup>78</sup> A related requirement for nuclear power plants was established in Ref. [12], para. 2.38.

<sup>79</sup> A related requirement for research reactors was established in the Code on the Safety of Nuclear Research Reactors: Design, Safety Series No. 35-S1, IAEA, Vienna (1992), para. 556; this Code is to be superseded by a Safety Requirements publication on the Design and Operation of Nuclear Research Reactors (in preparation).

supplementary control room and other important points in the [facility], and with the on-site and off-site emergency response organizations. Appropriate measures shall be taken to protect the occupants for a protracted time against hazards resulting from a severe accident.” (Ref. [11], para. 6.87.)

5.28. Laboratories shall be designated to make the necessary arrangements to be able to perform appropriate and reliable analyses of environmental and biological samples and measurements of internal contamination for the purposes of an emergency response<sup>80</sup>. It shall be ensured that these facilities would be operational under postulated emergency conditions.

5.29. A national emergency facility or facilities shall be designated for the coordination of response actions and public information.

5.30. Arrangements shall be made to obtain appropriate support for logistics and communication, for social welfare and in other areas from the organizations responsible for providing such support in conventional emergencies.

## TRAINING, DRILLS AND EXERCISES

5.31. The operator and the response organizations shall identify the knowledge, skills and abilities necessary to be able to perform the functions specified in Section 4. The operator and the response organizations shall make arrangements for the selection of personnel and for training to ensure that the personnel have the requisite knowledge, skills, abilities, equipment, and procedures and other arrangements to perform their assigned response functions<sup>81, 82</sup>. The arrangements shall include ongoing refresher training on an appropriate schedule and arrangements for ensuring that personnel assigned to positions with responsibilities for emergency response undergo the specified training.

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<sup>80</sup> This could be addressed for threat category IV areas with assistance provided under the Assistance Convention [1].

<sup>81</sup> A related requirement was established in Ref. [3], Appendix V, para. V.3.

<sup>82</sup> 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. 1608; this Code is to be superseded by a Safety Requirements publication on the Design and Operation of Nuclear Research Reactors (in preparation).

5.32. For facilities in threat category I, II or III all employees and all other persons on the site shall be instructed in the arrangements for them to be notified of an emergency and their actions when notified of an emergency<sup>83</sup>.

5.33. Exercise programmes shall be conducted to ensure that all specified functions required to be performed for emergency response and all organizational interfaces for facilities in threat category I, II or III and the national level programmes for threat category IV or V are tested at suitable intervals<sup>84, 85</sup>. These programmes shall include the participation in some exercises of as many as possible of the organizations concerned. The exercises shall be systematically evaluated and some exercises shall be evaluated by the regulatory body. The programme shall be subject to review and updating in the light of experience gained<sup>86</sup> (see paras 3.8, 3.16, 5.37 and 5.39 for further requirements in relation to exercises).

5.34. The staff responsible for critical response functions<sup>87</sup> for a facility in threat category I, II or III shall participate in a training exercise or drill at least once every year. For facilities, practices or jurisdictions in threat category IV or V the staff responsible for critical response functions shall participate in training exercises or drills on an appropriate schedule<sup>88</sup>.

5.35. The officials off the site responsible for making decisions on protective actions for the population within the precautionary action zone and/or the urgent protective action planning zone (see para. 4.48) shall be trained in the strategy for protective action and shall regularly participate in exercises.

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<sup>83</sup> A related requirement for nuclear power plants was established in Ref. [12], para. 2.35.

<sup>84</sup> 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. 1609; this Code is to be superseded by a Safety Requirements publication on the Design and Operation of Nuclear Research Reactors (in preparation).

<sup>85</sup> A related requirement was established in Ref. [3], Appendix V, para. V.3. Major international exercises are held at suitable intervals and co-ordinated by IACRINA.

<sup>86</sup> A related requirement for nuclear power plants was established in Ref. [12], para. 2.37.

<sup>87</sup> Critical response functions are functions that must be performed promptly and correctly in order to classify and declare an emergency effectively, to manage the response, to activate the emergency organization, to take mitigatory actions, to protect emergency workers and to take urgent protective actions on and off the site in accordance with international safety standards.

<sup>88</sup> A related requirement was established in Ref. [3], Appendix V, para. V.3.

5.36. The performance of exercises at facilities in threat category I, II or III shall be evaluated against established response objectives that demonstrate that identification, notification, activation and other initial response actions can be performed in time to achieve the practical goals of emergency response (see para. 2.3).

## QUALITY ASSURANCE PROGRAMME

5.37. The operator of a facility, practice or source in threat category I, II, III or IV and the off-site response organizations shall establish a quality assurance programme, in accordance with international standards, to ensure a high degree of availability and reliability of all the supplies, equipment, communication systems and facilities necessary to perform the functions specified in Section 4 in an emergency<sup>89, 90</sup> (see para. 5.25). This programme shall include arrangements for inventories, resupply, tests and calibrations, made to ensure that these items and facilities are continuously available and functional for use in an emergency. Arrangements shall be made to maintain, review and update emergency plans, procedures and other arrangements and to incorporate lessons learned from research, operating experience (such as the response to emergencies) and emergency drills and exercises (see paras 3.8, 3.16, 5.33 and 5.39).

5.38. For facilities in threat category I or II “[the] operating organization [and response organizations] shall prepare and put in place a comprehensive quality assurance programme covering all activities which may affect the [emergency response programme].” (Ref. [12], para. 2.19.) The operating organization and other organizations and persons concerned are subject to the requirements of the Code on Quality Assurance for Safety in Nuclear Power Plants and Other Nuclear Installations [16].

5.39. The operator of a facility, practice or source in threat category I, II, III or IV and the off-site response organizations shall make arrangements to review and evaluate responses in emergencies and in drills and exercises, to record the areas in which improvements are necessary and to ensure that the necessary improvements are made<sup>91</sup>.

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<sup>89</sup>A related requirement for nuclear power plants was established in Ref. [12], para. 2.38.

<sup>90</sup> 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. 1610; this Code is to be superseded by a Safety Requirements publication on the Design and Operation of Nuclear Research Reactors (in preparation).

<sup>91</sup> Related requirements were established in Ref. [3], Appendix V, para. V.3 (c), Ref. [10], para. 5.16, and Ref. [12], para. 2.37.

## REFERENCES

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- [12] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety of Nuclear Power Plants: Operation, Safety Standards Series No. NS-R-2, IAEA, Vienna (2000).
- [13] INTERNATIONAL ATOMIC ENERGY AGENCY, Planning and Preparing for Emergency Response to Transport Accidents Involving Radioactive Material, Safety Standards Series No. TS-G-1.2, IAEA, Vienna (2002).



- [14] INTERNATIONAL ATOMIC ENERGY AGENCY, OECD NUCLEAR ENERGY AGENCY, INES: The International Nuclear Events Scale Users Manual, 2001 edition, IAEA, Vienna (2001).
- [15] INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION, Protection of the Public in Situations of Prolonged Radiation Exposure, Publication 82, Pergamon Press, Oxford and New York (2000).
- [16] INTERNATIONAL ATOMIC ENERGY AGENCY, Quality Assurance for Safety in Nuclear Power Plants and Other Nuclear Installations, Safety Series No. 50-C/SG-Q, IAEA, Vienna (1996).

## Annex I

### REQUIREMENTS ON PROTECTION FOR WORKERS UNDERTAKING AN INTERVENTION

I-1. “When undertaking intervention..., all reasonable efforts shall be made to keep doses to workers below twice the maximum single year dose limit, except for life saving actions, in which every effort shall be made to keep doses below ten times the maximum single year dose limit in order to avoid deterministic effects on health. In addition, workers undertaking actions in which their doses may approach or exceed ten times the maximum single year dose limit shall do so only when the benefits to others clearly outweigh their own risk.” (Ref. [I-1], Appendix V, para. V.27.)

I-2. “Workers who undertake actions in which the dose may exceed the maximum single year dose limit shall be volunteers<sup>1</sup> and shall be clearly and comprehensively informed in advance of the associated health risk, and shall, to the extent feasible, be trained in the actions that may be required.” (Ref. [I-1], Appendix V, para. V.28.)

I-3. “Once the emergency phase of an intervention has ended, workers undertaking recovery operations, such as repairs to [the facility] and buildings, waste disposal or decontamination of the site and surrounding area, shall be subject to the full system of detailed requirements for occupational exposure prescribed in Appendix I [of Ref. [I-1]].” (Ref. [I-1], Appendix V, para. V.30.)

I-4. “Workers shall not normally be precluded from incurring further occupational exposure because of doses received in an emergency exposure situation. However, qualified medical advice shall be obtained before any such further exposure if a worker who has undergone an emergency exposure receives a dose exceeding ten times the maximum single year dose limit or at the worker’s request.” (Ref. [I-1], Appendix V, para. V.32.)

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<sup>1</sup> If military personnel are involved, these requirements may not apply in some circumstances. Exposure of such personnel shall, however, be limited to ad hoc levels to be specified by the regulatory body.

## REFERENCE TO ANNEX I

- [I-1] FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, INTERNATIONAL ATOMIC ENERGY AGENCY, INTERNATIONAL LABOUR ORGANISATION, OECD NUCLEAR ENERGY AGENCY, PAN AMERICAN HEALTH ORGANIZATION, WORLD HEALTH ORGANIZATION, International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, Safety Series No. 115, IAEA, Vienna (1996).

## Annex II

### DOSE LEVELS AT WHICH INTERVENTION IS EXPECTED TO BE UNDERTAKEN UNDER ANY CIRCUMSTANCES<sup>1</sup>

II-1. Table II-I gives action levels of dose for acute exposure by organ or tissue [at which intervention is expected to be taken under any circumstances].

II-2. The possibility of deterministic effects for doses greater than about 0.1 Gy (delivered over less than 2 days) to an embryo or foetus should be taken into account in considering the justification and optimization of actual action levels for immediate protection.

TABLE II-I. ACTION LEVEL OF DOSE FOR ACUTE EXPOSURE, BY ORGAN OR TISSUE

Organ or tissue	Action level of dose: Projected absorbed dose to the organ or tissue in less than 2 days (Gy)
Whole body (bone marrow)	1
Lung	6
Skin	3
Thyroid	5
Lens of the eye	2
Gonads	3

### REFERENCE TO ANNEX II

[II-1] FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, INTERNATIONAL ATOMIC ENERGY AGENCY, INTERNATIONAL LABOUR ORGANISATION, OECD NUCLEAR ENERGY AGENCY, PAN AMERICAN HEALTH ORGANIZATION, WORLD HEALTH ORGANIZATION, International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, Safety Series No. 115, IAEA, Vienna (1996).

<sup>1</sup> Based on Schedule IV of Ref. [II-1], with revisions for incorporation into this Safety Requirements publication.

### Annex III

## GUIDELINES FOR INTERVENTION LEVELS AND ACTION LEVELS IN EMERGENCY EXPOSURE SITUATIONS<sup>1</sup>

### URGENT PROTECTIVE ACTIONS: SHELTERING, EVACUATION, IODINE PROPHYLAXIS

III-1. The generic optimized intervention level for sheltering is 10 mSv of avertable dose in a period of no more than 2 days. Authorities may wish to advise sheltering at lower intervention levels for shorter periods or so as to facilitate further countermeasures, e.g. evacuation.

III-2. The generic optimized intervention value for temporary evacuation is 50 mSv of avertable dose<sup>2</sup> in a period of no more than 1 week. Authorities may wish to initiate evacuation at lower intervention levels for shorter periods, and also where evacuation can be carried out quickly and easily, e.g. for small groups of people. Higher intervention levels may be appropriate in situations where evacuation would be difficult, e.g. for large population groups or if there is inadequate transport.

III-3. The generic optimized intervention value for iodine prophylaxis is 100 mGy of avertable committed absorbed dose to the thyroid due to radioiodine. [See Addendum to Annex III.]

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<sup>1</sup> Based on Ref. [III-1], Schedule V, paras V-7–V-13, with revisions for incorporation into this Safety Requirements publication.

<sup>2</sup> In some countries a value of 100 mSv of avertable dose is considered to be a more realistic level for temporary evacuation. The ICRP has recommended that evacuation would almost always be justified for an avertable dose of 500 mSv (or equivalent dose to the skin of 5000 mSv), and that the range of optimized values would be lower than this by no more than a factor of ten (see ICRP Publication 63 (footnote 42), p. 23). General recommendations are given in ICRP, Principles of Monitoring for the Radiation Protection of the Population, ICRP Publication No. 43, *Ann. ICRP* **15** 1, Pergamon Press, Oxford (1985).

## GENERIC ACTION LEVELS FOR FOODSTUFFS

III-4. Generic action levels for foodstuffs are given in Table III-I<sup>3</sup>. For practical reasons, the criteria for separate radionuclide groups shall be applied independently to the sum of the activities of the radionuclides in each group.

III-5. Paragraphs V.11-V.16 in Appendix V [of Ref. [III-1]] provide additional conditions that pertain to the use of these values in intervention situations.

TABLE III-I. GENERIC ACTION LEVELS FOR FOODSTUFFS

Radionuclide	Generic action level (kBq/kg)
<i>Foods destined for general consumption</i>	
Cs-134, Cs-137, I-131, Ru-103, Ru-106, Sr-89	1
Sr-90	0.1
Am-241, Pu-238, Pu-239, Pu-240, Pu-242	0.01
<i>Milk, infant foods and drinking water</i>	
Cs-134, Cs-137, Ru-103, Ru-106, Sr-89	1
I-131, Sr-90	0.1
Am-241, Pu-238, Pu-239, Pu-240, Pu-242	0.001

**Note:** Based on Table V-I of Ref. [III-1] and revised (by adding additional isotopes of Pu) to be consistent with Table V of Ref. [III-2].

<sup>3</sup> The table is based on, and consistent with, the Codex Alimentarius Commission's guideline levels for radionuclides in food moving in international trade following accidental contamination (Joint FAO/WHO Food Standards Programme, Codex Alimentarius Commission, Codex Alimentarius, Volume 1 (1991), Section 6.1, 'Levels for Radionuclides'), but it is limited to the nuclides usually considered relevant to [exposures in emergencies]. [The use of these levels is intended to be limited to the first year after a nuclear or radiological emergency.]

## TEMPORARY RELOCATION AND PERMANENT RESETTLEMENT

III-6. The generic optimized intervention levels for initiating and terminating temporary relocation are 30 mSv in a month and 10 mSv in a month, respectively. If the dose accumulated in a month is not expected to fall below this level within a year or two, permanent resettlement with no expectation of return to homes should be considered. Permanent resettlement should also be considered if the lifetime dose is projected to exceed 1 Sv.

III-7. The doses to be compared with these intervention levels are the total doses from all routes of exposure that can be [averted] by taking the countermeasure but usually this will exclude [routes involving] food and water.

### ADDENDUM TO ANNEX III

III-8. A joint IAEA/WHO Technical Committee Meeting (TCM)<sup>4</sup> reviewed the guidelines issued in the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (Basic Safety Standards, BSS) [III-1] for intervention in emergency situations involving exposure to radioactive iodine, including the action level of dose to the thyroid for acute exposure<sup>5</sup>, the intervention level for iodine prophylaxis, long term iodine prophylaxis to reduce the uptake of radioiodine from contaminated food<sup>6</sup>, and planning, distribution zones and distribution strategies for iodine prophylaxis<sup>7</sup>.

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<sup>4</sup> This addendum is based on the advice of a joint IAEA/WHO Technical Committee Meeting to assess and review the international safety standards for intervention in emergency exposure situations involving radioactive iodine, held on 17–19 September 2001 at the IAEA in Vienna.

<sup>5</sup> With regard to the action level of dose for acute thyroid exposure (see Table IV-I of the BSS [III-1]), the TCM advised the IAEA and WHO secretariats to re-examine the action level with a view to lowering it.

<sup>6</sup> With regard to long term iodine prophylaxis as a possible protective action against the ingestion of food contaminated with radioiodine, the TCM advised the IAEA and WHO secretariats to consider amending the BSS to reflect the following: (a) that iodine prophylaxis is intended primarily as a protective action against inhalation and that it is therefore primarily a short term measure (up to a few days); (b) that iodine prophylaxis should only be used to reduce the uptake of ingested radioiodine if it is impossible to provide supplies of uncontaminated food, especially for children and particularly in relation to milk; and that, even if this is the case, iodine prophylaxis is intended for relatively short periods of time, since supplies of uncontaminated food should be provided as soon as possible.

III-9. With regard to the intervention level for iodine prophylaxis (the administration of stable iodine to reduce the uptake of radioiodine) in the event of a nuclear emergency, the TCM advised the IAEA and the WHO secretariats to consider amendments to the Basic Safety Standards [III-1]<sup>8</sup> that reflect the following consensus:

- The administration of stable iodine to the public is an effective early measure for the protection of the thyroid to prevent deterministic effects and to minimize stochastic effects for persons of any age. However, it is primarily intended for the protection of children and the embryo or foetus.
- The current generic optimized intervention level for iodine prophylaxis of 100 mGy provides an operational basis for prompt decision making and efficient application in the event of a nuclear or radiological emergency. However, as there are strong indications of an age dependence of the risk of induction of thyroid cancer by radioiodine, the administration of stable iodine at significantly lower levels of dose to the thyroid may be recommended in order to take into account the higher sensitivity to radioiodine of children and the embryo or foetus.
- This advice is proffered to serve as a basis for planning, which needs to be optimized to take into account practical, operational, social and economic considerations; other protective actions to reduce the intake of radioiodine, such as sheltering and control of food supplies, also need to be considered.

III-10. This advice to the IAEA and WHO secretariats, which is presented for information in this Addendum to Annex III, will only become a requirement if established as such in an IAEA safety standard and agreed to by the co-sponsoring organizations of the Basic Safety Standards [III-1]. Nevertheless, relevant operating and response organizations with responsibilities for the formulation of emergency plans may wish to take it into consideration, in particular the need to give priority to the protection of children, newborn babies and the embryo or foetus.

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<sup>7</sup> With regard to planning, distribution zones and distribution strategies, the TCM advised the IAEA and WHO secretariats to consider amending the BSS to emphasize the need for considering the early administration of stable iodine in a nuclear emergency in conjunction with other possible protective actions, such as evacuation. This would imply the possible need for the predistribution of stable iodine in certain areas and rapid distribution strategies for other areas.

<sup>8</sup> In revising the Basic Safety Standards [III-1] and related Safety Guides the IAEA and co-sponsoring organizations will need to take account of all the recommendations made by the joint IAEA/WHO Technical Committee Meeting to the IAEA and the WHO secretariats.



### REFERENCES TO ANNEX III

- [III-1] FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, INTERNATIONAL ATOMIC ENERGY AGENCY, INTERNATIONAL LABOUR ORGANISATION, OECD NUCLEAR ENERGY AGENCY, PAN AMERICAN HEALTH ORGANIZATION, WORLD HEALTH ORGANIZATION, International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, Safety Series No. 115, IAEA, Vienna (1996).
- [III-2] INTERNATIONAL ATOMIC ENERGY AGENCY, Intervention Criteria in a Nuclear or Radiation Emergency, Safety Series No. 109, IAEA, Vienna (1994).

## GLOSSARY

**accident.** Any unintended event, including operating errors, equipment failures or other mishaps, the consequences or potential consequences of which are not negligible from the point of view of protection or safety.

**action level.** The level of dose rate or activity concentration above which remedial actions or protective actions should be carried out in chronic exposure or emergency exposure situations. An action level can also be expressed in terms of any other measurable quantity as a level above which intervention should be undertaken.

**arrangements (for emergency response).** The integrated set of infrastructural elements necessary to provide the capability for performing a specified function or task required in response to a nuclear or radiological emergency. These elements may include authorities and responsibilities, organization, co-ordination, personnel, plans, procedures, facilities, equipment or training.

**authorization.** The granting by a regulatory body or other governmental body of written permission for an operator to perform specified activities.

**avertable dose.** The dose that could be averted if a countermeasure or set of countermeasures were to be applied.

**dangerous source.** A source that could, if not under control, give rise to exposure sufficient to cause severe deterministic effects. This categorization is used for determining the need for emergency response arrangements and is not to be confused with categorizations of sources for other purposes.

**deterministic effect.** A health effect of radiation for which generally a threshold level of dose exists above which the severity of the effect is greater for a higher dose. Such an effect is described as a 'severe deterministic effect' if it is fatal or life threatening or results in a permanent injury that reduces quality of life.

**emergency.** A non-routine situation or event that necessitates prompt action, primarily to mitigate a hazard or adverse consequences for human health and safety, quality of life, property or the environment. This includes nuclear and radiological emergencies and conventional emergencies such as fires, release of hazardous chemicals, storms or earthquakes. It includes situations for which prompt action is warranted to mitigate the effects of a perceived hazard.

**emergency action level (EAL).** A specific, predetermined, observable criterion used to detect, recognize and determine the emergency class.

**emergency class.** A set of conditions that warrant a similar immediate emergency response. This is the term used for communicating to the response organizations and the public the level of response needed. The events that belong to a given emergency class are defined by criteria specific to the installation, source or practice, which if exceeded indicate classification at the prescribed level. For each emergency class, the initial actions of the response organizations are predefined.

**emergency classification.** The process whereby an authorized official classifies an emergency in order to declare the applicable emergency class. Upon declaration of the emergency class, the response organizations initiate the predefined response actions for that emergency class.

**emergency phase.** The period of time from the detection of conditions warranting an emergency response until the completion of all the actions taken in anticipation of or in response to the radiological conditions expected in the first few months of the emergency. This phase typically ends when the situation is under control, the off-site radiological conditions have been characterized sufficiently well to identify where food restrictions and temporary relocation are required, and all required food restrictions and temporary relocations have been implemented.

**emergency plan.** A description of the objectives, policy and concept of operations for the response to an emergency and of the structure, authorities and responsibilities for a systematic, co-ordinated and effective response. The emergency plan serves as the basis for the development of other plans, procedures and checklists.

**emergency preparedness.** The capability to take actions that will effectively mitigate the consequences of an emergency for human health and safety, quality of life, property and the environment.

**emergency procedures.** A set of instructions describing in detail the actions to be taken by response personnel in an emergency.

**emergency response.** The performance of actions to mitigate the consequences of an emergency for human health and safety, quality of life, property and the environment. It may also provide a basis for the resumption of normal social and economic activity.

**emergency services.** The local off-site response organizations that are generally available and that perform emergency response functions. These may include police, fire fighters and rescue brigades, ambulance services and control teams for hazardous materials.

**emergency worker.** A worker who may be exposed in excess of occupational dose limits while performing actions to mitigate the consequences of an emergency for human health and safety, quality of life, property and the environment.

**emergency zones.** The precautionary action zone and/or the urgent protective action planning zone.

**exposure.** The act or condition of being subject to irradiation. Exposure can be either external exposure (due to a source outside the body) or internal exposure (due to a source within the body).

**first responders.** The first members of an emergency service to respond at the scene of an emergency.

**initial phase.** The period of time from the detection of conditions that warrant the performance of response actions that must be taken promptly in order to be effective until those actions have been completed. These actions include mitigatory actions by the operator and urgent protective actions on and off the site.

**intervention.** Any action intended to reduce or avert exposure or the likelihood of exposure to sources which are not part of a controlled practice or which are out of control as a consequence of an accident.

**intervention level.** The level of avertable dose at which a specific protective action is taken in an emergency or a situation of chronic exposure.

**longer term protective action.** A protective action that is not an urgent protective action. Such protective actions are likely to be prolonged over weeks, months or years. These include measures such as relocation, agricultural countermeasures and remedial actions.

**mitigatory action.** Immediate action by the operator or other party:

- (1) To reduce the potential for conditions to develop that would result in exposure or a release of radioactive material requiring emergency actions on or off the site; or

- (2) To mitigate source conditions that may result in exposure or a release of radioactive material requiring emergency actions on or off the site.

**notification.**

- (1) A report submitted promptly to a national or international authority providing details of an emergency or a potential emergency; for example, as required by the Convention on Early Notification of a Nuclear Accident.
- (2) A set of actions taken upon detection of emergency conditions with the purpose of alerting all organizations with responsibility for emergency response in the event of such conditions.

**notification point.** A designated organization with which arrangements have been made to receive notification (meaning (2)) and to initiate promptly the predetermined actions to activate a part of the emergency response.

**notifying State.** The State that is responsible for notifying (meaning (1)) potentially affected States and the IAEA of an event or situation of actual, potential or perceived radiological significance for other States. This includes:

- (1) The State Party that has jurisdiction or control over the facility or activity (including space objects) in accordance with Article 1 of the Convention on Early Notification of a Nuclear Accident; or
- (2) The State that initially detects, or discovers evidence of, a transnational emergency, for example by: detecting significant increases in atmospheric radiation levels of unknown origin; detecting contamination in transboundary shipments; discovering a dangerous source that may have originated in another State; or diagnosing medical symptoms that may have resulted from exposure outside the State.

**nuclear or radiological emergency.** An emergency in which there is, or is perceived to be, a hazard due to:

- (a) the energy resulting from a nuclear chain reaction or from the decay of the products of a chain reaction; or
- (b) radiation exposure.

**off-site.** Outside the site area.

**on-site.** Within the site area.

**operational intervention level (OIL).** A calculated level, measured by instruments or determined by laboratory analysis, that corresponds to an intervention level or action level. OILs are typically expressed in terms of dose rates or of activity of radioactive material released, time integrated air concentrations, ground or surface concentrations, or activity concentrations of radionuclides in environmental, food or water samples. An OIL is a type of action level that is used immediately and directly (without further assessment) to determine the appropriate protective actions on the basis of an environmental measurement.

**operator (or operating organization).** Any organization or person applying for authorization or authorized and/or responsible for nuclear, radiation, radioactive waste or transport safety when undertaking activities or in relation to any nuclear facilities or sources of ionizing radiation. This includes private individuals, governmental bodies, consignors or carriers, licensees, hospitals and self-employed persons. It includes those who are either directly in control of a facility or an activity during use (such as radiographers or carriers) or, in the case of a source not under control (such as a lost or illicitly removed source or a re-entering satellite), those who were responsible for the source before control over it was lost.

**practice.** Any human activity that introduces additional sources of exposure or exposure pathways or extends exposure to additional people or modifies the network of exposure pathways from existing sources, so as to increase the exposure or the likelihood of exposure of people or the number of people exposed.

**precautionary action zone.** An area around a facility for which arrangements have been made to take urgent protective actions in the event of a nuclear or radiological emergency to reduce the risk of severe deterministic health effects off the site. Protective actions within this area are to be taken before or shortly after a release of radioactive material or an exposure on the basis of the prevailing conditions at the facility.

**protective action.** An intervention intended to avoid or reduce doses to members of the public in emergencies or situations of chronic exposure.

**radiation protection officer.** A person technically competent in radiation protection matters relevant for a given type of practice who is designated by the registrant or licensee to oversee the application of relevant requirements established in international safety standards.

**radiation specialist.** A person trained in radiation protection and other areas of specialization necessary in order to be able to assess radiological conditions, to mitigate radiological consequences or to control doses to responders.

**radiological assessor.** A person who in the event of a nuclear or radiological emergency assists the operator of a dangerous source by performing radiation surveys, performing dose assessments, controlling contamination, ensuring the radiation protection of emergency workers and formulating recommendations on protective actions. The radiological assessor would generally be the radiation protection officer.

**regulatory body.** An authority or a system of authorities designated by the government of a State as having legal authority for conducting the regulatory process, including issuing authorizations, and thereby regulating nuclear, radiation, radioactive waste and transport safety.

**response organization.** An organization designated or otherwise recognized by a State as being responsible for managing or implementing any aspect of an emergency response.

**significant transboundary release.** A release of radioactive material to the environment that may result in doses or levels of contamination beyond national borders from the release which exceed international intervention levels or action levels for protective actions, including food restrictions and restrictions on commerce.

**site area.** A geographical area that contains an authorized facility, activity or source and within which the management of the authorized facility or activity may directly initiate emergency actions. This is typically the area within the security perimeter fence or other designated property marker. It may also be the controlled area around a radiography source or a cordoned off area established by first responders around a suspected hazard.

**source.** Anything that may cause radiation exposure — such as by emitting ionizing radiation or by releasing radioactive substances or materials — and can be treated as a single entity for protection and safety purposes. For example, materials emitting radon are sources in the environment; a sterilization gamma irradiation unit is a source for the practice of radiation preservation of food; an X ray unit may be a source for the practice of radiodiagnosis; a nuclear power plant is part of the practice of generating electricity by nuclear fission, and may be regarded as a source (e.g. with respect to discharges to the environment) or

as a collection of sources (e.g. for occupational radiation protection purposes). A complex or multiple installation situated at one location or site may, as appropriate, be considered a single source for the purposes of application of international safety standards.

**special facility.** A facility for which predetermined facility specific actions need to be taken if urgent protective actions are ordered in its locality. Examples include chemical plants that cannot be evacuated until certain actions have been taken to prevent fire or explosions and telecommunications centres that must be staffed in order to maintain telephone services.

**special population groups.** Members of the public for whom special arrangements are necessary in order for effective protective actions to be taken. Examples include disabled persons, hospital patients and prisoners.

**stochastic effect (of radiation).** A radiation induced health effect, the probability of occurrence of which is greater for a higher radiation dose and the severity of which (if it occurs) is independent of dose. Stochastic effects may be somatic effects or hereditary effects, and generally occur without a threshold level of dose. Examples include thyroid cancer and leukaemia.

**threat assessment.** The process of analysing systematically the hazards associated with facilities, activities or sources within or beyond the borders of a State in order to identify:

- (a) those events and the associated areas for which protective actions may be required within the State;
- (b) the actions that would be effective in mitigating the consequences of such events.

**transient population groups.** Those members of the public who are residing for a short period of time (days to weeks) in a location (such as a camping ground) that can be identified in advance. This does not include members of the public who may be travelling through an area.

**transnational emergency.** A nuclear or radiological emergency of actual, potential or perceived radiological significance for more than one State. This includes:

- (1) A significant transboundary release of radioactive material (however, a transnational emergency does not necessarily imply a significant transboundary release of radioactive material);



- (2) A general emergency at a facility or other event that could result in a significant transboundary release (atmospheric or aquatic) of radioactive material;
- (3) Discovery of the loss or illicit removal of a dangerous source that has been transported across or is suspected of having been transported across a national border;
- (4) An emergency resulting in significant disruption to international trade or travel;
- (5) An emergency warranting the taking of protective actions for foreign nationals or embassies in the State in which it occurs;
- (6) An emergency resulting in or potentially resulting in severe deterministic effects and involving a fault and/or problem (such as in equipment or software) that could have serious implications for safety internationally;
- (7) An emergency resulting in or potentially resulting in great concern among the population of more than one State owing to the actual or perceived radiological hazard.

**urgent protective action.** A protective action in the event of an emergency which must be taken promptly (normally within hours) in order to be effective, and the effectiveness of which will be markedly reduced if it is delayed. The most commonly considered urgent protective actions in a nuclear or radiological emergency are evacuation, decontamination of individuals, sheltering, respiratory protection, iodine prophylaxis and restriction of the consumption of potentially contaminated foodstuffs.

**urgent protective action planning zone.** An area around a facility for which arrangements have been made to take urgent protective actions in the event of a nuclear or radiological emergency to avert doses off the site in accordance with international safety standards. Protective actions within this area are to be taken on the basis of environmental monitoring — or, as appropriate, prevailing conditions at the facility.

**warning point.** A contact point that is staffed or able to be alerted at all times for promptly responding to, or initiating a response to, an incoming notification (meaning (1)), warning message, request for assistance or request for verification of a message, as appropriate, from the IAEA.

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## THE SPONSORING ORGANIZATIONS

The Food and Agriculture Organization of the United Nations (FAO) was established in 1945 to supersede the International Institute of Agriculture. Among its aims is to secure improvements in the efficiency of the production and distribution of food and agricultural products. FAO's main tasks are: carrying out major programmes of technical advice and assistance for the agricultural community; collection, analysis and dissemination of information; advising governments on policy and planning; and providing opportunities for governments and experts to meet and discuss food and agricultural issues. FAO provides advice and assistance to its member governments, through a variety of formal and informal channels, on all aspects of the production, distribution and consumption of food and agricultural products in accordance with current needs. In 1962, the FAO and the World Health Organization (WHO) established the Codex Alimentarius Commission with the aims of: protecting the health of consumers and ensuring fair practices in the food trade; promoting co-ordination of all work and undertakings relating to food standards by international, governmental and non-governmental organizations; determining priorities and initiating and guiding the preparation of draft standards through and with the aid of appropriate organizations and publishing these standards in a Codex Alimentarius; and amending published standards after appropriate survey in the light of developments. The major interests of FAO in safety standards relate to the Codex Alimentarius and to the subject of agricultural countermeasures in the event of a radiological accident.

The IAEA was established in 1957. Its statutory objective is to seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world. One of the IAEA's functions is "To establish or adopt, in consultation and, where appropriate, in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, standards of safety for protection of health and minimization of danger to life and property (including such standards for labour conditions), and to provide for the application of these standards to its own operations as well as to the operations making use of materials, services, equipment, facilities, and information made available by the Agency or at its request or under its control or supervision; and to provide for the application of these standards, 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 atomic energy." Moreover, with respect to any IAEA project or other arrangement whereby the IAEA is requested by the parties concerned to apply safeguards, the IAEA has the right and responsibility, to the extent relevant to the project or arrangement, "to require the observance of any health and safety measure prescribed by the Agency" and "to send into the territory of the recipient

State or States inspectors... to determine whether there is compliance with [such] health and safety measures.” IAEA safety standards are intended, among other things, to facilitate the discharging of these functions, rights and responsibilities of the IAEA.

The International Labour Organization (ILO) was established in 1919 by the Treaty of Versailles to bring governments, employers and trade unions together for united action in the cause of social justice and better living conditions everywhere. It is a tripartite organization, with worker and employer representatives taking part in its work on equal status with those of governments. The ILO was an autonomous part of the League of Nations and in 1946 it became the first specialized agency associated with the United Nations. The protection of the worker against sickness, disease and injury arising from employment is one of the tasks assigned to the ILO in the Preamble of its Constitution. One of the main features of the International Labour Organization, in addition to its tripartite structure, is its standard setting activity. Some 60 international Conventions and Recommendations concern the protection of workers against occupational hazards. In 1949 the ILO published a set of practical international standards on radiation protection which were revised and considerably extended in 1957 and were incorporated into the ILO Manual of Industrial Radiation Protection. In 1960, the International Labour Conference adopted the Radiation Protection Convention (No. 115) and Recommendation (No. 114). The Convention applies to all activities involving exposure of workers to ionizing radiations in the course of their work and provides that all appropriate steps shall be taken to ensure the effective protection of workers in the light of knowledge available at the time. The Recommendation adds that due regard should be given to the recommendations made from time to time by the International Commission on Radiological Protection and the standards adopted by other competent organizations. In 1986 the ILO Governing Body approved the publication of a Code of Practice for the radiation protection of workers (ionizing radiations) which gives practical guidance on the implementation of a radiation protection programme at the enterprise level and takes into account the provisions of the Basic Safety Standards for Radiation Protection (1982). Some other international labour standards of the ILO are also relevant to the protection of workers against ionizing radiations, notably the Occupational Cancer Convention and Recommendation (1974); the Working Environment (air pollution, noise and vibration) Convention and Recommendation (1977); and the List of Occupational Diseases appended to the Employment Injury Benefit Convention (1964).

The OECD Nuclear Energy Agency (NEA) was established in 1958 under the name of the OEEC European Nuclear Energy Agency. It received its present designation on 20 April 1972, when Japan became its first non-European full Member. NEA membership today consists of 28 OECD Member countries: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, Mexico, the

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.



## **BODIES FOR THE ENDORSEMENT OF SAFETY STANDARDS**

### **Nuclear Safety Standards Committee**

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