

The Gazette of Pakistan

PART II

Statutory Notification (S.R.O.)

GOVERNMENT OF PAKISTAN

PAKISTAN NUCLEAR REGULATORY AUTHORITY

NOTIFICATIONS

Islamabad, the 24th July, 2008

S.R.O. 912 (I)/2008.— In exercise of the powers conferred by Section-56 of the Pakistan Nuclear Regulatory Authority Ordinance, 2001 (III of 2001), the Pakistan Nuclear Regulatory Authority is pleased to make and promulgate the following regulations:-

1. Short Title and Commencement.— (1) These regulations may be called the “Regulations on Management of a Nuclear or Radiological Emergency - (PAK/914) (Rev.0)”.

- (2) These regulations shall extend to the whole of Pakistan.
- (3) These regulations shall come into force at once.

2. Definitions.— In these regulations, unless there is anything repugnant in the subject or context, the following expressions shall have the meanings hereinafter assigned to them:

- (a) “accident” means 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;
- (b) “action level” means 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;
- (c) “activity” means the quantity A for an amount of radionuclide in a given energy state at a given time, defined as:

$$A(t) = dN/dt$$

where dN is the expectation value of the number of spontaneous nuclear transformations from the given energy state in the time interval dt .

- (d) “arrangements” (for emergency response) means 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, coordination, personnel, plans, procedures, facilities, equipment or training;

- (e) "Authority" means the Pakistan Nuclear Regulatory Authority established under section 3 of the Ordinance;
- (f) "authorization" means an authorization granted under section 20 or, as the case may be, sections 21,22 or 23 of the Ordinance;
- (g) "avertable dose" means the dose that could be averted, if a countermeasure or set of countermeasures were to be applied;
- (h) "collective dose" means an expression for the total radiation dose incurred by a population, defined as the product of the number of individuals exposed to a source and their average radiation dose, the collective dose is expressed in man-sieverts (man.Sv);
- (i) "dangerous source" means 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;
- (j) "deterministic effect" means 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, examples of deterministic effects include erythema and acute radiation syndrome (radiation sickness);
- (k) "effective dose, E" means the quantity E, defined as a summation of the tissue equivalent doses, each multiplied by the appropriate tissue weighting factor:

$$E = \sum_T w_T \cdot H_T$$

where H_T is the equivalent dose in tissue T and w_T is the tissue weighting factor for tissue T. From the definition of equivalent dose, it follows that:

$$E = \sum_T w_T \cdot \sum_R w_R \cdot D_{T,R}$$

where w_R is the radiation weighting factor for radiation R and $D_{T,R}$ is the average absorbed dose in the organ or tissue T.

- (l) "equivalent dose, H_T " means the quantity $H_{T,R}$, defined as:

$$H_{T,R} = w_R \cdot D_{T,R}$$

where $D_{T,R}$ is the absorbed dose delivered by radiation type R averaged over a tissue or organ T and w_R is the radiation weighting factor for radiation type R. When the radiation field is composed of different radiation types with different values of w_R the equivalent dose is:

$$H_T = \sum_R W_R \cdot D_{T R}$$

- (m) “emergency” means 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;
- (n) “emergency action level” (EAL) means a specific, predetermined, observable criterion used to detect, recognize and determine the emergency class;
- (o) “emergency class” means 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;
- (p) “emergency classification” means 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;
- (q) “emergency control center - ECC” means a notification point for the facilities in hazard category I & II that is staffed or able to be alerted at all times for promptly responding to, or initiating a response to an emergency, it is established to plan, assess, monitor and implement on-site and off-site emergency response actions;
- (r) “emergency phase” means 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;
- (s) “emergency plan” means 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, coordinated and effective response, the emergency plan serves as the basis for the development of other plans, procedures and checklists;
- (t) “emergency preparedness” means 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;
- (u) “emergency procedures” means a set of instructions describing in detail the actions to be taken by response personnel in an emergency;
- (v) “emergency response” means 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;

- (w) “emergency services” means 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;
- (x) “emergency worker” means 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;
- (y) “emergency zones” means the precautionary action zone and/or the urgent protective action planning zone;
- (z) “exposure” means 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);
- (aa) “first responders” means the first members of an emergency service to respond at the scene of an emergency;
- (bb) “gray” means the SI unit of kerma and absorbed dose, it is expressed as (Gy) and is numerically equal to 1 J/kg;
- (cc) “initial phase” means 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;
- (dd) “intervention” means 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;
- (ee) “intervention level” means the level of avertable dose at which a specific protective action is taken in an emergency or a situation of chronic exposure;
- (ff) “licensee” means the holder of a license issued under section 19 of the Ordinance;
- (gg) “longer term protective action” means 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;
- (hh) “mitigatory action” means immediate action by the operator or other party:
 - (i) 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
 - (ii) to mitigate source conditions that may result in exposure or a release of radioactive material requiring emergency actions on or off the site;
- (ii) “national disaster management authority” (NDMA) means the authority which serves as a focal point and coordinating body to facilitate implementation of disaster risk management strategies at national level, it undertakes joint planning with PNRA and its licensees for instituting nuclear or radiological disaster hazard profiling, preparedness and mitigation measures with respect to off-site consequences;
- (jj) “notification” means
 - (i) a report submitted promptly to the Authority providing details of an emergency or a potential emergency; or

- (ii) 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;
- (kk) “notification point” means a set up in facilities in hazard category III, IV & V which have arrangements to receive notification and to initiate promptly the predetermined actions to activate the emergency response;
- (ll) “nuclear or radiological emergency” means an emergency in which there is, or is perceived to be, a hazard due to:
 - (i) the energy resulting from a nuclear chain reaction or from the decay of the products of a chain reaction; or
 - (ii) radiation exposure;
- (mm) “off-site” means outside the site area;
- (nn) “on-site” means within the site area;
- (oo) “operational intervention level” (OIL) means 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 radio nuclides 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;
- (pp) "ordinance" means the Pakistan Nuclear Regulatory Authority Ordinance (III of 2001);
- (qq) “practice” means 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;
- (rr) “precautionary action zone - PAZ” means 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;
- (ss) “protective action” means an intervention intended to avoid or reduce doses to members of the public in emergencies or situations of chronic exposure;
- (tt) “radiation protection officer” – RPO means an individual technically competent in radiation protection matters relevant for a given type of practice who is designated by the licensee to oversee the application of the requirements of these regulations;
- (uu) “radiation specialist” means 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;
- (vv) “radiological assessor” means 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;

- (ww) “response organization” means an organization designated or otherwise recognized as being responsible for managing or implementing any aspect of an emergency response;
- (xx) “sievert” means the SI unit of *equivalent dose* and *effective dose*, it is expressed as (Sv) and is numerically equal to 1 J/kg;
- (yy) “significant transboundary release” means 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;
- (zz) ”site area” means 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;
- (aaa) ”source” means 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;
- (bbb) “special facility” means 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 centers that must be staffed in order to maintain telephone services;
- (ccc) “special population groups” means 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;
- (ddd) “stochastic effect” (of radiation) means 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 leukemia;
- (eee) “hazard assessment” means the process of analyzing systematically the hazards associated with facilities, activities or sources within or beyond the borders of a State in order to identify:
 - (i) those events and the associated areas for which protective actions may be required within the State;
 - (ii) the actions that would be effective in mitigating the consequences of such events;
- (fff) “transient population groups” means 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 traveling through an area;
- (ggg) “transnational emergency” means a nuclear or radiological emergency of actual, potential or perceived radiological significance for more than one State, this

includes:

- (i) a significant transboundary release of radioactive material (however, a transnational emergency does not necessarily imply a significant transboundary release of radioactive material);
 - (ii) a general emergency at a facility or other event that could result in a significant transboundary release (atmospheric or aquatic) of radioactive material;
 - (iii) 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;
 - (iv) an emergency resulting in significant disruption to international trade or travel;
 - (v) an emergency warranting the taking of protective actions for foreign nationals or embassies in the State in which it occurs;
 - (vi) 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;
 - (vii) 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;
- (hhh) “urgent protective action” means 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;
- (iii) “urgent protective action planning zone - UPZ” means 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;

3. Objective- These regulations establish the requirements for an adequate level of preparedness and response for a nuclear or radiological emergency. Their implementation is intended to minimize the consequences for people, property and the environment of any nuclear or radiological emergency.

4. Scope – (1) These regulations shall apply to all those practices and sources that have the potential for causing radiation exposure or environmental radioactive contamination warranting an emergency intervention.

(2) The types of practices and sources covered by these regulations include: land based nuclear reactors; facilities for the mining and processing of radioactive ores; facilities for fuel reprocessing and other fuel cycle facilities; facilities for the management of radioactive waste; the transport of radioactive material; sources of radiation used in industrial, agricultural, medical, research and teaching applications; facilities using radiation or radioactive material; and satellites and radio thermal generators using radiation sources or reactors. These regulations shall also cover emergencies arising from radiation sources of an unknown or untraceable origin and any other source or practice as specified by the Authority.

(3) These regulations shall apply to actions in preparedness and response for emergencies involving hazards associated with ionizing radiation only.

5. Interpretation - The decision of the Chairman of the Authority, regarding the interpretation of any word or phrase of these regulations or applicability of these regulations shall be final and binding on the licensee.

6. General Responsibilities - (1) The licensee shall; 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 those of very low probability, any radiological consequences would be minor and below prescribed limits; and to ensure that the likelihood of accidents with serious radiological consequences is extremely low.”

(2) **Goals of Emergency Response** - 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.

(3) **Goals of Emergency Preparedness** – The practical goal of emergency preparedness is to ensure that arrangements are in place for a timely, managed, controlled, coordinated and effective response at the scene, and at the local, regional, national and international level, to any nuclear or radiological emergency.

7. General Requirements

(1) Basic Responsibilities

- (a) The preparedness for emergency response actions both within and outside facilities, if applicable, or elsewhere, for sources under the control of the licensee shall include the actions to be taken both in and after an emergency.
- (b) The licensee shall, in advance, coordinate with local response organizations for the management of interventions in emergency exposure or environmental radioactive contamination situations.
- (c) The licensee shall, in consultation with the Authority, coordinate with National Disaster Management Authority (NDMA)/ Provincial Disaster Management Authority (PDMA) or District Disaster Management Authority (DDMA) for the provision of necessary support in case the consequences are expected to be beyond the control of licensee and local response organizations. Roles and responsibilities of above referred stakeholders with regards to generating off site awareness on radiation safety and hazard profiling, disaster risk mitigation, preparedness and response will be defined in National Radiological Emergency Plan.
- (d) The licensee shall establish the preparedness and response arrangements for

nuclear and radiation related hazards as grouped in Table I.

- (e) The licensee in hazard category I, II or III shall establish appropriate emergency preparedness and response programs from the time that nuclear fuel or significant amounts of radioactive or fissile material is brought to the site. Complete emergency preparedness shall be ensured before the commencement of operation.
- (f) The licensee shall demonstrate that the emergency arrangements are tested in an exercise/drill before the commencement of operation [of a new practice]. Thereafter, exercises/drills of the emergency arrangements shall be conducted at suitable intervals as agreed in the emergency plans, some of which will be witnessed by the Authority.
- (g) The licensee shall establish an appropriate management system for implementing an effective strategy so that suitable arrangements are adopted to meet the time scale for response throughout the emergency.

(2) **Assessments of Hazards**

- (a) The licensee shall:
 - (i) in designing a hazard category I facility, ensure the adequacy of emergency response arrangements;
 - (ii) in designing a hazard category I, II or III facility, carry out comprehensive safety analysis 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 will be established.
- (b) The nature and extent of emergency arrangements for preparedness and response shall be commensurate with the potential magnitude and nature of the hazard associated with the facility or activity. The full range of postulated events shall be considered in hazard assessment. In the hazard assessment, emergencies involving a combination of a nuclear or radiological emergency and a conventional emergency such as an earthquake shall be considered. In the hazard assessment any populations at risk shall be identified and, to the extent practicable, the likelihood, nature and magnitude of the various radiation related hazards shall be considered. The hazard assessment shall be so conducted as to provide a basis for establishing detailed requirements for arrangements for preparedness and response by categorizing facilities and practices consistent with five hazard categories.
- (c) The licensee shall periodically conduct a review in order to ensure that all practices or situations that could necessitate an emergency intervention are identified. This review shall take into account the lessons learned from research, operating experience and emergency exercises/drills.
- (d) In a hazard assessment licensee shall identify sources, on-site areas, off-site areas and locations for which a nuclear or radiological emergency could warrant:
 - (i) precautionary 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;
 - (ii) urgent protective action to prevent stochastic effects to the extent practicable by averting doses, in accordance with Annex-III;
 - (iii) agricultural countermeasures, countermeasures to ingestion and longer

- term protective measures, in accordance with Annex-III; or
- (iv) protection for the workers responding (undertaking an intervention), in accordance with Annex-III.
 - (e) The licensee shall identify locations at which there is a significant probability of encountering a dangerous source that has been lost, abandoned, illicitly removed or illicitly transported in the hazard assessment.

8. Functional Requirements

(1) Establishing Emergency Management and Operations

(a) Response

- (i) The on-site emergency response shall be promptly executed and managed by the licensee without impairing the performance of the continuing operational safety functions.
- (ii) The off-site emergency response shall be effectively managed and coordinated with the on-site response.
- (iii) The licensee shall coordinate with concerned response organizations.
- (iv) The licensee for facilities in hazard category I or II jurisdictions shall ensure coordination and mutual support among response organizations that fall within the Precautionary Action Zone (PAZ) or the Urgent Protective action planning Zone (UPZ).

(b) Preparedness

- (i) The licensee for facilities in hazard category I, II or III shall clearly define the transition from normal to emergency operations and make it effective 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.
- (ii) The licensee for facilities in hazard category I or II, shall make arrangements to coordinate the emergency responses of all the off-site response organizations with the on-site response.
- (iii) The licensee shall make arrangements for the implementation of a command and control system for the response to a nuclear or radiological emergency. This shall include arrangements for coordinating activities and for developing strategies.

(2) Identifying, Notifying and Activating

(a) Response

- (i) When circumstances necessitate an emergency response, licensee shall promptly determine the appropriate emergency class or the level of emergency response and shall initiate the appropriate on-site actions. The licensee shall notify and provide updated information to the Authority and as appropriate, to the off-site authorities.
- (ii) The licensee shall immediately notify a nuclear or radiological emergency warranting an off-site response to the concerned person in that organization, so as to enable the off-site authorities to promptly initiate the preplanned and coordinated response, appropriate to the level of emergency.

(b) Preparedness

- (i) The licensee shall establish an on-site Emergency Control Center-ECC/Notification Point which is responsible for sending emergency notifications of an actual or potential nuclear or radiological emergency arising due to sources under his control. The ECC/notification point shall be made continuously available to send or receive any notification or request for assistance and to respond promptly or to initiate an off-site response.
- (ii) In case a dangerous source is lost, illicitly removed or illicitly transported, licensee shall promptly inform the Authority and make arrangements to ensure that the local authorities responsible for response are aware of the indicators of a potential emergency and aware of the immediate actions warranted if an emergency is suspected.
- (iii) The licensee of a facility or practice in hazard category I, II, III or IV shall make arrangements for the prompt identification of an actual emergency and its potential consequences for determination of the appropriate level of response. This shall include a system for classifying all potential nuclear and radiological emergencies that warrant an intervention to protect workers and the public, in accordance with Annexure-III, which covers emergencies of the following types at facilities (i-iv) and other emergencies such as (v) below:
 - (1) **General emergencies** at facilities in hazard category I or II involving an actual or substantial risk of release of radioactive material or radiation exposure that requires urgent protective actions off the site. Upon declaration of this class of emergency, actions shall be promptly taken to mitigate the consequences to protect people within the PAZ and UPZ, as appropriate.
 - (2) **Site area emergencies** at facilities in hazard 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) **Plant/Facility emergencies** at facilities in hazard 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 hazard.
 - (4) **Stand by/Alerts** at facilities in hazard 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.
- (iv) The criteria for classification shall have predefined Emergency Action Levels (EALs) that relate to abnormal conditions at the facility or practice concerned. 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 licensee, urgent protective actions and the protection of emergency workers.

- (v) For each facility or practice in hazard category I or II an off-site ECC with territory within the emergency zones shall be designated responsible for receiving emergency notification of an actual or potential nuclear or radiological emergency. This off-site ECC shall be continuously available to receive a notification or request for assistance and to initiate promptly the appropriate preplanned off-site response.
 - (vi) The licensee of a facility or practice in hazard category I, II, III or IV shall designate a person available at all times who is authorized and made responsible: to classify a nuclear or radiological emergency and upon classification promptly inform the Authority and initiate an appropriate response. This person shall be provided with suitable means of alerting on-site response personnel and notifying the off-site authorities.
 - (vii) The licensee of a facility or practice in hazard category I, II, III or IV shall ensure that adequate arrangements are made for identifying a situation that requires emergency response and communicating it to the responsible authorities, for:
 - (1) early prediction or assessment of the extent and significance of any unplanned discharge of radioactive substances to the environment or exposures;
 - (2) rapid and continuous assessment of the nuclear or radiological emergency as it proceeds; and
 - (3) determining the need for protective actions for the public and workers.
- (3) **Taking Mitigatory Action**
- (a) **Response**
 - (i) The licensee of a facility or practice in hazard 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 his responsibility.
 - (ii) The licensee shall ensure the availability of emergency services to support the response at facilities in hazard category I, II or III.
 - (b) **Preparedness**
 - (i) For all activities under hazard category IV, the licensee shall
 - (1) promptly inform the Authority,
 - (2) coordinate with the Authority for on-call advice,
 - (3) dispatch to the scene an emergency team that includes radiation specialists capable of assessing hazards involving radioactive or fissile material, assessing radiological conditions, mitigating the radiological consequences and managing the exposure of emergency workers.
 - (ii) The licensee of 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 (RPO) who is trained and qualified to assess the emergency and to mitigate any consequences.
 - (iii) The licensee shall inform the Authority and initiate a prompt search in the event of a dangerous source being lost.
 - (iv) For facilities in hazard category I, II or III, the licensee shall make arrangements for mitigatory actions to prevent an escalation of the hazard, 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 emergency response actions necessary in the facility; the conditions in the facility in which emergency response 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 on mitigatory actions for severe conditions, for the full range of postulated emergencies, including accidents beyond the design basis.

- (v) For facilities in hazard category I, II or III, the licensee shall make arrangements to provide technical assistance to the staff of ECC/Notification Point. 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 in the anticipated emergency conditions or environmental conditions. The personnel directing mitigatory actions shall be provided with an operating environment, information and technical assistance that allow them to take effective actions to mitigate the consequences of the emergency. Arrangements shall be made to obtain support promptly from off-site authorities.

(4) Taking Urgent Protective Action

(a) Response

The licensee shall take;

- (i) all appropriate measures to save lives.
- (ii) urgent protective actions, in accordance with Annex-II & III, to prevent to the extent practicable the occurrence of severe deterministic health effects and to avert doses.
- (iii) urgent protective actions modified as appropriate to take into account any new information relating to the emergency that becomes available.
- (iv) action to discontinue a protective action when it is no longer justified.

(b) Preparedness

- (i) Optimized intervention levels for taking urgent protective actions shall be established by the licensee that are in accordance with Annex-III.
- (ii) For facilities in hazard category I or II arrangements shall be made by the licensee for effectively implementing decisions on urgent protective actions to be taken off the site. This capability shall make use of existing public infrastructure to limit the occurrence of severe deterministic health effects and to avert doses, in accordance with Annex-II & III, for the full range of possible emergencies at those facilities. These arrangements shall include the following:
 - (1) The specification of off-site emergency zones 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:
 - (a) A **Precautionary Action Zone (PAZ)**, for facilities in hazard category I or II, 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.

- (b) An **Urgent Protective action planning Zone (UPZ)**, for facilities in hazard 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 Annex-III.
 - (i) Criteria, based on the emergency classification and 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 PAZ and UPZ. 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 traveling 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.
 - (ii) A single position on the site made responsible at all times to recommend the protective actions to be taken, to the off-site authorities upon the declaration of a nuclear or radiological emergency, shall be notified to the Authority.
 - (iii) Arrangements for the prompt notification to the off-site ECC which has the authority and responsibility to take urgent protective actions within the PAZ and UPZ. This shall include all the jurisdictions within the emergency zones.
- (iii) The licensee in coordination with off-site authorities within the PAZ and/or UPZ shall ensure to take appropriate actions promptly upon the notification of a nuclear or radiological emergency. This shall include arrangements for: taking appropriate actions for the protection of emergency workers; alerting permanent, transient and special population groups; taking urgent protective actions; protecting supplies of food and water; imposing restrictions on the immediate consumption of products from farms or gardens and of locally produced milk; monitoring and 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 coordinated with all the jurisdictions within the emergency zone.
- (iv) The licensee in hazard category I, II or III shall make appropriate 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; 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. The escape

routes shall have considerations for radiation zoning and fire protection. 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.

- (v) The licensee in hazard category I, II or III shall ensure the availability of diverse means of communication necessary for communicating protective actions to be taken on-site and by the off-site authorities at all times.

(5) **Providing Information and Issuing Instructions and Warnings to the Public**

(a) **Response**

- (i) Upon declaration of a general emergency the licensee shall make arrangements that the public is promptly warned of the emergency and informed of the protective actions that they should take. There shall be no undue delay that could jeopardize the effectiveness of the protective actions.

(b) **Preparedness**

- (i) The licensee for facilities in hazard category I or II, shall make arrangements to provide information on the response to a nuclear or radiological emergency to permanent, transient and special population groups and to special facilities within the PAZ and the UPZ. 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 by the licensee.

- (ii) The licensee shall make arrangements for facilities in hazard category I or II to provide promptly a warning and instruction to permanent, transient and special population groups and to special facilities in the PAZ and the UPZ 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.

(6) **Protecting Emergency Workers**

(a) **Response**

- (i) The licensee shall make arrangements to protect emergency workers, in accordance with agreed emergency plans and obligations under relevant national regulations.

(b) **Preparedness**

- (i) The licensee shall make arrangements to designate as emergency workers those who may undertake an intervention to do the following:

- (1) to save lives or to prevent serious injury, including severe deterministic health effects;
- (2) to take actions to avert a large collective dose; or
- (3) to take actions to prevent the development of catastrophic conditions.

- (ii) Those called upon to respond at a facility in hazard category I, II or III or within the PAZ or the UPZ shall be designated as emergency workers. In addition, the radiation specialists, radiation protection officers and radiological assessors who may respond to emergencies involving practices or other hazards in hazard category IV shall be considered emergency workers.

- (iii) Those persons who may be called upon from off site authorities shall be informed of the risks of radiation exposure and the meanings of radiation signs and placards.
- (iv) Emergency plans accepted by the Authority shall be adopted for managing, controlling and recording the doses received by emergency workers. This 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 [refer Annex-I].
- (v) For facilities in hazard 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 by the licensee.
- (vi) The licensee shall make arrangements for taking all practicable measures to provide protection for emergency workers for the range of anticipated hazardous conditions in which they may have to perform response functions on or off the site. 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 emergency plans; and arrangements for the provision of appropriate specialized protective equipment, procedures and training for emergency response in the anticipated hazardous conditions.
- (vii) 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 control as specified in PAK/904.
- (viii) When the intervention has ended, the doses received and the consequent health risk shall be communicated to the workers involved.
- (ix) The designated person within each response organization (on-site as well as off-site) responsible for ensuring compliance with the requirements for the protection of workers undertaking an intervention shall be specified in emergency plans and procedures.

(7) **Assessing the Initial Phase**

(a) **Response**

- (i) The licensee shall appraise the magnitude and likely development of hazardous conditions initially and throughout the emergency in order to identify new hazards promptly and to refine the strategy for response accordingly.
- (ii) The licensee shall carry out radiation monitoring and environmental sampling and assessment in order to identify new hazards promptly and to refine the strategy for response accordingly.
- (iii) The licensee shall promptly make available the information about emergency conditions, emergency assessments and the protective actions recommended and taken to all relevant off-site response organizations throughout the period of the emergency.

(b) **Preparedness**

- (i) Licensee of practices or sources in hazard 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.

- (ii) The licensee of facilities in hazard 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; and any actual or potential exposures of the public. These assessments shall be used for mitigatory actions by the licensee, 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. These arrangements shall include access to instruments displaying or measuring those parameters that can readily be measured or observed in the event of a nuclear or radiological emergency and which form the basis for the EALs 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.
- (iii) For the PAZ & UPZ, the licensee shall make arrangements 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.
- (iv) For the team of radiation specialists who provide support to the emergency workers, arrangements shall be made by the licensee for identifying gamma, beta and alpha emitters and for delineating the areas in which urgent protective action is warranted.
- (v) The licensee shall make arrangements 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.

(8) **Managing the Medical Response**

(a) **Response**

- (i) The licensee shall make arrangements for provision of appropriate specialized treatment to any person who receives a dose that could potentially result in severe deterministic health effects.

(b) **Preparedness**

- (i) The licensee shall make arrangements for medical personnel and emergency staff on the site, to be made aware of the medical symptoms of radiation exposure and immediate actions warranted if a nuclear or radiological emergency is suspected.
- (ii) Facilities in hazard category I, II or III licensee shall have appropriate

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.

- (iii) The licensee of a facility in hazard category I or II shall have a medical management plan/procedure for the treatment of highly exposed members of the public or workers, if required, in designated medical facilities.

(9) **Keeping the Public Informed**

(a) **Response**

- (i) The licensee shall take all practicable steps to provide the public with useful, timely, consistent and appropriate information throughout a nuclear or radiological emergency.

(b) **Preparedness**

- (i) The licensee shall make all necessary arrangements for: providing useful, timely, consistent and appropriate information to the public in the event of a nuclear or radiological emergency; responding to incorrect information and rumors; and responding to requests for information from the public and from the news and information media.
- (ii) These arrangements shall be made in coordination/consultation with the Authority, NDMA/PDMA/DDMA and other local response organizations.

(10) **Taking Agricultural Countermeasures, Countermeasures Against Ingestion and Longer Term Protective Actions**

(a) **Response**

The licensee shall;

- (i) Take agricultural countermeasures and longer term protective actions in accordance with Annex-III(b) to avert doses.
- (ii) Manage radioactive waste and contamination in accordance with existing regulations.
- (iii) Discontinue a protective action when further assessment shows that continuation of the action is no longer justified.

(b) **Preparedness**

- (i) The licensee shall follow the intervention levels and action levels for agricultural countermeasures, countermeasures against ingestion and longer term protective actions in accordance with Annex-III(b).
- (ii) In the UPZ and beyond, where relocation may be necessary as a result of a major release of radioactive material from a facility in hazard category I or II, the licensee shall ensure arrangements for temporary relocation in coordination with off-site response organizations. These arrangements shall include: Operational Intervention Levels (OILs) for dose rates due to deposition; the means to revise the OILs; timely monitoring for ground contamination; the means for accomplishing relocation; and arrangements for assisting those persons who have been relocated.
- (iii) The licensee in collaboration with off-site response organizations shall ensure arrangements for emergency zones; 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.

- (iv) Arrangements shall be made for the safe and effective management of radioactive waste in accordance with PAK/915.
 - (v) The licensee in hazard category I or II shall make arrangements to assess exposure incurred by members of the public as a consequence of a nuclear or radiological emergency. 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, public and the environment.
- (11) **Conducting Recovery Operations**
- (a) **Response**
 - (i) Once the emergency phase of an intervention has ended, workers undertaking recovery operations shall be subject to the full system of detailed requirements for occupational exposure as prescribed in PAK/904.
 - (b) **Preparedness**
 - (i) After the termination of plant or site emergency the licensee shall establish arrangements for the transition from emergency phase operations to routine recovery operations. Decisions to cancel restrictions and other arrangements imposed in response to a nuclear or radiological emergency shall be made by a formal process. Principles and criteria for intervention actions shall be established under intimation to the Authority.

9. Requirements for Infrastructure

(1) Organization

- (a) The Licensee shall establish organizational relationships and interfaces between all the major response organizations.
- (b) The positions responsible within operating and off-site response organization for the performance of the response functions specified in Section-9 shall be assigned in the off-site emergency plans. The copy of the off-site emergency plan shall be made available to all parties involved.
- (c) 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.

(2) Plans and Procedures

- (a) Plans for emergency response shall be based on the assessment of the hazards as described in Section-8, including events with potentially severe consequences.
- (b) The plans for response to a nuclear or radiological emergency shall be coordinated with any other plans such as plans for physical protection or fire fighting, which 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.
- (c) The licensee shall ensure that emergency plans are periodically reviewed, updated and are submitted to the Authority.
- (d) Emergency plans shall include, as appropriate:
 - (i) allocation of responsibilities for performing the functions specified in Section-9;
 - (ii) identification of the various Postulated Initiating Events (PIEs), operating and other conditions which could lead to the need for intervention;

- (iii) intervention levels, as specified in Annex-III, 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;
 - (iv) procedures, including assistance and communication arrangements, for contacting any relevant off-site response organizations;
 - (v) a description of the methodology and instrumentation for assessing the nuclear or radiological emergency and its consequences on and off the site;
 - (vi) a description of the public information arrangements in the event of a nuclear or radiological emergency; and
 - (vii) the criteria for terminating each protective action.
- (e) The licensee of a facility or practice in hazard 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 and it shall be submitted to the Authority.
- (f) The emergency plan of the operating organization of a facility or practice in hazard category I, II or III, shall include the following [as appropriate]:
- (i) a description of the on-site organization used to perform the functions specified in Section-9, including the designation of persons for directing on-site activities and for ensuring liaison with off-site organizations;
 - (ii) 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 authorities off the site;
 - (iii) the arrangements for initial and subsequent assessment of the conditions at the facility and radiological conditions on and off the site;
 - (iv) 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;
 - (v) 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;
 - (vi) the chain of command and communication, including a description of related facilities and procedures;
 - (vii) an inventory of the emergency equipment to be kept in readiness at specified locations;
 - (viii) the actions to be taken by persons and organizations involved in the implementation of the plan for each class of emergency;
 - (ix) arrangements for declaring the termination of an emergency.
- (g) On-site emergency plans shall be implemented by the licensee whereas the coordination with off-site response organizations regarding implementation of off-site emergency plans shall be ensured by the licensee.
- (3) **Logistical Support and Facilities**
- (a) The licensee shall make available the adequate tools, instruments, supplies, equipment, communication systems, facilities and documentation (such as procedures, checklists, telephone numbers and manuals) for performing the

functions specified in Section-9. These support items shall be located or provided in a manner that allows their effective use under postulated emergency conditions.

- (b) For facilities in hazard category I or II, emergency facilities shall be designated where the following will be performed in the different phases of the response: the coordination 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 Annex-I.
- (c) For facilities in hazard category I and II, an on-site emergency control centre, 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 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.

(4) **Training, Drills and Exercises**

- (a) The licensee shall:
 - (i) 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, 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;
 - (ii) instruct all employees and all other persons on the site of facilities in hazard category I, II or III about the arrangements for them to be notified of an emergency and their actions when notified of an emergency.
- (b) Exercises/drills shall be conducted to ensure that all specified functions required to be performed during emergency response and all organizational interfaces for facilities in hazard category I, II or III are tested at intervals agreed by the Authority in the emergency plans. The exercises shall include the participation, in some exercises, of as many as possible of the response organizations concerned. All the exercises shall be systematically evaluated however some of these shall be observed/evaluated by the Authority. The schedule of exercises/drills shall be subject to review and updating in the light of experience gained.
- (c) The staff responsible for critical response functions for a facility in hazard category I, II or III shall participate in training drills/exercises at least once every year.
- (d) The officials off the site responsible for implementation and coordination of protective actions for the population within the PAZ and/or UPZ shall be trained

in the strategy for implementation of protective actions.

- (e) The performance of exercises at facilities in hazard 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.

(5) **Quality Assurance Programme**

- (a) The licensee of a facility in hazard category I shall establish a quality assurance programme, in accordance with PAK/912, to ensure a high degree of availability and reliability of all the supplies, equipment, communication systems and facilities necessary to perform the functions in an emergency as specified in Section-9.
- (b) The licensee of a facility, practice or source in hazard category II or III shall establish a quality assurance programme to ensure a high degree of availability and reliability of all the supplies, equipment, communication systems and facilities necessary to perform the functions in an emergency as specified in Section-9. 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 operating experience (such as the response to emergencies) and emergency drills and exercises.

ANNEX - I

Requirements on Protection for Workers Undertaking an Intervention

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.
2. Workers who undertake actions in which the dose may exceed the maximum single year dose limit shall be volunteers 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.
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 PAK/904.
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.

Dose Levels at Which Intervention is Expected to be Undertaken Under any Circumstances

1. Table II gives action levels of dose for acute exposure by organ or tissue at which intervention is expected to be taken under any circumstances.
2. The possibility of deterministic effects for doses greater than about 0.1 Gy (delivered over less than 2 days) to an embryo or fetus should be taken into account in considering the justification and optimization of actual action levels for immediate protection.

Guidelines for Intervention Levels and Action Levels in Emergency Exposure Situations

- 1. Urgent Protective Actions: Sheltering, Evacuation, Iodine Prophylaxis**
 - (1) The generic optimized intervention level for sheltering is 10 mSv of avertable dose in a period of no more than 2 days. Sheltering at lower intervention levels may be advised for shorter periods so as to facilitate further countermeasures, e.g. evacuation.
 - (2) The generic optimized intervention value for temporary evacuation is 50 mSv of avertable dose in a period of no more than 1 week. Initiation of evacuation at lower intervention levels may be advised for shorter periods, 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.
 - (3) The generic optimized intervention value for iodine prophylaxis is 100 mGy of avertable committed absorbed dose to the thyroid due to radioiodine.
- 2. Generic Action Levels for Foodstuffs**
 - (1) Generic action levels for foodstuffs are given in Table III. For practical reasons, the criteria for separate radionuclide groups shall be applied independently to the sum of the activities of the radio nuclides in each group.
 - (2) Classes of food, such as spices, that are consumed in small quantities (e.g. less than 10 kg per person per year), which represents a very small fraction of the total diet and would increase individual exposure very little, may have action levels ten times higher than those for major foodstuffs.
 - (3) Action levels for the withdrawal and substitution of specific supplies of food and drinking water shall be specified in emergency plans as appropriate.
- 3. Temporary Relocation and Permanent Resettlement**
 - (1) 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.
 - (2) 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.

TABLE - I.
**FIVE CATEGORIES OF NUCLEAR AND RADIATION RELATED HAZARDS FOR
 THE PURPOSES OF THE REQUIREMENTS**

Hazard category	Description
I	Facilities, such as nuclear power plants, for which on-site events ^a (including very low probability events) are postulated that could give rise to severe deterministic health effects ^b off the site, or for which such events have occurred in similar facilities.
II	Facilities, such as some types of research reactors, for which on-site events ^a are postulated that could give rise to doses to people off the site that warrant urgent protective action in accordance with Annexure III , or for which such events have occurred in similar facilities. Hazard category II (as opposed to hazard 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. Hazard category III (as opposed to hazard 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; such as activities involving transport of dangerous mobile sources used in industrial radiography.
V	Activities not normally involving sources of ionizing radiation, but which yield products with a significant likelihood ^c of becoming contaminated as a result of events at facilities in hazard category I or II, including such facilities in other States, to levels necessitating prompt restrictions on products in accordance with international standards.

- (a) Involving an atmospheric or aquatic release of radioactive material or external exposure (such as due to a loss of shielding or a criticality event) that originates from a location on the site.
- (b) Doses in excess of those for which intervention is expected to be undertaken under any circumstances; as per Annex II. See the definition of ‘deterministic effect’.
- (c) Conditional on the occurrence of a significant release of radioactive material from a facility in hazard category I or II.

TABLE – II.
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

TABLE –III.
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

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